

Prime Number, Cause, Causality, Logic, Supersymmetry and the Universe: The Problem of Metaphysics in the *Critique of Pure Reason*

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Abstract: *The metaphysical exploration – an attempt to rectify the foundation of Kant’s transcendental philosophy – led us to the findings in regard to metaphysics and mathematics, that 1) the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$ ” is first-order logic, 2) “ $0 \rightarrow$ prime number (one and itself) $\rightarrow 0$ ” can substitute for the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$ ” or the cardinality in the converse domain; “ $0 \rightarrow 1 \rightarrow e^{i\pi} = -1 \rightarrow 0$ ” or “ $0 \rightarrow e^{i\pi} = -1 \rightarrow 0$,” 3) prime number – one and itself – pertains, as the analogy of realities in the world, of substances, causality, and necessity, to abstracted relations, and mere relations to one another in the domain, 4) since prime number, which sands in homogeneity with the domain on the one hand and the converse domain on the other at the same time could be the mediating representation which is to combine the domain and the converse domain, it signifies realitates phaenomena, i.e., real opposition, where one reality, if combined in one subject with another, cancels out the effect of the latter – the reciprocity-converse – and the pure understanding (realitas noumenon), where no opposition between realities can be thought – the instantaneity-simultaneity – which would lead us to the concept of the instantaneous and simultaneous reciprocity-converse, namely supersymmetry or the dynamical antinomy. Those findings would be the clue to the solution of the conundrums in mathematics and physics.*

Keywords: Cause, Causality, Relations, Prime Number, Logic, Supersymmetry, the Universe

1. INTRODUCTION

In an attempt to make Kant’s metaphysics in the *Critique of Pure Reason*, which seems so complicated and difficult to grasp, more comprehensible, we tried to solve the conundrum in it, namely Kant’s things in themselves or thing in itself, by means of the “transcendental analytic” (B87*) – “the part of transcendental logic” (B87) which “has a manifold of sensibility that lies before it *a priori*, which the transcendental aesthetic has offered to it” (B102-A77) (YAMAMOTO 2016: 87-100, YAMAMOTO 2017a: 19-37, YAMAMOTO 2017b: 72-81, YAMAMOTO 2017d: 19-29, YAMAMOTO 2018: 20-45, YAMAMOTO 2019: 43-70). The transcendental analytic, which rests on sensibility and the “synthesis of intuitions, in accordance with the categories” (B152), led us to the findings that 1) Kant’s things in themselves signifies “appearances themselves” (A104), namely filled space-elapsing time or empty space-nullified time, 2) appearances themselves, which signify the

* B87 designates the pagination of the standard German edition of Kant’s works, as indicated by means of marginal numbers in the *Critique of Pure Reason* (Kant, Immanuel, *Critique of Pure Reason*, Cambridge University Press, 1999). All citations are the same.

“transcendental ideality of appearances” (A506/B534), are parallel to the “entire universe” (A274), 3) the transcendental ideality of appearances is the ground from which the “pure schema of magnitude (*quantitatis*)” (B182) – “number” – is drawn, 4) the pure schema of magnitude (*quantitatis*) and “numerical formulas” (B206) could, in turn, enable us to attain to the possibility of “the absolute whole of magnitude (the world-whole)” (A483) – the entire universe – 5) this tautology might be the destination of our itinerancy in search for the solution of the conundrum in science. Since “no one has ever been able to define possibility, existence, and necessity except through obvious tautologies if he wanted to draw their definition solely from the pure understanding” (B302), we absolutely need to break the “obvious tautologies” by means of defining it solely from “an object of pure understanding” (B319), i.e., “one thing (*numerica identitas*)” (B319) – “prime number.” Before our being able to believe that we are approaching the destination, we have to discuss more in regard to number, mathematics, and the universe.

So far, we have made “synthetic propositions” (B18), on the ground of “synthetic *a priori* judgments” (A158), which says that 1) the entire universe – “everything that exists simultaneously in the various positions in space” (B320) – could amount to the “mathematically unconditioned unity” (A532/B560), which signifies the possibility of “the absolutely unconditioned, i.e., what is unconditioned in every relation” (A326) – the “impossibility” (A221) – and the “possibility itself” (B294) of “what is possible in all respects in every relation” (B381), 2) the former signifies empty space-nullified time, i.e., space-time itself ($e^{i\pi} = -1 = i^2$) while the latter signifies filled space-elapsing time ($\{i^2 \cdot e^{i\pi}\} = 1$), 3) the entire universe is deemed to amount to appearances themselves – filled space-elapsing time and empty space-nullified time ($\{i^2 \cdot e^{i\pi}\} = 1$ and $e^{i\pi} = -1 = i^2$) (YAMAMOTO 2019: 43-70). We have found that 1) all appearances themselves, “considered extensively as well as intensively, are continuous magnitudes” (A171), 2) “all alteration (transition of a thing from one state into another) is also continuous” (A171-B213), 3) “the causality of an alteration in general did not lie entirely beyond the boundaries of a transcendental philosophy and presuppose empirical principles” (B213), 4) the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$,” namely “ $0 \rightarrow \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \dots\} \rightarrow \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \dots\} \times i^2 = -1$ or $e^{i\pi} = -1 \rightarrow 0$ ” comprises the “principle of continuity” (B281), the “principles of modality” (B281) and the “principle of contradiction” (B192) (YAMAMOTO 2017a: 19-37, YAMAMOTO 2017d: 19-29, YAMAMOTO 2019: 43-70). Therefore, we dare to say that 1) the cardinality in the domain is nothing other than first-order logic – “the principle of causality (under the analogies of experience)” (B281) – 2) “the causality of an alteration in general” (B213), equivalent to first-order logic, stands for the absolutely unconditioned, i.e., what is unconditioned in every relation ($e^{i\pi} = -1 = i^2$) and the unconditioned, which is conditioned by “oneness” ($\{i^2 \cdot e^{i\pi}\} = 1$) – the entire universe (YAMAMOTO 2019: 43-70). Since “a consequence of the principle of causality (under the analogies of experience)” (B281) – first-order logic – has been cognized within the boundaries of a transcendental philosophy and empirical principles, we say that the causality of an alteration in general belongs to “a synthetic *a priori* concept” (A220), which is to “pertain to possible experience” (B267) and “rules of synthetic *a priori* unity” (A217). In view of the facts that 1) the causality of an alteration in general is to signify “*a priori* conditions for a possible experience” (A95) and “*a priori* conditions” (A217) of the thoroughgoing and necessary space-time-determination “of all existence in appearance” (A217), without which empirical time-determination or empirical space-determination would be impossible, 2) first-order logic, which stands for one ($\{i^2 \cdot e^{i\pi}\} = 1$) and itself ($e^{i\pi} = -1 = i^2$), namely “pure *a priori*

concepts” (A95), is subject to number and numerical formulas, we say that our “synthetic proposition” (A48) or “a singular proposition” (B205) in regard to first-order logic is to be enhanced to “synthetic *a priori* propositions” (B205) or “universal propositions *a priori*” (B357) – “principles” (B357). In other words, “particular cognitions” (A647/B675)” in regard to pure *a priori* concepts, i.e., rules of synthetic *a priori* unity are to necessarily stand under metaphysical axioms, which is, in turn, homogeneous with “rules of a mathematical synthesis” (B221) or the “mathematical principles” (B223). In the exploration of the relationship between metaphysics and science, we have to discuss more on the causality of an alteration in general, i.e., the principle of causality (under the analogies of experience) from the viewpoint of metaphysical axioms and the dynamical categories (thereby the mathematical categories) (YAMAMOTO 2017c: 57-70, YAMAMOTO 2017d: 19-29, YAMAMOTO 2018: 20-45, YAMAMOTO 2019: 43-70).

2. ALTERATION, DEDEKIND CUT, COMMERCIIUM, NOTHING OR A VACUUM

When Kant makes a discourse in regard to “alteration,” saying, “alteration is the combination of contradictorily opposed determinations in the existence of one and the same thing” (B291), we, thinking that the “alteration” is meant to be an alteration of a part of filled space-elapsing time to empty space-nullified time, or a passing out of a part of filled space-elapsing time into a part of filled space-elapsing time as “the succession of the states itself” (A207), or an alteration of empty space-nullified time to a part of filled space-elapsing time (YAMAMOTO 2017a: 19-37, YAMAMOTO 2017b: 72-81, YAMAMOTO 2017c: 57-70, YAMAMOTO 2017d: 19-29), agree with him, under our acknowledgement that alteration is also “a combination of contradictorily opposed predicates (e.g., a thing’s being in a place and the not-being of the very same thing in the same place) in one and the same object” (B48). In view of the fact that all alteration (transition of a thing from one state into another) is continuous, we have to think that 1) “all alteration” is to stand under “relation-numbers” – “ $e^{i\pi} = -1 = i^2$ and $\{i^2 \cdot e^{i\pi}\} = 1$ ” – 2) “*realitates phaenomena*” (B329) – all series in the domain – could be combined with the converse domain through the paths – the instantaneous and simultaneous reciprocity-converse, i.e., $\{i^2 \cdot e^{i\pi}\}$ – 3) this “representation of the synthetic unity of the manifold” (B130-B131) – $\{i^2 \cdot e^{i\pi}\} = 1$ – pertains to “alteration” (YAMAMOTO 2019: 43-70). Thus, all alteration is to be homogeneous with first-order logic; “ $0 \rightarrow \{|i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdots\} \rightarrow \{|i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdots\} \times i^2 = -1$ or $e^{i\pi} = -1 \rightarrow 0$,” which is to signify the principle of continuity, the principles of modality and the principle of contradiction. The principles of modality are “nothing further than definitions of the concepts of possibility, actuality, and necessity in their empirical use” (A219) while the principle of continuity and the principle of contradiction give us “permission and allowance for their transcendental use” (A219). Since the cardinality in the domain is to “pertain to possible experience and its synthetic unity, in which alone objects of cognition are given” (B267), they “are to concern things and their possibility, actuality, and necessity” (B267). Kant makes it clear that a human needs “an example” (B292) in order for him or her to cognize and understand through “intuition” and reason that “from a given state an opposed state of the same thing should follow” (B292). We think that there are two “examples” – the “*a priori* categories” (B159), e.g., “perceptions themselves” (B219) and “intuitions themselves (which contain a manifold)” (B160), and “a pure category” (B304), e.g., the “anticipation of perception” (B217) as “a perception itself” (A180) and the “sensation itself” (B217). At the same time, there are two intuitions – an “*a priori* intuition” (B40) and the “pure intuition” (A21). In regard to “an empirical datum” (B58) and the

alteration – examples and intuitions – we have already made a discourse, saying, “that 1) since an object – ‘one thing (*numerica identitas*)’ – signifies the difference of the places of the appearance at the same time, it signifies ‘an aggregate of many appearances,’ i.e., an aggregate of many ‘one thing (*numerica identitas*),’ 2) since an object – ‘one thing (*numerica identitas*)’ – signifies the difference in the time of the appearance at the same place, it signifies an appearance – ‘a series’ (B389) of ‘one thing (*numerica identitas*)’ – 3) since an object – ‘one thing (*numerica identitas*)’ – signifies the difference in the time of the appearance at different places, it signifies an aggregate of many ‘one thing (*numerica identitas*),’ and a series of ‘one thing (*numerica identitas*),’ 4) since an object – ‘one thing (*numerica identitas*)’ – signifies no difference in the time of the appearance at the same place, it is commensurate with ‘one thing (*numerica identitas*)’ – the category – 5) since ‘an object of pure understanding’ (B319) – ‘one thing (*numerica identitas*)’ – signifies nullity in space-time, it belongs among the category – ‘one thing (*numerica identitas*)’” (YAMAMOTO 2018: 20-45). Here, “one thing” is to correspond to the “moment of gravity” (B210) – the category and the categories – which would be in a reciprocal and converse parallel to the converse moment of gravity – the category.

In regard to the category and the categories, we have to acknowledge that the principle of continuity forbids “any gap or cleft between two appearances in the sum of all empirical intuitions” (A229) in space-time while it does not necessarily forbid “any leap in the series of appearances (alterations)” (B281), for, following what Kant says (A229), we can express the proposition thus: any gap or cleft between two appearances in the sum of all empirical intuitions can enter experience or possible experience that proves “the void” (A229) or even permits it as a part of the synthesis of intuitions, in accordance with the categories, namely as “the field or the entire object of possible experience” (A95) or the “objects of possible experience” (B73), while any leap in the series of appearances (alterations) can enter experience or possible experience that proves “nothing” (A229) or “a *vacuum*” (A229), as the impossibility, or even permits it as a part of “the pure synthesis, in accord with a rule of unity according to concepts in general, which the category expresses” (A142), namely as “the concept in itself” (A221) in which nothing prevails. Therefore, we say, following what Kant refers to (A229-B282), as follows.

For as far as concerns nothing or a *vacuum* that one might think of outside of the field of possible experience (the world), this does not belong to the jurisdiction of the mere understanding which limits “a manifold of sensibility” (B102) inside “the bounds of experience”(A462/B490), but belong to the jurisdiction of “the pure understanding (*realitas noumenon*)” (B320) which extends the elements of itself to inside “the bounds of possible experience” (A644/B672) “that must be contained somewhere in the nexus of experience” (A227) of which the “possibility of experience” (A158) or the possibility itself of possible experience is a part, judging about “what surrounds and bounds this” (B282), namely the impossibility of possible experience, for “*a priori* cognition” (B166). It is not “a problem for ideal reason, which goes beyond the sphere of a possible experience” (A229-B282), but a problem for “the understanding” (A51) and “a judgment, i.e., a relation that is objectively valid” (B142).

In regard to this, we have already made a discourse, saying, “In contrast to ‘the mere understanding,’ which limits ‘a manifold of sensibility’ (B102), such as ‘mere appearances’ (A49) or the ‘mere categories’ (B288) or ‘mere representations’ (A537/B565), inside ‘the bounds of

experience' (A462/B490) or inside the domain, 'the pure understanding (*realitas noumenon*)' (B320), as the 'faculty for bringing forth representations itself' (A51), extends them to inside 'the bounds of possible experience' (A644/B672) or to the converse domain by calling 'mere appearances' 'beings of understanding (*noumena*)' or by calling the 'mere categories' imaginary number or by calling 'mere representations' 'an object of a non-sensible intuition' (B307), i.e., the possibility itself of possible experience. In other words, Max Planck (1858-1947) – 'the receptivity of impressions' (A50/B74) and 'the understanding itself' (B127) – could extend the elements of itself (an appearance or the category or a representation) to inside 'the bounds of possible experience' or to the converse domain under the aegis of '*Planck's constant*' (YAMAMOTO 2019: 43-70). Thus, the understanding itself, i.e., the "spontaneity of cognition" (A51) pertains to the "schemata of the concepts of pure understanding" (B185-A146) and the "schema of the pure concept of the understanding" (B224). Here, the schemata of the concepts of pure understanding, namely the schemata of "a third thing" (A138/B177) is meant to be " $\{i^2 \cdot e^{i\pi}\} = 1$ " – the schemata of the category and the categories – while the schema of the pure concept of the understanding, namely the schema of "a something = X " (A250) is meant to be " $e^{i\pi} + 1 = 0 = i^2 + 1$ " – the category. Any gap or cleft between two appearances in the sum of all empirical intuitions – the "Dedekind gap" – is filled by a median class having \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$, indicating that the schema of a something = X – " $e^{i\pi} + 1 = 0 = i^2 + 1$ " signifies "*non datur hiatus*" (A229). When the "Dedekind cut" is functional, continuous magnitudes of the series of appearances during alterations are achieved in the schemata of a third thing – " $\{i^2 \cdot e^{i\pi}\}$ " – while when it ceases to be functional, the series of appearances transmutes to "a persisting image of sensibility" (A525/B553-A526/B554), which could "progress to infinity" (A526/B554). Therefore if "that which bounds must be distinguished from that which is bounded by it" (A515/B543), the distinction depends on the function of the boundary, namely the schemata of a third thing. Thus that which is bounded by that which bounds needs not continue its "regress further to this condition" (A515/B543). Since the Dedekind cut, i.e., the schemata of a third thing holds the property of relation-numbers, "all Dedekindian series having Cantorian continuity" – $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$ – are, at the same time, to signify " $e^{i\pi} = -1 = i^2$, i.e., $e^{i\pi} + 1 = 0 = i^2 + 1$." In other words, the Dedekindian series which is bounded by the "Cantorian continuity" is not to be distinguished from the Cantorian continuity which bounds the Dedekindian series, indicating that we need not continue our regress further to the Cantorian continuity, i.e., " $e^{i\pi} = -1 = i^2$." We say that the Dedekind cut – $\{i^2 \cdot e^{i\pi}\}$ – is homogeneous with "a receptivity for being affected in a certain way with representations, whose relation to one another is a pure intuition of space and time" (A494). In view of the fact that representations, whose relation to one another is a pure intuition of space and time, are parallel to "objects in themselves" (A30), namely either objects of possible experience, e.g., "the field of possible experience" (A248-B305) or the "possibility of the objects of experience" (A111), e.g., "appearances in the field of experience" (A186), which signify contradictorily opposed determinations and contradictorily opposed predicates, we can say that 1) the Dedekind cut – $\{i^2 \cdot e^{i\pi}\}$ – which holds the property of "*synthesis speciosa*" (B151) and "*synthesis intellectualis*" (B151) could be affected by "objects in themselves in which the absolutely unconditioned might possibly occur" (A508/B536), 2) as a result of the "intensive magnitude, i.e., a degree of influence on sense" (B208), the Dedekind cut – $\{i^2 \cdot e^{i\pi}\}$ – might decompose into "a composite (*compositum reale*)" (B262), i.e., "natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$," 3) number "1" or "prime number" or one and itself – the category, i.e., one thing (*numerica identitas*) – is commensurate with the Dedekind cut – $\{i^2 \cdot e^{i\pi}\}$ –

which could signify “the contingent existence of a substance itself” (A560/B588) – “the necessary existence of one” (A560/B588) – 4) “natural number” ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) could signify the aggregate of many “one thing (*numerica identitas*)” – the contingent existence of a substance itself – indicating that the Dedekindian series ($|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$) having Cantorian continuity ($e^{i\pi} = -1 = i^2$, i.e., $e^{i\pi} + 1 = 0 = i^2 + 1$) could signify “a reciprocal influence, i.e., a real community (*commercium*) of substances” (B261). Natural number or $i^2 = -1$ could signify the possibility itself of the objects of possible experience (namely the objects of possible experience) and the possibility of the objects of experience – the category and the categories. Therefore, when the Dedekind cut forfeits the function of $\{i^2 \cdot e^{i\pi}\}$, namely when the Dedekind cut is multiplied by $i^2 = -1$ or $e^{i\pi} = -1$, the number “1” or prime number or one and itself – “a series” (B389), i.e., $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$ – is dissolved into parts, resulting either in “an aggregate of many appearances” (B212), i.e., “the unconditioned in the series of appearances” (A543/B571) – natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – or in “elements of cognition that are to be encountered in us *a priori*” (B166) – “ $e^{i\pi} = -1 = i^2$, i.e., $e^{i\pi} + 1 = 0 = i^2 + 1$.” An aggregate of many appearances in conjunction with elements of cognition that are to be encountered in us *a priori* could be equivalent to “real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$)” – a composite (*compositum reale*), i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$. Thus, a series in the domain – the Dedekindian series having Cantorian continuity, which could consist of an aggregate of many appearances and the elements of cognition – is homogeneous with a real community (*commercium*) of substances, indicating that a composite (*compositum reale*) is to signify either “the combination of parts into a whole” (A560/B588), or “the dissolution of a whole into its parts” (A560/B588). Therefore we say that 1) even if parts are unconditioned, the whole could be conditioned, or even if the whole is unconditioned, parts could be conditioned, 2) a composite (*compositum reale*) could pertain to the unconditioned part of the unconditioned whole, i.e., the impossibility of possible experience and the conditioned part of the unconditioned whole, i.e., the possibility itself of possible experience – the “possibility of an unconditioned whole” (A560/B588) – 3) the possibility of an unconditioned whole is homogeneous with “an unconditioned part of a given whole” (A560/B588), i.e., the possibility of the objects of experience and the objects of possible experience – the category and the categories. Therefore, we say that a real community (*commercium*) of substances, or a composite (*compositum reale*), which could be commensurate with an aggregate of many appearances, i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and elements of cognition that are to be encountered in us *a priori*, i.e., $e^{i\pi} = -1 = i^2$, is nothing other than “the manifold that is given in a sensible intuition” (B143) – the category and the categories, i.e., “the possibility of the category of community” (B292).

We have to take note of the facts that 1) “each of the parts in a continuously progressing decomposition is once again divisible” (A523/B551), and “the division” (A523/B551) of each of the parts in a continuously progressing decomposition goes in “an indeterminately continued regress (*in indefinitum*)” (A518/B546), 2) the “*regressus in infinitum*” (A519/B547) from the conditioned (a series, i.e., $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$) to the unconditioned ($e^{i\pi} = -1 = i^2$, i.e., $e^{i\pi} + 1 = 0 = i^2 + 1$) could go instantaneously, resulting in manifesting the elements of cognition that are to be encountered in us *a priori* – the “pure category, in which abstraction is made from any condition of sensible intuition” (B304) – which could be commensurate with the reciprocal-converse moment of gravity or $e^{i\pi} = -1$ or the converse light itself (YAMAMOTO 2019: 43-70), 3) the “*regressus in indefinitum*” (A520/B548) from the conditioned (a series, i.e., $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$) to

the unconditioned in the series of appearances, i.e., an aggregate of many appearances could go simultaneously, resulting in manifesting the “aggregates (multitudes of antecedently given parts)” (B204) – the *a priori* categories – which are to be commensurate with the “moment of gravity” (B210) or $i^2 = -1$ or the light itself. The dismemberment of a series – the *regressus in infinitum* or the *regressus in indefinitum* – could occur in accordance with the dissolution of $\{i^2 \cdot e^{i\pi}\}$, i.e., the decomposition of “a correlate of things that subsists by itself” (A487/B515). Since a correlate of things that subsists by itself, e.g., “A thing = A, which is something = B” (B192), can “at the same time be *non-B*” (B192), its being homogeneous with “a pure *a priori* intuition” (A48), e.g., supersymmetry or the instantaneous and simultaneous reciprocity-converse, we say that 1) it would dissolve into “A thing = A” – the pure intuition, e.g., the instantaneity-simultaneity – and “A, which is something = B” – an “*a priori* intuition,” e.g., the reciprocity-converse (thereby null-reciprocity) – 2) the pure intuition pertains to the *a priori* categories, e.g., humans, which are the “ground for the possibility of *a priori* mathematical cognitions” (B57) while an *a priori* intuition pertains to a pure category, e.g., “number,” which is the ground for “pure *a priori* cognitions” (A119) of the converse domain ($e^{i\pi} + 1 = 0 = i^2 + 1$). Kant calls an *a priori* intuition a “non-sensible intuition” (B307) or “another kind of intuition than the sensible kind” (A254). At the same time, the *a priori* categories (e.g., the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$ ”) signify the Dedekindian series having Cantorian continuity – a series of one thing (*numerica identitas*) ($\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$). We can say that 1) the Dedekindian series having Cantorian continuity, i.e., a series of one thing (*numerica identitas*) is commensurate with the domain, i.e., a real community (*commercium*) of substances, while an *a priori* intuition in regard to “a community (*communio*) of apperception” (B261) – *a priori* cognition of null-reciprocity in virtue of the instantaneity-simultaneity – is homogeneous with the converse domain – “pure *a priori* cognition” (A87) of null reciprocity in virtue of the instantaneity-simultaneity – 2) therefore, the converse domain – an object of pure understanding – could be cognized, as the void, through “empirical intuition” (B206) in regard to “a reciprocal influence” (B261), namely the reciprocity-converse – the “mere perception (sensation and thus reality)” (B212) of null-reciprocity in virtue of the instantaneity-simultaneity – or could be perceived, as nothing or a *vacuum* (null-reciprocity), through an *a priori* intuition in regard to null-reciprocity – the anticipation of null-reciprocity in virtue of the instantaneity-simultaneity. In other words, the category – null-reciprocity in space-time, i.e., space-time itself – could be perceived in the anticipation of the “intuition and the real” (B221), which is homogeneous with *a priori* cognition of the sensation itself, i.e., the instantaneity-simultaneity, and pure *a priori* cognition of a perception itself, i.e., null-reciprocity (thereby the reciprocity-converse). The pure *a priori* cognition is nothing other than a “cognition from principles” (B357), namely from rules of a mathematical synthesis. We should like to rephrase Kant’s saying; “I cognize the particular in the universal through concepts” (B357) as follows; “we cognize the universal in the particular through the principle of contradiction, the principle of continuity and the principles of modality, i.e., through the instantaneous and simultaneous null-reciprocity (nothing or a *vacuum*).” Furthermore, we say that 1) the converse domain, i.e., a pure category ($e^{i\pi} + 1 = 0 = i^2 + 1$) could be drawn from “the logical function for bringing the manifold under a concept” (A245), namely a median class having \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$, 2) the dismemberment or decomposition of the Dedekindian series having Cantorian continuity signifies the “leap” (B281), namely the dissolution of the combination of contradictorily opposed predicates and contradictorily opposed determinations, resulting in exhibiting

such fact as a thing's being in a place and the being of the very same thing in another place – the existence of one thing. Thus, “one thing” can be thought to exist as *numerica identitas*, i.e., “prime number,” which signifies an object of pure understanding, and the possibility of the category of community – the category and the categories. The utter dismemberment of the Dedekindian series ($\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \dots\}$), which is to correspond to its “leap,” results in disclosing “one thing (*numerica identitas*)” – a pure category ($e^{i\pi} + 1 = 0 = i^2 + 1$) or “prime number” – which signifies the “decomposition to infinity” (A526/B554) while the dismemberment of the Dedekindian series, which is to correspond to revealing the “gap or cleft” (A229) in it, results in yielding an aggregate of many appearances, i.e., the unconditioned in the series of appearances which signifies the possibility of “the divisibility of space” (A525/B553) to infinity, i.e., the “infinite divisibility” (A527/B555). Thus the Dedekindian series having Cantorian continuity is to signify the possibility of the category of community – the category and the categories, i.e., the possibility of the objects of experience (nothing or a *vacuum*) and the objects of possible experience (the void). In other words, the Dedekindian series having Cantorian continuity signifies the intuition and the real, which is homogeneous with *a priori* cognition of the objects of possible experience (namely the instantaneous and simultaneous reciprocity-converse), and pure *a priori* cognition of “a number” (A527/B555) (the instantaneous and simultaneous null-reciprocity), which could be equivalent to the saying that “*I think, therefore I am*” (DESCARTES 1998: 18-22), namely *cogito, ergo sum* – “the single proposition I think” (A342) and “the representation I think” (B132). Therefore, when Kant says, “In space considered in itself there is nothing movable; hence the movable must be something that is found in space only through experience, thus an empirical datum. In the same way the transcendental aesthetic cannot count the concept of alteration among its *a priori* data; for time itself does not alter, but only something that is within time. For this there is required the perception of some existence and the succession of its determinations, thus experience” (B58), we, thinking that “the perception of some existence” (B58) is homogeneous with the cognition of the objects of possible experience – *a priori* cognition of the existence of the categories – or pure *a priori* cognition of the possibility of the objects of experience, namely of the category or a number – entirely agree with him. We have to add the most important thing, saying that 1) the instantaneous and simultaneous reciprocity-converse is to signify the infinite divisibility, 2) *a priori* cognition of the objects of possible experience (the instantaneous and simultaneous reciprocity-converse, e.g., the void) is to be combined, in a manner of the instantaneous and simultaneous reciprocity-converse, with the succession of its determinations, thus experience – pure *a priori* cognition of a number (the instantaneous and simultaneous null-reciprocity, e.g., nothing or a *vacuum*). We should like to put it another way, saying that a composite (*compositum reale*), i.e., “natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$, thereby $e^{i\pi} = -1$ ” is to operate in a reciprocal and converse parallel to real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$), yielding the “unity of the categories” (A249), i.e., number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$, thereby $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) – “one and itself” (YAMAMOTO 2019: 43-70). Therefore, a series of one thing (*numerica identitas*) – one and itself (*cogito, ergo sum*) – offers the ground for “*a priori* cognitions of objects of an intuition in general” (B159), i.e., *a priori* cognitions of numerical formulas – “the possibility of *a priori* mathematical cognitions.” This is the “*a priori* mathematical doctrines in regard to real things” (B57) – first-order logic – which is the ground for *a priori* cognitions of the category and the categories. We think that the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$,” which we rewrite as “ $e^{i\pi} + 1 = 0 = i^2 + 1 \rightarrow \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \dots\} \rightarrow \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \dots\} \times i^2 = -1$ or

$e^{i\pi} = -1 \rightarrow e^{i\pi} = -1 = i^2$ ” is the schemata of first-order logic.

3. QUANTUM, THE VOID, NUMERICA IDENTITAS AND SUBSTANTIAE NOUMENA

In view of the fact that a series corresponds to a Dedekindian series having Cantorian continuity – “one thing (*numerica identitas*)” – we say that the Dedekindian series is nothing other than the “object in itself” (A45) – A thing = A, which is something = B, namely “the appearance as *quantum continuum*” (A527/B555)” – while “merely intelligible objects” (A286) – “mere appearances” (A49) – are correspondent to an aggregate of Dedekindian series, which could be equivalent to an aggregate of many “one and itself,” namely an aggregate of many appearances, indicating that the object in itself signifies a real community (*commercium*) of substances – *quantum continuum* – while merely intelligible objects signify the contingent existence of a substance itself – “*quantum discretum*” (A527/B555) – in which “the multiplicity of units” (A527/B555) is determined. Since an aggregate of “one thing” corresponds to “one thing,” *quantum discretum* (appearances in the field of experience) is equivalent to *quantum continuum* (the appearance as *quantum continuum*), indicating that the categories (the objects of possible experience) are to be equivalent to the category (the possibility of the objects of experience). Kant was startled “to hear that a thing should consist entirely of relations, but such a thing is also mere appearance, and cannot be thought at all through pure categories; it itself consists in the mere relation of something in general to the senses” (A285). We think that 1) mere appearance must be commensurate with a Dedekindian series having Cantorian continuity, 2) the object in itself – a series of one thing (*numerica identitas*) – necessarily pertains to a pure category ($e^{i\pi} = -1 = i^2$) while merely intelligible objects (mere appearance) – the contingent existence of a substance itself – are to signify the “mere categories” (B288) and the “mere category” (B151). Since the “reality” of mere appearance or of the contingent existence of a substance itself “is represented only through the pure understanding (*realitas noumenon*)” (B320), their realities must be “no opposition,” namely “a merely dialectical conflict” (A505/B533) or “a dialectical opposition” (A504/B532). Furthermore, in view of the fact that “no opposition between realities” (B320) – null-reciprocity – is to occur in a *vacuum* (nothing) and in the void, we dare to say that 1) a *vacuum* (nothing) – the “absolutely unconditioned” (A326) or the unconditioned part of an unconditioned whole – is homogeneous with the void – an unconditioned part of a given whole – 2) a *vacuum* (nothing) and the void could signify the category and the categories – the impossibility and the possibility itself (of possible experience).

In view of the facts that 1) “any gap or cleft between two appearances in the sum of all empirical intuitions” (A229) in space-time – the Dedekind gap – is neutralized by “a median class having \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$,” 2) the object in itself, i.e., a series of one thing (*numerica identitas*) necessarily pertains to a one-one relation between the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$ ” and the cardinality in the converse domain; “ $0 \rightarrow 1 \rightarrow e^{i\pi} = -1 \rightarrow 0$ ” or “ $0 \rightarrow e^{i\pi} = -1 \rightarrow 0$,” we have to say that 1) the mere categories and the mere category are to be necessarily combined with a pure category (e.g., $e^{i\pi} = -1 = i^2$), yielding the series of one thing (*numerica identitas*), namely $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$ – the *a priori* categories – 2) the necessity is the Dedekind cut, e.g., a merely dialectical conflict – nothing or a *vacuum* – 3) an aggregate of many appearances or an aggregate of one thing (*numerica identitas*) or an aggregate of the *a priori* categories arises either as a result of a dissolution of the Dedekind cut, or as a result of the manifestation of the Dedekind gap. Furthermore, we should like to say that “a median class having \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$,” e.g., which

is to neutralize the Dedekind gap in the Dedekindian series is homogeneous with the Dedekind cut, e.g., the instantaneous and simultaneous reciprocity-converse, which is to neutralize the contradictions among the mere categories and the mere category, or among the *a priori* categories and a pure category, yielding “Dedekindian continuity.” Since the “synthesis of the manifold of sensible intuition” (B151), i.e., *synthesis speciosa* and the “synthesis of the manifold of a homogeneous intuition in general” (A143), i.e., *synthesis intellectualis* – the instantaneous and simultaneous reciprocity-converse – are “to take place simultaneously in one and the same occurrence” (A336/B564) in “everything that exists simultaneously in the various positions in space no matter how similar and equal they might otherwise be” (B320) or no matter how dissimilar and unequal they appear to be, it is possible to say that “all intuitions” (A116) and “all appearances” (A34) – “the correlate of all of our representations” (A123) (e.g., the category and the categories) – are to go “through the composition of that which is homogeneous and the consciousness of the synthetic unity of this manifold (of the homogeneous)” (B202-B203), which is nothing but the Dedekind cut – $\{i^2 \cdot e^{i\pi}\}$. The Dedekind cut, which is commensurate with “the concept of a magnitude (*Quanti*)” (B203), signifies “the consciousness of the homogeneous manifold in intuition in general, insofar as through it the representation of an object first becomes possible” (B203). What is the *Quanti* – $\{i^2 \cdot e^{i\pi}\}$ – with the consciousness of the homogeneous manifold in intuition? It is to be equivalent to the number “1” or prime number or one and itself in the domain – *cogito, ergo sum*.

From the discourse above, it follows that we have to think that 1) the principle of continuity is congruous with “the sum total of all appearances (the world)” (A334) – the Dedekindian series having Cantorian continuity – 2) the Dedekindian continuity and the Cantorian continuity frame the schemata of first-order logic, 3) the Dedekindian continuity is to be commensurate with the domain ($|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$) or real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) while the Cantorian continuity is to be commensurate with the converse domain ($e^{i\pi} + 1 = 0 = i^2 + 1$) or a composite (*compositum reale*), i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$, thereby $e^{i\pi} = -1$. The synthetic proposition in regard to the converse domain, in virtue of pure *a priori* concepts – the instantaneous and simultaneous null-reciprocity – which can “certainly contain nothing empirical” (A95), is to be “strictly *a priori* conditions for a possible experience” (A95). Thus, the synthetic proposition in regard to the converse domain can be thought to belong to the synthetic *a priori* propositions. Furthermore, in view of the facts that 1) first-order logic; “ $e^{i\pi} + 1 = 0 = i^2 + 1 \rightarrow |\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots| \rightarrow |\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots| \times i^2 = -1$ or $e^{i\pi} = -1 \rightarrow e^{i\pi} = -1 = i^2$,” which comprises the principle of continuity, the principle of contradiction, and the principles of modality, signifies the succession of the states itself or the succession of “the state of representations” (A274), i.e., the succession of the “sense itself” (A274), 2) the converse domain – the Cantorian continuity; “ $e^{i\pi} = -1 = i^2$ ” – belongs to relation-numbers, we can say that 1) the converse domain is to signify the absolutely unconditioned, i.e., what is unconditioned in every relation, which could be the “intelligible substances (*substantiae noumena*)” (A276), 2) the intelligible substances, i.e., “ $e^{i\pi} = -1 = i^2$ ” are absolutely impossible to alter while the unconditioned, which is conditioned by oneness, i.e., $\{i^2 \cdot e^{i\pi}\} = 1$, which signifies “matter,” i.e., “*substantia phaenomenon*” (B333) is “absolutely possible” (B381) to alter. Additionally, we say that 1) the Dedekindian continuity ($|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$) signifies what is possible in all respects in every relation, namely “possibility itself” while the Cantorian continuity ($e^{i\pi} = -1 = i^2$) signifies the absolutely unconditioned, i.e., what is unconditioned in every relation, namely the “impossibility,” 2) “every relation” is meant

to be “a sum total of mere relations” (B321) and a sum of “abstracted relations” (B57), 3) a sum total of mere relations pertains to matter, i.e., *substantia phaenomenon* while a sum of abstracted relations pertains to the intelligible substances (*substantiae noumena*), 4) thus, “every relation” is equivalent to relation-numbers; “ $e^{i\pi} = -1 = i^2$ and $\{i^2 \cdot e^{i\pi}\} = 1$ ” – the entire universe or the absolute whole of magnitude (the world-whole). Furthermore, the converse domain ($e^{i\pi} + 1 = 0 = i^2 + 1$), which is to signify the impossibility of a manifold of sensibility and of a perception itself, is conditioned by the domain ($\{i^2 \cdot e^{i\pi}\} = 1$), which is to signify the possibility of a manifold of sensibility and of a perception itself. Since “empirical cognition, however, is experience” (B165-B166), the possibility of experience is parallel to “the possibility of empirical cognition” (B147). Seeing that the antinomy between the impossibility and the possibility itself or between a *vacuum* (nothing) and the void, under which the converse domain stands, signifies a merely dialectical conflict, we dare to say that the possibility itself of possible experience (the void) in conjunction with the impossibility of experience (a *vacuum* or nothing) – in other words, the possibility of experience without experience – can be “a proof of empty space or of time” (B214), i.e., the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity). This could be correspondent to the pure schema of magnitude, i.e., a number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$), which appears to signify a *vacuum* (nothing) or the entire universe. Thus, we can reach the converse domain, e.g., the intelligible substances (*substantiae noumena*), and the domain, e.g., matter (*substantia phaenomenon*) through the conditions which determine the possibility itself of a possible experience and the impossibility of experience – namely through a composite (*compositum reale*) or prime numbers. In other words, the converse domain or the intelligible substances (*substantiae noumena*) corresponds to “a something = X” (A250) – the possibility itself of possible experience, e.g., $e^{i\pi} + 1 = 0 = i^2 + 1$ or the impossibility of experience, e.g., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) while the domain or *substantia phaenomenon* corresponds to a third thing ($\{i^2 \cdot e^{i\pi}\} = 1$) which “is determinable through the manifold of those appearances” (A251), as “the field of possible empirical cognition” (A644/B672), namely the field of possible experience. The logicians, who stand under first-order logic, call the converse domain or the intelligible substances (*substantiae noumena*) matter, namely “components (*essentialia*)” (B322), and call the field of possible empirical cognition or the field of possible experience its “specific difference” (B322). Since “the concept of possible experience” (A95) is *a priori* conditions for a possible experience, which signifies pure *a priori* concepts, e.g., a real community (*commercium*) of substances while the possible empirical cognition corresponds to “the origin of the *a priori* categories” (B159) – humans, namely the *a priori* categories – we can say that “the *a priori* categories make pure *a priori* concepts possible, and pure *a priori* concepts make the *a priori* categories possible.” Since the pure *a priori* concepts are to correspond to numbers, namely a composite (*compositum reale*), we say that “the *a priori* categories make numbers possible, and numbers make the *a priori* categories possible,” which could be equivalent to the saying that “a synthetic *a priori* concept makes pure *a priori* concepts possible” (YAMAMOTO 2019: 43-70).

In view of the facts that 1) “a cause” (B213) must be found in “the unalterable” (B213), 2) the intelligible substances (*substantiae noumena*), i.e., “ $e^{i\pi} = -1 = i^2$ ” is unalterable, 3) “community is the causality of a substance in the reciprocal determination of others” (B111), we have to think that 1) a cause is to correspond to the intelligible substances, i.e., “ $e^{i\pi} = -1 = i^2$,” 2) the causality is to reside in matter, i.e., *substantia phaenomenon* – $\{i^2 \cdot e^{i\pi}\} = 1$ – 3) the causality of a substance in the reciprocal determination of others is the causality of an alteration in general, indicating that the relations in

$\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$ which are alterable could be the causality. What are the relations in $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$ which are alterable? They are meant to be the relations of the reciprocity-converse to null-reciprocity in conjunction with the relations of the instantaneity to the simultaneity, which would be the “true correlate, i.e., the thing in itself” (A30) – the causality of an alteration in general. The cause (e.g., $e^{i\pi} = -1 = i^2$) and the causality (e.g., $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$), which are commensurate with first-order logic, signifies “the concepts of reality, substance, causality, even that of necessity in existence” (A677/B705). On account of the fact that it amounts to a sum of abstracted relations and a sum total of mere relations, we can say that the alteration of relations among $\{|i^2 \cdot e^{i\pi}\}$, namely among the instantaneous and simultaneous reciprocity-converse – “wavefunctions” (PENROSE 2007: 493-526) – must be thought to pertain to “the degree of reality” (B210) – the moment of gravity and “gravitational mass” (PENROSE 2007: 383-411). Therefore, when Kant makes discourse in regard to “an absolute boundary” (A519/B547-A520/B548), we should like to put it another way, saying, “we should never assume an absolute boundary, but rather we should subordinate every appearance as conditioned ($\{|i^2 \cdot e^{i\pi}\} = 1$) to another as wavefunctions or as the instantaneous and simultaneous reciprocity-converse, and thus we must progress further to the instantaneous and simultaneous null-reciprocity; this is a *regressus in indefinitum* – ‘Planck’s constant’ (PENROSE 2007: 493-526) – which, because it determines no magnitude in the object, cannot be distinguished clearly enough from the regress *in infinitum*.” When *substantia phaenomenon* – $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$ – dissolves into real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) in concurrence with the splitting of $\{|i^2 \cdot e^{i\pi}\}$, *substantia phaenomenon* is revealed in the regress *in infinitum* in virtue of wavefunctions, and a *regressus in indefinitum* in virtue of *Planck’s constant*, which enable us to determine the magnitude of the object. It is obvious that the pure category (e.g., the converse domain) can certainly contain nothing empirical while the entire universe, which comprises what is possible in all respects in every relation, cannot certainly contain nothing empirical. The entire universe, which consists in the absolutely unconditioned, i.e., what is unconditioned in every relation – the intelligible substances (*substantiae noumena*) – and what is possible in all respects in every relation – matter, i.e., *substantia phaenomenon* – can be called “*a parte priori* without bounds (without a beginning)” (B445-A418) and “*potentialiter* infinite” (B446).

In view of the fact that the causality of an alteration in general – first-order logic – has been cognized through general logic and the transcendental analytic, we can say that 1) the principle of causality (under the analogies of experience), i.e., the causality of an alteration in general, which comprises the principle of continuity, the principle of contradiction and the principles of modality, is the synthetic proposition – pure *a priori* concepts – which is to correspond to the synthetic *a priori* propositions which rest on “synthetic *a priori* cognition” (A14/B28), i.e., “universal cognition” (B357), 2) first-order logic is a synthetic *a priori* concept, which is to pertain to possible experience and its “synthetic *a priori* unity” (A217), in which alone the field of possible empirical cognition or the field of possible experience is given. Therefore, when Kant makes discourse in regard to *Physica*, saying, “Natural science (*Physica*) contains within itself synthetic *a priori* judgments as principles. I will adduce only a couple of propositions as examples, such as the proposition that in all alterations of the corporeal world the quantity of matter remains unaltered, or that in all communication of motion effect and counter-effect must always be equal. In both of these not only the necessity, thus their *a priori* origin, but also that they are synthetic propositions is clear” (B17-B18), we, thinking that 1) our proposition in regard to “supersymmetry,” namely “the instantaneous and simultaneous

reciprocity-converse” (YAMAMOTO 2019: 43-70) belongs to “the principle of contradiction, as a merely logical principle” (B192), 2) supersymmetry or the “black holes” (HAWKING 2012: 87-119), which pertains to the quantity of matter in all communication of motion, is nothing but the principle of contradiction, as a merely logical principle, namely the “*principle of equivalence*” (PENROSE 2007: 383-411) in regard to the intelligible substances, i.e., “ $e^{i\pi} = -1 = i^2$ ” and *substantia phaenomenon*, i.e., $\{i^2 \cdot e^{i\pi}\} = 1$, agree with him. Kant adds, saying that “the proposition is thus not analytic, but synthetic, and nevertheless thought *a priori*, and likewise with the other propositions of the pure part of natural science” (B18). We say that it is first-order logic, which signifies the principle of causality (under the analogies of experience) – the causality of an alteration in general. The findings suggest that the causality of an alteration in general – first-order logic – stands for the absolutely unconditioned, i.e., what is unconditioned in every relation ($e^{i\pi} = -1 = i^2$) and the unconditioned, which is conditioned by oneness ($\{i^2 \cdot e^{i\pi}\} = 1$) – a pure category and the *a priori* categories, e.g., “the entire universe” (YAMAMOTO 2019: 43-70). The causality of an alteration in general, namely the instantaneous and simultaneous reciprocity-converse can be thought to be the “transcendental truth” (A146) in virtue of transcendental ideality of appearances or “synthetic *a priori* principles” (B305). The principle of continuity (i.e., $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$ and $e^{i\pi} = -1 = i^2$), which is parallel to the saying that “A thing = A, which is something = B, can at the same time be non-B” (YAMAMOTO 2017b: 72-81) belongs to the “dynamical principles” (B281), which could be the “unbounded reality” (B322) – “the matter of all possibility” (B322). We think that 1) the entire universe, which consists in the objects of possible experience (*realitates phaenomena et substantia phaenomenon*, i.e., the *a priori* categories) and an object of pure understanding (*realitas noumenon et substantiae noumena*, i.e., a pure category) signifies “the manifold that is simultaneous” (A217) or everything that exists simultaneously in the various positions in space or “a sum of all existence (simultaneous)” (B262), 2) since the entire universe itself is not to “stand in community” (A217), at least the impossibility of the category of community in regard to it, namely that it appears to be a “regulative idea of merely speculative reason” (A684/B712), “can be known with certainty” (A480/B508). On the contrary, since the objects of possible experience (i.e., the *a priori* categories) which necessarily stand under the principle of continuity, the principle of contradiction and the principles of modality, signify the possibility of the category of community, it can be known that the field of possible experience, which stands under the “regulative principles” (A671/B699) and the “constitutive principles” (A671/B699), signifies the *principle of equivalence*. The field of possible experience, which is homogeneous with the unity of the categories, is the causality of an alteration in regard to itself, whose state “of which alone we can cognize the necessity, and moreover only from other states, which are given in perception, in accordance with empirical laws of causality” (A227-B280), which rest on “the empirical reality” (B52) of space-time or the “empirical affinity” (A114) or “empirical synthesis” (A157). This is nothing more than “the law of possible experience that everything that happens is determined *a priori* through its cause in appearance” (B280), namely “reciprocal causality in the relation of substances to each other (*commercium*)” (B302) – a reciprocal influence, i.e., a real community (*commercium*) of substances. This is tantamount to the saying that a series of one thing (*numerica identitas*) – a Dedekindian series having Cantorian continuity (i.e., $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$) – signifies the possibility of the category of community, namely “the dynamical law of nature” (A553/B581) – the instantaneous and simultaneous reciprocity-converse – and “the dynamical law of causality” (A228) – the *principle of equivalence*.

We think that it is possible to “define possibility, existence, and necessity” (B302) “through obvious tautologies” (B302), namely through the reciprocal causality in the relation of substances to each other (*commercium*), which is to correspond to the dynamical principles, namely the *principle of equivalence*. At last, we are coming to an astonishing finding that “the instantaneous and simultaneous reciprocity-converse” is nothing other than what Euclid’s fifth postulate (EUCLID 2002: 1-36, TANTON 2005: 377-378) means.

4. MERE RELATIONS, ABSTRACTED RELATIONS AND ONE PRINCIPLE

When we make discourse in regard to the causality of an alteration, we have to think that since the entire universe cannot pertain to “*a priori* principles of the possibility of experience” (B294), “their possibility itself rests entirely on this relation” (B294). What does “this relation” mean? It means that the possibility itself of the entire universe is to rest on the impossibility of the category of community – *a priori* principles of the category of non-community, namely the impossibility of experience or the impossibility of empirical cognition. This relation is homogeneous with the reciprocal-converse relation of the objects of possible experience (i.e., $|\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots|$ or the *a priori* categories) to an object of pure understanding (i.e., $e^{i\pi} = -1 = i^2$ or a pure category), which is tantamount to the saying that 1) the instantaneity-simultaneity, namely “all principles of the pure understanding are nothing further than *a priori* principles of the possibility of experience” (B294) while the reciprocity-converse (thereby null-reciprocity), namely all principles of *realitates phaenomena* are homogeneous with the impossibility of experience or the impossibility of empirical cognition, and 2) “all synthetic *a priori* propositions” (B294) such as the entire universe or first-order logic (e.g., *cogito, ergo sum*) stand under *a priori* principles of the possibility of experience – the instantaneity-simultaneity – and *a priori* principles of the category of non-community in virtue of all principles of *realitates phaenomena* – the reciprocity-converse (thereby null-reciprocity). We dare to say that the instantaneity-simultaneity in conjunction with the reciprocity-converse (thereby null-reciprocity) is to yield nothing further than a merely dialectical conflict or “the dynamical antinomy” (A530/B558) such as a conflict or an antinomy between the instantaneous and simultaneous reciprocity-converse and the instantaneous and simultaneous null-reciprocity or a conflict between the void and nothing or a *vacuum* – being logically equivalent to “no contradiction within our judgment” (B190) in regard to “real opposition” (B329) and no opposition between realities. The relation of the *a priori* categories to a pure category, which is homogeneous with the relation of the instantaneity-simultaneity to the reciprocity-converse (thereby null-reciprocity), can be said to signify “a thoroughgoing connection in one experience” (A146), e.g., the void and “the systematic in cognition, i.e., its interconnection based on one principle” (A645/B673), e.g., nothing or a *vacuum*, enabling us to attain the synthetic *a priori* propositions such as the entire universe, or supersymmetry, i.e., black holes. The most important thing is that “one experience” (e.g., the void) and “one principle” (e.g., nothing, i.e., a *vacuum*) signify a merely dialectical conflict, namely the dynamical antinomy. This is analogous with parallel lines in Euclid’s fifth postulate, which never meet no matter how far they are extended. The parallel lines are to be connected thoroughly through the systematic in cognition in regard to parallelism, namely the instantaneous and simultaneous reciprocity-converse or supersymmetry. It can be said that 1) the “cognition” of parallel lines in Euclid’s fifth postulate is to correspond to “its interconnection based on one principle” (A645/B673), 2) it is “not merely a contingent aggregate but a system interconnected in accordance with necessary

laws” (A645/B673). In other words, “a contingent aggregate” (A645/B673) – the mere categories and the mere category – is a system interconnected in accordance with “one principle,” namely the instantaneous and simultaneous reciprocity-converse, and this “system interconnected in accordance with necessary laws” is to be equivalent to the entire universe. The interconnection based on one principle pertains to “a transcendental concept of reason” (A326) – a metaphysical figure itself – which always goes to the absolutely unconditioned, i.e., what is unconditioned in every relation – “ $e^{i\pi} = -1 = i^2$ ” – and never ends except with “the absolute totality in the synthesis of conditions” (A326), namely the schemata of a third thing – “ $\{i^2 \cdot e^{i\pi}\} = 1$ ” – or with the entire universe – the absolute whole of magnitude (the world-whole). A metaphysical figure itself (i.e., Leonhard Euler) has reached the absolutely unconditioned, i.e., what is unconditioned in every relation, i.e., “ $e^{i\pi} + 1 = 0$ ” through discovering, in the “zeta function,” that the infinite series could converge if s is greater than 1 (TANTON 2005: 535-536), while another metaphysical figure itself (i.e., Bernhard Riemann) has gone to the absolute totality in the synthesis of conditions by means of “the Riemann zeta-function” (CONREY 2003: 341-353). Here, we focus on the instantaneous and simultaneous null-reciprocity, thinking that 1) Euler’s identity; “ $e^{i\pi} + 1 = 0$ ” belongs among “a thing in itself which one thought through pure concepts of the understanding” (A525/B553), namely through the decomposition to infinity (e.g., the reciprocity-converse to null-reciprocity) which do not lie “beyond the field of possible experience” (A248-B305), 2) therefore, it is to be homogeneous with *a priori* principles of the possibility of experience and *a priori* principles of the category of non-community, 3) its “possibility itself rests entirely on this relation” (B294) – the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity). We dare to say that this relation is to signify the “dynamical synthesis” (A530/B558). Thus, Euler’s identity is nothing other than “pure cognition” (B87), that “has its origin solely in the understanding” (B87) – “the pure understanding (*realitas noumenon*),” namely the instantaneity-simultaneity. This cognition is to be correspondent to the “intuition and the real in their perception” (B221) which “could be generated in accordance with rules of a mathematical synthesis” (B221), e.g., parallel lines in Euclid’s fifth postulate, and its possibility itself rests entirely on this relation – on a “one-one relation whose domain is the one class and whose converse domain is the other” (RUSSELL 1971: 52-62), i.e., the systematic in cognition such as the instantaneous and simultaneous reciprocity-converse or a merely dialectical conflict, which can be represented as nothing or a *vacuum*.

Since the cardinality in the domain; “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$ ” and the cardinality in the converse domain; “ $0 \rightarrow 1 \rightarrow e^{i\pi} = -1 \rightarrow 0$ ” or “ $0 \rightarrow e^{i\pi} = -1 \rightarrow 0$ ” have a one-one relation, number “1” or prime number or one and itself in the domain can be thought to have a one-one relation to that in the converse domain (YAMAMOTO 2018: 20-45, YAMAMOTO 2019: 43-70). Furthermore, in view of the fact that the one-one relation amounts to the relation between the domain and the converse domain through the metaphysical path, i.e., *synthesis speciosa* and the “transcendental path” (A87), i.e., *synthesis intellectualis*, we can say that 1) the paths, namely the “instantaneous and simultaneous reciprocity-converse” – $\{i^2 \cdot e^{i\pi}\}$ – signifies the bridge between the domain and the converse domain, e.g., parallel lines in Euclid’s fifth postulate, 2) this “schematism of the understanding through the transcendental synthesis of imagination” (B185) is commensurate with the property of number “1” or prime number or one and itself – “the function that corresponds to inner sense (to a receptivity)” (B185), “inner perception” (B68) and “inner intuition” (B68) – which signify the paths, i.e., the “instantaneous and simultaneous reciprocity-converse” (YAMAMOTO 2019:

43-70). These findings would lead us to an astonishing conclusion that “ $e^{i\pi} + 1 = 0$ ” – “*inertial mass*” (PENROSE 2007: 383-411) – pertains to an intensive magnitude, i.e., a degree of influence on sense in the domain – the intuition and the real in perception which could be generated in accordance with rules of a mathematical synthesis, namely “numerical magnitudes” (B221) – *gravitational mass*. In view of the facts that 1) number “1” or prime number or one and itself is homogeneous with a metaphysical figure itself (YAMAMOTO 2019: 43-70), and 2) the possibility itself of a metaphysical figure rests entirely on this relation, i.e., on the relation of the decomposition to infinity (the reciprocity-converse to null-reciprocity) to the infinite divisibility (the instantaneity-simultaneity), we can think that a metaphysical figure itself is nothing other than “the unconditioned (e.g., $e^{i\pi} = -1 = i^2$), which is conditioned by oneness ($\{i^2 \cdot e^{i\pi}\} = 1$)” (YAMAMOTO 2019: 43-70). Furthermore, seeing that a transcendental concept of reason – a metaphysical figure itself – never ends except with the schemata of a third thing or with the entire universe, we say that 1) the absolute totality in the synthesis of conditions – the schemata of a third thing, i.e., the instantaneous and simultaneous reciprocity-converse – is to correspond to “the representation of the synthetic unity of the manifold” (B130-B131), i.e., number “1” or prime number or one and itself ($\{i^2 \cdot e^{i\pi}\} = 1$), 2) “the absolute totality of conditions” (B383), i.e., the entire universe ($\{i^2 \cdot e^{i\pi}\} = 1$ and $e^{i\pi} = -1 = i^2$) is to signify “the constituents of matter” (B322), i.e., “axioms” (B205) or first-order logic, which is nothing other than synthetic *a priori* propositions. Apparently, this discourse does not go around in circles endlessly. Why? There are two reasons. The first is that since the impossibility of possible experience is conditioned by the possibility of experience, the impossibility of possible experience in regard to “the absolutely unconditioned, i.e., what is unconditioned in every relation” (A326) – nothing or a *vacuum* – can be known with certainty. The second is that the impossibility of the category of community in regard to the absolute totality of conditions, i.e., the entire universe can be known with certainty. We have to think that 1) in regard to the relation of the *a priori* categories to a pure category, the impossibility of a thoroughgoing connection in one experience can be known with certainty, 2) this impossibility is homogeneous with the impossibility of the category of community in regard to the entire universe, and the impossibility of possible experience in regard to nothing or a *vacuum*, 3) therefore, the possibility of a thoroughgoing connection in one experience must be given from the systematic in cognition, i.e., its interconnection based on one principle – a metaphysical figure itself – which is possible to cognize the absolutely unconditioned, i.e., what is unconditioned in every relation through *cogito, ergo sum*, e.g., “synthetic *a priori* cognitions of things” (A247).

The relation of the possibility itself to the impossibility is parallel to the relation between parallel lines in Euclid’s fifth postulate, which never meet no matter how far they are extended. It is tantamount to the saying that the “apparent antinomy” (A560/B588) in regard to the possibility itself and the impossibility is neutralized thoroughly through the systematic in cognition in regard to parallel lines in Euclid’s fifth postulate, namely the instantaneous and simultaneous reciprocity-converse. In other words, “the mathematical antinomy” (A530/B558) – the contradiction between the impossibility of possible experience and the possibility itself of possible experience – can be neutralized thoroughly through the instantaneous and simultaneous reciprocity-converse, which signifies a merely dialectical conflict. The relation of the *a priori* categories to a pure category – the instantaneous and simultaneous reciprocity-converse – can be said to signify a thoroughgoing connection in one experience and the systematic in cognition, i.e., its interconnection based on one principle, enabling us to attain to the synthetic *a priori* propositions such as the entire universe or supersymmetry, i.e., black

holes. Since the absolute totality in the synthesis of conditions ($\{i^2 \cdot e^{i\pi}\} = 1$), which pertains to a sum total of mere relations, necessarily stands under a sum of abstracted relations, we think that the systematic in cognition, i.e., its interconnection based on one principle is parallel to the schemata of a third thing. In contrast to it, since the absolute totality of conditions, e.g., “the absolute whole of magnitude (the world-whole)” (A483) – “the antinomy of pure reason in its cosmological ideas” (A506/B534) – necessarily stands under the impossibility of experience or of empirical cognition, it must lie beyond the possibility of the category of community, which is tantamount to the saying that it signifies the impossibility of the category of community. In view of the fact that the impossibility of the category of community is logically equivalent to the possibility itself of the category of non-community, we can think that 1) the absolute totality of conditions – the absolute whole of magnitude (the world-whole) or the entire universe – is homogeneous with the converse domain or Cantorian continuity ($e^{i\pi} = -1 = i^2$, i.e., “ $e^{i\pi} + 1 = 0 = i^2 + 1$ ”) (YAMAMOTO 2019: 43-70), 2) the impossibility of a thoroughgoing connection in one experience – the antinomy of pure reason in its cosmological ideas – is to signify the principle of contradiction, as a merely logical principle. If there is “one thing” in the absolute totality of conditions that can be distinct, it is “one and itself,” which pertains to “the inner determinations of a *substantia phaenomenon*” (B321) in space-time, i.e., “an instant” (B210) and the “simultaneity” (A144), signifying real opposition, i.e., *realitates phaenomena* which rest on “forces” (B321), and no opposition between realities, i.e., *realitas noumenon* which rests on “the active power” (A274). Since forces – *gravitational mass* and the moment of gravity – pertain to the “reciprocal destruction” (A274), e.g., “an analytical opposition” (A504/B532) while the active power – *inertial mass* and the converse moment of gravity – pertains to “the opposition of reciprocal destruction” (A274), e.g., a dialectical opposition, we say that 1) a series of one thing (*numerica identitas*) – one and itself – must pertain to the instantaneous and simultaneous reciprocity-converse, and 2) “the series of appearances” (A552/B580) in the domain have “mere relations” (A284) to one another, yielding “a real contradiction” (A503) – the reciprocal destruction, namely the instantaneous and simultaneous reciprocity-converse – which is “the condition of a successive series of occurrences” (A552/B580), though its being “empirically unconditioned” (A552/B580). In view of the fact that a series of one thing (*numerica identitas*) or the series of appearances is to stand under “ $\{i^2 \cdot e^{i\pi}\} = 1$,” we say that 1) while a series of one thing (*numerica identitas*) – the series of appearances – has mere relations to one another in the domain, it has abstracted relations, through the field of “instantaneous and simultaneous reciprocity-converse,” to “what is unconditioned in every relation,” 2) “prime number” in the domain is combined with that in the converse domain through the field of instantaneous and simultaneous reciprocity-converse, which is congruous to rules of a mathematical synthesis.

Since one and itself or a metaphysical figure itself, signifies “the real condition” (B52) under which “the representation of objects” (B52) stands, and the “subjective representation related to something external that could be called *a priori* objective” (A28) as well, we can say that “mere representations of relation” (B67), i.e., the instantaneous and simultaneous reciprocity-converse, are “given to us through outer sense” (B67), e.g., the instantaneity-simultaneity, and through “the real upon which, whenever it is posited, something else always follows” (A144), e.g., the reciprocity-converse. The instantaneity-simultaneity is to “contain in its representation only the relation of an object to the subject” (B67), i.e., “the reciprocal causality of substances with regard to their accidents” (A144)

while the reciprocity-converse is to contain in its representation “the reciprocal sequence of the determinations of these things” (B257), i.e., wavefunctions. Thus, one and itself or a metaphysical figure itself pertains, as mere representations of relation, to the relation of an object to the subject, namely “the reciprocal causality of substances” (A144). We dare to say that one and itself or a metaphysical figure itself, which pertains to the reciprocal causality of substances with regard to the accidents and the reciprocal sequence of the determinations of these things, could manifest itself as “the reciprocal sequence of perceptions” (B257), namely wavefunctions. Since “through mere relations no thing in itself is cognized” (B67), one and itself or a metaphysical figure itself is not to be cognized as “thing in itself” but is to be cognized as “only appearances of outer sense” (B333), namely as mere appearances, which corresponds to the way of thinking that “matter is *substantia phaenomenon*” (B333). It is tantamount to the saying that *substantia phaenomenon* would manifest “in all parts of space that it occupies and in all effects that it carries out” (B333). We can put it another way, saying that matter, i.e., *substantia phaenomenon*, under which one and itself or a metaphysical figure itself necessarily stands, compel it to act in virtue of a sum total of mere relations which causes “the succession of the states itself (that which has happened)” (A207) and all alteration (transition of a thing from one state into another) – *realitates phaenomena* and “*realitas phaenomenon*” (A265). In view of the fact that *substantia phaenomenon* pertains to “mere relations” and forces, we dare to say that 1) *substantia phaenomenon*, which pertains to the “schema of community (reciprocity)” (A144) and a reciprocal influence, i.e., a real community (*commercium*) of substances – the reciprocal destruction and the opposition of reciprocal destruction – is to be the schema of the reciprocal causality of substances, 2) *realitates phaenomena et substantia phaenomenon* is homogeneous with the moment of gravity and *gravitational mass*, while *realitas noumenon et substantiae noumena*, which pertains to “null-reciprocity in space-time,” is homogeneous with the reciprocal-converse moment of gravity and *inertial mass*.

Since relation-numbers – “ $e^{i\pi} = -1 = i^2$ and $\{i^2 \cdot e^{i\pi}\} = 1$ ” – signify abstracted relations, it appears that mere relations and forces are distinct from “abstracted relations,” e.g., from the opposition of reciprocal destruction. However, we have to take note of the fact that mere relations and forces, under which one and itself or a metaphysical figure itself stands, signify “all effects that it carries out” (B333). Therefore, we say that one and itself or a metaphysical figure itself in the domain arises in virtue of the “dynamical categories” or the “metaphysical categories” (YAMAMOTO 2017d: 19-29) and acts, in virtue of the “mathematical categories” (B110), with all effects that it carries out. In view of the fact that one and itself or a metaphysical figure itself, which belongs to the metaphysical categories, is necessarily subject to mere relations and forces, we say that the metaphysical categories (thereby the mathematical categories) are to have “all power and influence” (A468/B496). We have already made a discourse in regard to the categories in “Table of Categories” (B106), saying, “We cannot think that ‘inductive numbers,’ which the prisoners-mathematicians use inside the cave, are the ‘transcendental product of the imagination, which concerns the determination of the inner sense’ (A142) – ‘the mathematical categories’ (B110). This is the Plato’s schemata of ‘the shadows’ – a product of ‘a mere function of thinking’ (A253). We have to take note of the fact that the categories which the prisoners-mathematicians think in terms of *phaenomena* belong among ‘merely sophistical (dialectical) concepts’ (A644/B672) or ‘the mere category’ (B151)” (YAMAMOTO 2018: 20-45). The

mere relations of “inductive numbers” which rest on “the shadows of the artificial objects” (The Republic 514-516*) to one another cannot be the active power while the mere relations of the mere category, namely natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) to one another (e.g., numerical formulas), can be thought to pertain to “realities in appearance (*realitas phaenomenon*)” (A265), namely the reciprocal destruction or *realitates phaenomena* (thereby *realitas noumenon*), namely the opposition of reciprocal destruction, causing all alteration (transition of a thing from one state into another) and the succession of the states itself (that which has happened) as the active power. Since “a persistent appearance in space (impenetrable extension) contains mere relations” (A284), mere relations of the mere category to one another enable one and itself or a metaphysical figure itself to cognize all appearances in the world of sense “in their intuition, as extensive magnitudes” (B212) and “in their mere perception (sensation and thus reality), as intensive ones” (B212), like “two moving forces in the same straight line that either push or pull a point in opposed directions” (B321) or forces “in drawing others to it (attraction) or in preventing penetration of it (repulsion and impenetrability)” (B321). Therefore, mere relations of the mere category to one another – a sum total of mere relations, namely the intensive magnitude and a sum of abstracted relations, namely extensive magnitude – are to be homogeneous with “forces” and “the active power” – “the gravitational and inertial mass” (PENROSE 2007: 383-411) – indicating that *inertial mass*, which pertains to “resistance to acceleration” (PENROSE 2007: 383-411), could be parallel to the *gravitational mass*, which pertains to “acceleration” (PENROSE 2007: 383-411). On the other hand, on account of the facts that 1) any leap in the series of appearances (alterations) is commensurate with *realitas phaenomenon* which “ceases in nothingness (= 0 = *negatio*)” (A143) and *substantia phaenomenon* which sinks into nothingness (= 0 = *negatio*), 2) the leap in the series of appearances (alterations) rests on the conditions of space-time and their determinations – the instantaneous and simultaneous null-reciprocity – making “every reality representable as a quantum” (B183), we say that “any leap” is to be cognized, in the anticipation of perception, namely in the anticipation of *realitas phaenomenon* which ceases in nothingness (= 0 = *negatio*), as the instantaneity-simultaneity (*realitas noumenon*), and in their mere perception (sensation and thus reality) of “a continuous magnitude” (B212), i.e., *substantia phaenomenon* which sinks into nothingness (= 0 = *negatio*) as null-reciprocity (*substantiae noumena*). Thus the mere perception (sensation and thus reality) would enable us to cognize continuous magnitudes, e.g., *realitates phaenomena et substantia phaenomenon* as *substantiae noumena*. Since *realitates phaenomena et substantia phaenomenon* – continuous magnitudes – are represented through the pure understanding (*realitas noumenon*), namely through the instantaneity-simultaneity, as *substantiae noumena* (a continuous magnitude), no opposition between *realitates phaenomena et substantia phaenomenon* (the instantaneous and simultaneous reciprocity-converse), e.g., “beings of sense (*phaenomena*)” (B306), and *realitas noumenon et substantiae noumena* (the instantaneous and simultaneous null-reciprocity), e.g., “beings of understanding (*noumena*)” (B306) can be considered.

Furthermore, since *realitates phaenomena et substantia phaenomenon* (the moment of gravity and *gravitational mass*) is in a reciprocal and converse parallel to *realitas noumenon et substantiae noumena* (the converse moment of gravity and *inertial mass*), “a dynamical synthesis of appearances”

* ‘The Republic 514-516’ designates Stephanus pagination 514-516 of *The Republic* (Plato, *The Republic Books VI-X*, Harvard University Press, 1935).

(A529/B557) – the synthesis of *realitates phaenomena et substantia phaenomenon* (the instantaneous and simultaneous reciprocity-converse) and *realitas noumenon et substantiae noumena* (the instantaneous and simultaneous null-reciprocity), or “the synthesis of two concepts” (A155), namely the “combination *a priori*” (B131) of “contradictorily opposed determinations” (B291) and “contradictorily opposed predicates” (B48) – is to signify real opposition where “one reality, if combined in one subject with another, cancels out the effect of the latter” (B329) – the reciprocity-converse – and no opposition between realities, i.e., “a relation such that when they are bound together in one subject they cancel out their consequences, as in $3 - 3 = 0$ ” (B320-A265) – the instantaneity-simultaneity – being equivalent to the instantaneous and simultaneous reciprocity-converse, namely “number.” This signifies nothing but a merely dialectical conflict. Therefore, we can think that real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) could manifest, through the combination *a priori* of mere perception (sensation and thus reality) and anticipation of perception, in the synthesis of two concepts, e.g., the instantaneous and simultaneous reciprocity-converse, which is tantamount to the saying that beings of sense (*phaenomena*) is in a reciprocal and converse parallel to beings of understanding (*noumena*), or that *quantum discretum* is in a reciprocal and converse parallel to *quantum continuum*. In contrast to real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$), prime numbers, i.e., one thing (*numerica identitas*) could arise as *realitas noumenon* and *realitates phaenomena* when “reality is represented only through the pure understanding (*realitas noumenon*)” (B320), in other words, only when it is cognized that an object of pure understanding – one thing (*numerica identitas*) – has “no relation (as far as the existence is concerned) to anything that is different from it” (B321), namely beings of understanding (*noumena*) or the void, indicating that an object of pure understanding – one thing (*numerica identitas*) – is homogeneous with the “impossibility of possible experience” (e.g., nothing or a *vacuum*). Furthermore, in view of the facts that 1) *substantiae noumena* – the converse domain or prime number – pertains to the possibility of *realitas noumenon* (no opposition, i.e., the instantaneity-simultaneity) while *substantia phaenomenon* – the domain or prime number – pertains to the possibility itself of *realitates phaenomena* (real opposition, i.e., the reciprocity-converse), 2) *substantiae noumena*, namely null-reciprocity has relation (as far as the existence is concerned) to *realitas noumenon*, i.e., the instantaneity-simultaneity, we can think that 1) prime number, which has relation (as far as the existence is concerned) to possibility and possibility itself – the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity) – is homogeneous with the pure schema of magnitude (*quantitatis*), i.e., “number” – the instantaneous and simultaneous reciprocity-converse – 2) therefore “prime number” or “number” is to correspond to a composite (*compositum reale*), i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$, thereby real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$).

In regard to this issue, we have already made discourse, saying, “Kant...says, ‘The infinite division indicates only the appearance as *quantum continuum*, and is inseparable from the filling of space; for the ground of its infinite divisibility lies precisely in that. But as soon as something is assumed as a *quantum discretum*, the multiplicity of units in it is determined; hence it is always equal to a number’ (A527/B555)...In Kant’s metaphysics, number – *quantum continuum* – is homogeneous with ‘the appearance as *quantum continuum*.’ However, when it is under the aegis of Kant’s assumption, number is transformed into one in which the multiplicity of units is determined” (YAMAMOTO 2017a: 19-37, YAMAMOTO 2018: 20-45). “This metaphysics appears to be in contradiction with our empirical intuition and understanding” (YAMAMOTO 2017a: 19-37). What does “something” mean?

What does “Kant’s assumption” mean? Since “something” is to signify an aggregate of many appearances, i.e., the unconditioned in the series of appearances – natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – we think that 1) something must be commensurate with “a third thing” (A138/B177) – supersymmetry, namely the instantaneous and simultaneous reciprocity-converse – 2) Kant’s assumption that merely intelligible objects or mere appearances – *quantum continuum* – signify the contingent existence of a substance itself, i.e., *quantum discretum* in which the multiplicity of units can be determined, is to belong to the transcendental truth in virtue of transcendental ideality of appearances or synthetic *a priori* principles. Natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – *quantum discretum* – can “go to infinity” (A513/B541) “in the progressive decomposition, or the regress itself” (A524/B552), thereby being “divisible to infinity” (A525/B553). At the same time, “natural number” ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) which signifies *quantum discretum* under the condition that there is no opposition between *realitates phaenomena et substantia phaenomenon* and *realitas noumenon et substantiae noumena*, leads us to the schematism of the understanding through the transcendental synthesis of imagination such that it “can ascend to infinity” (A512/B540), and “in this regress of decomposition an unconditioned (indivisible) member of this series of conditions is never encountered” (A513/B541), thereby being divisible to infinity. Thus, *quantum discretum*, which is homogeneous with *quantum continuum*, corresponds to “number.”

We think that insofar as a thing – *quantum discretum*, e.g., *gravitational mass* and the moment of gravity – is assumed to be equivalent to *quantum continuum*, e.g., *inertial mass* and the converse moment of gravity, the assumption is parallel to “Newton’s second law” (PENROSE 2007: 383-411). Therefore, when Kant makes a discourse in regard to the series of appearances, namely *realitates phaenomena et substantia phaenomenon*, which signifies *gravitational mass* and the moment of gravity, we have to say, following what Kant refers to (A505/B533), as follows.

The series of appearances (e.g., the *gravitational mass* and the moment of gravity) is encountered not only in the regressive synthesis itself (the instantaneous and simultaneous reciprocity-converse, e.g., acceleration), but also in itself in appearance, as a thing on its own given prior to every regress, namely as *inertial mass* (e.g., resistance to acceleration) and the converse moment of gravity. Hence we have to say: the multiplicity of parts in a given appearance is in itself finite and infinite, because appearance is existing in itself, and the parts are given for the very first time through the regress of the decomposing synthesis (the instantaneous and simultaneous reciprocity-converse), and in this regress, which is never given absolutely wholly either as finite nor as infinite.

In other words, *inertial mass* and the converse moment of gravity (e.g., the instantaneous and simultaneous null-reciprocity), which appears to be given prior to *gravitational mass* and the moment of gravity (e.g., the instantaneous and simultaneous reciprocity-converse), is never encountered prior to *gravitational mass* and the moment of gravity. Thus, on account of the fact that *inertial mass* and the converse moment of gravity, which are homogeneous with natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$), necessarily stand under *gravitational mass* and the moment of gravity, which are homogeneous with real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) or a composite (*compositum reale*), it is possible to measure *gravitational mass* and the moment of gravity (thereby *inertial mass* and the converse moment of gravity) by means of number and numerical formulas. Thus, we can attain the “synthetic *a priori* cognitions of things,” as synthetic *a priori* propositions.

5. PRIME NUMBER, A COMPOSITE, GEOMETRY, CAUSE AND CAUSALITY

From the discourse so far, it follows; we can think that 1) one and itself (*cogito, ergo sum*) – “a representation that summarizes the successive addition of one (homogeneous) unit to another” (B182), e.g., *quantum continuum* – is correspondent to prime number, which is homogeneous with *quantum discretum*, 2) *quantum discretum* and *quantum continuum*, namely pure schema of magnitude (*quantitatis*) is correspondent to “number” (B182) – a composite (*compositum reale*), i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$ – which “stand outside one another and yet in connection” (A215-B262) – the instantaneous and simultaneous reciprocity-converse and the instantaneous and simultaneous null-reciprocity. Thus, a composite (*compositum reale*) is considered to signify a reciprocal influence, i.e., a real community (*commercium*) of substances. We have to take note of the facts that 1) the converse domain; “ \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$ ” is to signify a community (*communio*) of apperception, e.g., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$), while the domain; $\{i^2 \cdot e^{i\pi}\} = 1$ is to signify a reciprocal influence, i.e., a real community (*commercium*) of substances, 2) a composite (*compositum reale*) is to signify the category and the categories, namely real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) insofar as the Dedekind gap is filled by means of “a median class having \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$,” enabling them to stand outside one another and yet in connection. “The three dynamical relations, from which all others arise, are those of inherence, of consequence, and of composition” (B262), such as “ \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$,” $\{i^2 \cdot e^{i\pi}\} = 1$ and a composite (*compositum reale*), respectively. These findings lead us to the principle of causality (under the analogies of experience), namely the *principle of equivalence*, which comprises the principle of continuity, the principle of contradiction and the principles of modality. We have to say, in association with a composite (*compositum reale*) which is to signify *quantum continuum* in terms of *realitates phaenomena et substantia phaenomenon*, that 1) “prime number” is to signify a third thing, namely the instantaneous and simultaneous reciprocity-converse that “prescribe laws *a priori* to appearances, thus to nature as the sum total of all appearances (*natura materialiter spectata*)” (B163), 2) “prime number,” as abstracted relations themselves, is to be commensurate with relation-numbers – \aleph_0 terms, i.e., $e^{i\pi} = -1 = i^2$ and $\{i^2 \cdot e^{i\pi}\} = 1$. Furthermore, in view of the fact that “relations” based on forces – a thoroughgoing connection in one experience – pertain to the alteration of the inner determinations of a *substantia phaenomenon* in space-time – the interconnection based on one principle – we have to think that “prime number” pertains to a reciprocal influence, i.e., real community (*commercium*) of substances – *gravitational mass* – along with number ($\mathbb{R} = \{1, 2, 3, 4, \dots\}$, thereby $\mathbb{N} = \{1, 2, 3, 4, \dots\}$), which pertains to a sum total of mere relations, e.g., the intensive magnitude – the moment of gravity. “One principle” corresponds to the instantaneous and simultaneous reciprocity-converse while “one experience” corresponds to the instantaneous and simultaneous null-reciprocity. We think that the absolutely unconditioned, i.e., what is unconditioned in every relation ($e^{i\pi} + 1 = 0 = i^2 + 1$), which is conditioned by one principle, i.e., the reciprocal causality in the relation of substances to each other (*commercium*) – the *principle of equivalence* – is nothing but “the unconditioned, which is conditioned by oneness” (YAMAMOTO 2019: 43-70) – the degree of reality or wavefunctions. Therefore, number “1,” or prime number or one and itself in the converse domain, if they are conjured up in nullity in space-time, could be, in a manner of instantaneous and simultaneous reciprocity-converse, equivalent to those in the domain, and vice versa, yielding *Planck’s constant*. Since the unconditioned, which is conditioned by oneness, i.e., $\{i^2 \cdot e^{i\pi}\} = 1$ is homogeneous with prime

number, we can say that prime number – *quantum continuum* – signifies the unity of the categories; the instantaneous and simultaneous reciprocity-converse, which is nothing other than “the concept of a number (which belongs to the category of allness)” (B111). Since “Unity” (B106) is equivalent to “allness (totality)” (B111), prime number is to signify the possibility itself of “the category of community” (B292) (namely the category of community) and the possibility of the category of community – a composite (*compositum reale*), i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and $i^2 = -1$, thereby $e^{i\pi} = -1$.

In view of the fact that prime number is to signify the possibility and the possibility itself of the category of community, i.e., *quantum discretum* (the moment of gravity or *gravitational mass*) or the impossibility of the category of community, i.e., *quantum continuum* (the converse moment of gravity or *inertial mass*), namely the possibility itself of the category of non-community (null-reciprocity), we can say that 1) *quantum discretum* and *quantum continuum* are to stand outside one another and yet in connection, 2) the “connection” of *quantum discretum* and *quantum continuum*, namely the connection of $i^2 = -1$ and natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) must be possible, enabling us to yield the unity of the categories, namely a composite (*compositum reale*) or prime number. Since $i^2 = -1$ or “prime number” is to signify the number “1,” the unity of the categories is homogeneous with the concept of a number (which belongs to the category of allness) – natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$). Are there any differences among prime numbers and natural numbers? No, there is no difference since they all belong to the same series of number except “1.” We have to think that “the state of representations” (A274) in regard to “number” are different from one another. We say that 1) the state of representations, which pertains to the possibility and the possibility itself of the category of community is to belong to “prime number” in the domain, signifying the category and the categories, 2) the state of representations, which pertains to the impossibility of the category of community, namely the possibility itself of the category of non-community (i.e., the category of non-community) is to belong to “prime number” in the converse domain, signifying the category, 3) the state of representations, which pertains to the “connection” of the possibility itself and the impossibility is to belong to “prime number,” as the connection of $i^2 = -1$, thereby $e^{i\pi} = -1$ and natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$), signifying the unity of the categories. Therefore, we say that “prime number” is to signify the domain (e.g., $i^2 = -1$) or the converse domain ($e^{i\pi} = -1$ or natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$)) or the “paths” (YAMAMOTO 2019: 43-70), namely the instantaneous and simultaneous reciprocity-converse (e.g., number “1” or $\{i^2 \cdot e^{i\pi}\} = 1$ or $\{|i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots\}$). The state of representations is deemed to pertain to the “categories of modality” (A219), which “do not augment the concept to which they are ascribed in the least, but rather express only the relation to the faculty of cognition” (A219). From the discourse above, it follows that we can think that 1) “prime number” or a composite (*compositum reale*), which signifies the whole state of representations, such as the domain, the converse domain and the paths, is correspondent to “a number (which belongs to the category of allness)” (B111) – “natural number” ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – 2) since the “connection” of the possibility, the possibility itself and the impossibility takes place, in the paths, as the instantaneous and simultaneous reciprocity-converse, it is to connect “the existence that is given by possibility itself” (B111) of the category of non-community such as the converse moment of gravity, and the existence that is given by the possibility itself of the category of community such as the moment of gravity, yielding the unity of the categories, namely the gravitational and inertial mass. We should like to put it another way, saying that the unity of the categories, e.g., one and itself (*cogito*,

ergo sum), is to signify number “1” which is commensurate with the existence that is given by the category of non-community and the category of community. This indicates that 1) “natural number” ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) is to signify the converse domain (the category of non-community) while $i^2 = -1$ is to signify the domain (the category of community), and 2) the number “1,” namely “ $-1 \times -1 = 1$ ” is to signify the unity of the categories (a reciprocal influence, i.e., a real community (*commercium*) of substances), e.g., one and itself (*cogito, ergo sum*). We have to note of the facts that $i^2 = -1$, which signifies the category of community such as the domain, appears to be parallel to nothing or a *vacuum* that is given by the impossibility of possible experience, or to the converse domain or the void that is given by the possibility itself of possible experience. The converse domain is to signify a pure category ($e^{i\pi} = -1 = i^2$) or prime numbers while the domain is to signify the *a priori* categories ($\{i^2 \cdot e^{i\pi}\} = 1$) or prime numbers. Since such categories of modality as the impossibility of possible experience or the possibility itself of possible experience do not augment the concept of a number (which belongs to the category of allness), they can express only the relation to the faculty of cognition – the existence or the non-existence of “the cognition itself *a priori* in intuition” (A88), i.e., *cogito, ergo sum*. The existence of the cognition itself *a priori* in intuition is to be homogeneous with the “objects of the senses” (B73), i.e., *realitates phaenomena et substantia phaenomenon* while its non-existence is to be homogeneous with an “object of the pure understanding” (B321), i.e., *realitas noumenon et substantiae noumena*. Since the law of nature determines the transition of the cognition itself *a priori* in intuition, e.g., $\{i^2 \cdot e^{i\pi}\} = 1$ from its existence, e.g., the possibility itself to its non-existence, e.g., the impossibility, we think that this transition, which stands under the unity of the categories, signifies “the pure fundamental concepts of all possible experience” (B213), namely the impossibility of possible experience (i.e., nothing or a *vacuum*), indicating that the category of allness, namely natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) is to be correspondent to the unity of the categories under the impossibility of possible experience. We have to take note of the fact that the entire universe, which is given by the impossibility of experience or the impossibility of the category of community cannot be “the causality of a substance in the reciprocal determination of others” (B111). Since “the schema of possibility is the agreement of the synthesis of various representations with the conditions of time in general, ... thus the determination of the representation of a thing to some time” (B184), we can think that “the conditions of time in general” – the instantaneity-simultaneity – would pertain to the determination of the category of community, i.e., the reciprocity-converse and the category of non-community, i.e., null-reciprocity. Furthermore, on account of the fact that “the regressive synthesis itself” (A505/B533) – the schemata of a third thing ($\{i^2 \cdot e^{i\pi}\}$) – is homogeneous with the possibility, i.e., the schemata of the void, while the regress itself – the schema of a something = X ($e^{i\pi} = -1 = i^2$) – is homogeneous with the impossibility of possible experience, i.e., the schema of nothing or a *vacuum*, it is possible for us to say that 1) the regressive synthesis itself and the regress itself – the schemata of a third thing, i.e., the instantaneous and simultaneous reciprocity-converse and the schema of a something = X ($e^{i\pi} = -1 = i^2$), i.e., the instantaneous and simultaneous null-reciprocity – is first-order logic (YAMAMOTO 2019: 43-70), 2) first-order logic pertains to the causality of a substance in the reciprocal determination of others. In regard to this issue, we have already said “that 1) ‘the regress of the decomposing synthesis’ – the regressive synthesis itself, namely ‘the mere continuation of productive synthesis of a certain kind’ (B212) and ‘the regress itself,’ namely ‘the repetition of an ever-ceasing synthesis’ (B212) – is ‘the true and sole conditions’ (A146) for providing the transcendental synthesis of the imagination ‘with a relation to objects, thus with significance’

(A146), ...3) the regressive synthesis itself and the regress itself serve to subject appearances to ‘the same inner determinations (*qualitas et quantitas*)’ (B319), i.e., transcendental space-time-determination, and ‘to general rules of synthesis through grounds of an *a priori* necessary unity’ (A146), thereby making them fit for ‘a thoroughgoing connection in one experience’ (A146)” (YAMAMOTO 2019: 43-70). We should like to elaborate on it, saying that 1) “the regress of the decomposing synthesis” (A505/B533) – parallel lines in Euclid’s fifth postulate – is the true and sole conditions for providing the transcendental synthesis of the imagination with a relation to objects, thus with significance, 2) the regressive synthesis itself, e.g., the mere continuation of productive synthesis of a certain kind (the mere continuation of the reciprocity-converse) and the regress itself, e.g., the repetition of an ever-ceasing synthesis (the repetition of the instantaneity-simultaneity) serve to subject appearances to the same inner determinations (*qualitas et quantitas*), i.e., transcendental space-time-determination and to general rules of synthesis through grounds of an *a priori* necessary unity, thereby making a thoroughgoing connection in one experience fit for the systematic in cognition, i.e., its interconnection based on one principle, and vice versa.

In regard to the issue of the category of allness and the unity of the categories, we have already made discourse, saying, “we can think that 1) ‘oneness,’ i.e., ‘an infinite set of representations within itself’ signifies ‘allness (totality)’ (B111), i.e., the category of allness and ‘a whole,’ i.e., the unity of the categories, 2) allness (totality), i.e., the category of allness – ‘number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$ and $i^2 = -1$)’ – and a whole, i.e., the unity of the categories – prime number – signify ‘the possibility of the category of community’ (B292) or the possibility itself of the category of community, 3) ‘number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$ and $i^2 = -1$)’ and prime number stand under a third thing, i.e., $\{i^2 \cdot e^{i\pi}\} = ‘1,’$ indicating that allness (totality), e.g., ‘number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$ and $i^2 = -1$)’ could be commensurate with the unity of the categories, e.g., prime number” (YAMAMOTO 2019: 43-70). Furthermore, in view of the facts that 1) the entire universe – the absolute whole of magnitude (world-whole) – could be commensurate with the absolutely unconditioned, i.e., what is unconditioned in every relation ($e^{i\pi} = -1 = i^2$, i.e., $e^{i\pi} + 1 = 0 = i^2 + 1$) and the unconditioned, which is conditioned by oneness (e.g., $\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots$), 2) therefore, the entire universe, which is analogous with parallel lines in Euclid’s fifth postulate, corresponds to the absolute totality of conditions, 3) a number (which belongs to the category of allness) pertains to a sum total of mere relations and a sum of abstracted relations, it is not farfetched to say that 1) a composite (*compositum reale*), which is to stand outside one another and yet in connection, signifies the possibility of the objects of experience and the objects of possible experience – the category and the categories – which appear to be commensurate with the entire universe, which could consist in an aggregate of many appearances and elements of cognition that are to be encountered in us *a priori*, being equivalent to the impossibility of experience, 2) the manifold that is given in a sensible intuition, i.e., “the conditioned itself” (A523/B551-A524/B552) – the objects of possible experience and the possibility of the objects of experience – could signify the entire universe – the mathematically unconditioned unity – 3) therefore a composite (*compositum reale*), or an object of pure understanding, i.e., one thing (*numerica identitas*) such as “prime number” or the Dedekindian series having Cantorian continuity belongs to the mathematically unconditioned unity which stand outside one another and yet in connection. Since the Dedekindian continuity, which could disappear, is always to appear, it signifies the “reciprocal sequence of the determinations of these things” (B257) which is never to cease. Since the Cantorian continuity, which could appear or disappear, is always to be, it signifies *essentialia*. This is tantamount to the saying that the entire

universe, which could consist in the Dedekindian continuity (namely the Dedekindian series) and the Cantorian continuity, is never to disappear in virtue of “reciprocal sequence,” i.e., wavefunctions while it always to be in virtue of *essentialia.*, i.e., *Planck’s constant*. When Kant says, “the unconditioned alone makes possible the totality of conditions, and conversely the totality of conditions is always itself unconditioned” (B379), we, thinking that since the mathematically unconditioned unity – the entire universe – which consists in “the conditions (the parts)” (A523/B551) – *essentialia* – would pertain to “what is conditioned in every relation,” namely the conditioned part of “an unconditioned whole” (A560/B588) and “what is unconditioned in every relation,” namely the unconditioned part of an unconditioned whole, an unconditioned whole in which the totality of the conditions resides, is homogeneous with “an unconditioned part of a given whole” (A560/B588), namely the instantaneous and simultaneous reciprocity-converse, entirely agree with him. We should like to put it another way, saying that since a composite (*compositum reale*) consists in the conditioned part and an unconditioned part of the mathematically unconditioned unity, it could signify the entire universe, namely the absolute totality of conditions or prime number or the Dedekindian series ($(\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots)$). In view of the fact that a composite (*compositum reale*), which is to be conditioned by the “instantaneous and simultaneous reciprocity-converse” is homogeneous with prime number, namely the absolute totality of conditions, we say that “prime number,” thereby a composite (*compositum reale*), i.e., number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$ and $i^2 = -1$) signifies the cause and the causality, namely the electron (PENROSE 2007: 609-626) and the photon (PENROSE 2007: 412-439). Then, it becomes possible for us to think that 1) the entire universe – the cosmological ideas – could consist in the mathematically unconditioned unity such as “the infinite Number ∞_1 ” (FREGE 1980: 99-119), namely “prime number” or a composite (*compositum reale*), 2) “the cosmological ideas dealing merely with mathematically unconditioned unity” (A532/B560) – the infinite Number ∞_1 or prime number – is commensurate with “unconditioned totality” (A531/B559), namely the entire universe or “a condition that is empirically unconditioned, but also nonsensible” (A531/B559), namely the instantaneous and simultaneous null-reciprocity. Since “prime number” can be thought to signify the cause and the causality, it necessarily pertains to a sum total of mere relations, namely the intensive magnitudes – forces – and to a sum of abstracted relations, i.e., the relation of *realitas noumenon et substantiae noumena* (e.g., *inertial mass* or the converse moment of gravity) to *realitates phaenomena et substantia phaenomenon* (e.g., *gravitational mass* or the moment of gravity) – “the active power” (A274) – yielding real opposition, namely an analytical opposition (the reciprocity-converse) and no opposition, namely a dialectical opposition (the instantaneity-simultaneity). On account of the fact that a sum total of mere relations and a sum of abstracted relations necessarily pertain to realities in appearance (*realitas phaenomenon*) and the inner determinations of a *substantia phaenomenon* in space-time, we can say that they enable one and itself or prime number to determine all appearances in *realitas phaenomenon* as the extensive magnitude and in *substantia phaenomenon* as the intensive magnitude, which is equivalent to the moment of gravity and *gravitational mass* – “forces” – or the converse moment of gravity and *inertial mass* – “the active power.” Since “prime number,” which signifies the moment of gravity and *gravitational mass*, is necessarily equivalent to the converse moment of gravity and *inertial mass*, it signifies “an act of the spontaneity of the power of representation” (B130), i.e., “synthesis” (B130). While a sum total of mere relations (*gravitational mass* and the moment of gravity) and a sum of abstracted relations (*inertial mass* and the converse moment of gravity) necessarily stands under “synthesis,” an

act of the spontaneity of the power of representation – “prime number” – must have mere relations to the active power in order for it to be competent. We should like to put it another way, saying that “prime number,” i.e., “synthesis” could be parallel to “Maxwell’s demon” (BENNETT 1987: 108-116) – the “acting subject, in its intelligible character” (A539/B567)” – implying that the “second law of thermodynamics” is violated in the interconnection based on one principle, namely in the entire universe and in the series of appearances.

Furthermore, when Kant makes discourse in regard to the whole, parts and the division (A523/B551-A524/B552), namely a series of one thing (*numerica identitas*), i.e., a Dedekindian series having Cantorian continuity, we, thinking that a series of one thing (*numerica identitas*) signifies first-order logic, should like to say as follows.

If we divide a whole that is given in intuition, then we go from a conditioned (a series, i.e., $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$) to the conditions of its possibility, namely the unconditioned ($e^{i\pi} = -1 = i^2$, i.e., $e^{i\pi} + 1 = 0 = i^2 + 1$). The division of the parts (*subdivisio* or *decompositio*) is the *regress* and *progress* in space-time from the conditioned to the unconditioned. The absolute totalities of this series would be given only when and if the *regress* and *progress* in space-time could attain to simple parts (e.g., the instantaneous and simultaneous null-reciprocity). But if each of the parts in a continuously progressing decomposition is once again divisible, the division, i.e., “the regress” from the conditioned to the unconditioned (e.g., simple parts), goes *in indefinitum*; for though the unconditioned (the parts, namely the instantaneity-simultaneity and null-reciprocity) are contained in the conditioned itself (the instantaneous and simultaneous reciprocity-converse), simple parts are not all given along with the conditioned, which is given as a whole in an intuition enclosed within its boundaries. The *regress* and *progress* in space-time thus may be called a regress *in indefinitum* (thereby the *regressus in infinitum*), as the previous cosmological idea (an unconditioned whole or the unconditioned totality) allowed, where we have proceeded from the conditioned (a series, i.e., $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$) to the unconditioned ($e^{i\pi} + 1 = 0 = i^2 + 1$) in the regressive synthesis itself which was given simultaneously with the regress itself but were not added to it in the empirical regress.

We say that a regress *in indefinitum* – “a *spontaneous* symmetry breaking” (PENROSE 2007: 627-654) – is “nothing more than principles of the exposition of appearances that do not go *a priori* beyond the formal possibility of experience” (A250), namely the instantaneity-simultaneity and null-reciprocity.

We are to “proceed *in indefinitum*” (A685/B713) in Euclidean geometry (e.g., parallel lines in Euclid’s fifth postulate) where reason itself is not considered as the determining cause, while we are to proceed *in infinitum* in “hyperbolic geometry” (TANTON 2005: 355-356) where “reason itself is considered as the determining cause (in the case of freedom)” (A685/B713). In regard to the issue of the “division of the parts (*subdivisio* or *decompositio*)” (A523/B551), namely the *regress* and *progress* in the series of these conditions, which is homogeneous with “a regress in the series of these conditions” (A523/B551), i.e., the regressive synthesis itself and the regress itself, we have to say that 1) the regressive synthesis itself and the regress itself – the regress of the decomposing synthesis, namely the instantaneous and simultaneous reciprocity-converse – corresponds to the law of nature in regard to “a given appearance” (A505/B533) or a thing existing in itself, 2) a given appearance or a

thing existing in itself is to stand under the regulative principles and the constitutive principles – the decomposition to infinity and the infinite divisibility, which are nothing but “symmetry breaking” (PENROSE 2007: 627-654). The “symmetry breaking” is to exhibit the cause (the instantaneity-simultaneity or *Planck’s constant*) and the causality (the reciprocity-converse or wavefunctions) – the electron, thereby the *positron* (PENROSE 2007: 609-626) and the photon. To rephrase it, saying that a given appearance or a thing existing in itself is nothing more than the regress of the decomposing synthesis (e.g., the instantaneity = the simultaneity, which is something = the reciprocity-converse, can at the same time be null-reciprocity), which is homogeneous with the transcendental synthesis of imagination along with *synthesis speciosa* and *synthesis intellectualis* (e.g., *gravitational mass* and the moment of gravity) or the “pure synthesis of the imagination” (A118) along with a “pure synthesis of apprehension” (A100) and the “pure synthesis of representations” (B104) (e.g., *inertial mass* and the converse moment of gravity). We dare to say that the inner determinations of a *substantia phaenomenon* in space-time is correspondent to the saying that “the instantaneity = the simultaneity, which is something = the reciprocity-converse, can at the same time be null-reciprocity.”

6. CONTINUOUS MAGNITUDE, PRIME NUMBER, IMMEDIATE INFERENCES AND SUPERSYMMETRY

Seeing that 1) “prime number,” which is to signify the cause and the causality, must pertain to a sum total of mere relations and a sum of abstracted relations, determining a series of one thing (*numerica identitas*) or the series of appearances, 2) it signifies the mathematical categories which necessarily stand under the metaphysical categories or the “dynamical ones” (B110), as indicated in “Table of Categories” (B106), i.e., “Of Quantity (Unity, Plurality, Totality)” and “Of Quality (Reality, Negation, Limitation),” we say that “prime number” could be commensurate with metaphysical axioms, thereby “mathematical axioms” (A300) insofar as it is cognized that the synthetic proposition in regard to “prime number” – first-order logic – could belong to the synthetic *a priori* propositions, e.g., the instantaneous and simultaneous reciprocity-converse or supersymmetry, which are grounded in synthetic *a priori* judgments, and “synthetic *a priori* cognitions of things” (A247), namely in *realitates phaenomena et substantia phaenomenon* (the moment of gravity and *gravitational mass*) and *realitas noumenon et substantiae noumena* (the converse moment of gravity and *inertial mass*). We define *realitates phaenomena et substantia phaenomenon* (the instantaneous and simultaneous reciprocity-converse) as “a thing,” which signifies “real opposition” (B329), or forces and *realitas noumenon et substantiae noumena* (the instantaneous and simultaneous null-reciprocity) as “a thing,” which signifies the “reality” which is represented only through the pure understanding, i.e., “no opposition between realities” (B320) – the active power. So far we have focused on prime number. Here we have to discuss “natural number” ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) in addition to the discourse which we have already made (YAMAMOTO 2017d: 19-29, YAMAMOTO 2018: 20-45, YAMAMOTO 2019: 43-70). Since the disappearance of realities in appearance, namely the disappearance of *realitas phaenomenon* is correspondent to the reciprocal-converse appearance of *realitas noumenon*, the disappearance of *realitas phaenomenon* and the reciprocal-converse appearance of *realitas noumenon* necessarily take place instantaneously and simultaneously, indicating that “the pure synthesis of the imagination in regard to all possible appearances” (A119), e.g., parallel lines in Euclid’s fifth postulate provides the “data for a possible experience” (A119), i.e., the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity). Therefore, *realitas phaenomenon* (the moment of

gravity or the regress of the photon or the void) and *realitas noumenon* (the converse moment of gravity or the regress of the electron or a *vacuum*) are cognizable in the anticipation of perception and in their mere perception (sensation and thus reality), namely in the milieu of the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity). Thus, the anticipation of perception and the mere perception (sensation and thus reality) enables us to cognize, in virtue of no opposition, e.g., the instantaneity-simultaneity and real opposition, e.g., the reciprocity-converse, “continuous magnitudes” (B212). Since the reality of continuous magnitudes, i.e., the reality of the instantaneity-simultaneity and the reciprocity-converse is to be represented not only through the “mere understanding” (A229) of the reciprocity-converse, namely through the reciprocal destruction, as *substantia phaenomenon*, but “through the pure understanding (*realitas noumenon*)” (B320) of the instantaneity-simultaneity, namely through the opposition of reciprocal destruction, as *substantiae noumena*, the reality of continuous magnitudes is to be homogeneous with the “reality” of the reciprocity-converse (thereby null-reciprocity) in the milieu of the instantaneity-simultaneity, which stands for supersymmetry or black holes. Since the reality – “contradictory opposites” (A504/B532) – is represented not only through the pure understanding (*realitas noumenon*), but also through sensibility, we say that 1) contradictory opposites – the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity) – can be provided from the pure synthesis of the imagination in regard to all possible appearances, e.g., parallel lines in Euclid’s fifth postulate, 2) the reality of continuous magnitudes could be correspondent to pure schema of magnitude (*quantitatis*), i.e., “number.” The finding that “number” is to signify the instantaneous and simultaneous reciprocity-converse, i.e., supersymmetry would enable us to think that “number” corresponds to the combination *a priori*, i.e., the representation of the synthetic unity of the manifold. “The representation of this unity cannot, therefore, arise from the combination” (B131) but arise from itself. “Number,” which is not “added to the representation of the manifold” (B131), “makes the concept of combination possible” (B131) or makes the moment of gravity or *gravitational mass* possible. This unity, which coincides with “all concepts of combination *a priori*” (B131) is the “transcendental unity of the synthesis of the imagination” (A118), which therefore “already presupposes combination” (B131) and is to “presuppose empirical principles” (B213), namely to presuppose the moment of gravity or *gravitational mass*. Thus, we understand that all appearances themselves, “considered extensively as well as intensively, are continuous magnitudes” (YAMAMOTO 2017a: 19-37). “The understanding” in regard to continuous magnitudes would give us an “inking *a priori* that a cause is possible which alters the state of things, i.e., determines them to the opposite of a certain given state” (B213), namely the electron.

Our synthetic proposition in regard to the representation of the synthetic unity of the manifold – the “paths” or supersymmetry – signifies the metaphysical categories, i.e., the dynamical ones (thereby the mathematical categories) – the transcendental unity of the synthesis of the imagination. The regress itself, i.e., the schema of the category, and the regressive synthesis itself, i.e., the schemata of the category and the categories – the parallel lines in Euclid’s fifth postulate – are nothing other than “representations” which are given “from elsewhere” (B102). When what is possible in all respects in every relation is combined with the absolutely unconditioned, i.e., what is unconditioned in every relation through the representation of the synthetic unity of the manifold, the physical world metamorphoses into the category of allness, i.e., natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) and the unity of categories (i.e., prime number) – the mental world or the Platonic mathematical world – yielding the

metaphysical categories (thereby the mathematical categories). Then a composite (*compositum reale*) manifests in virtue of the mathematical categories, namely real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$), through the “logical functions in judgments” (B131) that *gravitational mass* is to be equivalent to *inertial mass*. Therefore, we dare to say that 1) “number” is “the determination of a thing through which it can be thought how many units are posited in it” (B300), or how much space-time is posited in it, 2) the “successive repetition” (B300) in space-time and the “synthesis (of the homogeneous)” (B300) through it – wavefunctions – yields the “reality, in contrast to negation” (B300) which can “be defined only if one thinks of a time (as the sum total of all being) that is either filled by it or empty” (B300). The metaphysical categories, i.e., the dynamical ones (thereby the mathematical categories) are homogeneous with the categories of quantity (unity, plurality, totality) and of quality (reality, negation, limitation) in “Table of Categories.” Once “number” is enhanced to “the determination of a thing” (B300), i.e., the thing in itself, we can think that the thing in itself, i.e., “number” ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$ or $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) could signify “the analogy of realities in the world, of substances, causality, and necessity” (A678/B706). Since all appearances themselves, “considered extensively as well as intensively” (A171) are continuous in the succession of *realitates phaenomena et substantia phaenomenon* as the states itself (that which has happened), or in an alteration of *realitates phaenomena et substantia phaenomenon* to *realitas noumenon et substantiae noumena* as the “transition of a thing from one state into another” (A171-B213), we have to think that an appearance – *gravitational mass* and the moment of gravity, i.e., number ($\mathbb{R} = \{1, 2, 3, 4, \dots\}$ or $i^2 = -1$) – is necessarily combined with *realitas noumenon et substantiae noumena* – number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – through the representation of the synthetic unity of the manifold. We stress that the representation of the synthetic unity of the manifold pertains to “the reception of representations (the receptivity of impressions)” (A50/B74), and signifies “the faculty for cognizing an object by means of these representations (spontaneity of concepts)” (A50/B74). In other words, the representation of the synthetic unity of the manifold endowed with the reception of representations (the receptivity of impressions) and the faculty for cognizing an object by means of these representations (spontaneity of concepts) – Isaac Newton (1642-1727) – could have found that the *realitas phaenomenon* and *realitates phaenomena* – the moment of gravity and *gravitational mass* – are in a reciprocal and converse parallel to *realitas noumenon et substantiae noumena* – the converse moment of gravity and *inertial mass*. Therefore, real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) or a composite (*compositum reale*) – the metaphysical categories (thereby the mathematical categories), namely the instantaneous and simultaneous reciprocity-converse – can be thought to signify an alteration or a succession, which corresponds to the combination of contradictorily opposed determinations and a combination of contradictorily opposed predicates. Furthermore, since “prime number” is to signify the acting subject, in its intelligible character, in which “no action would arise or perish, hence it would not be subject to the laws of everything alterable” (A539/B567-A540/B568) in its space-time-determination “that everything that happens must find its cause in the appearances (of the previous state)” (A540/B568), indicating that “they would constitute members of a single series of the natural order” (A539/B567).

Nevertheless, if it is merely proclaimed that concepts can be generated by “a transcendental faculty” (B356) of reason through mere “synthetic cognitions” (A301), the concepts merely induced are empty. The “first faculty” (A299) of reason, which has been defined by logicians “as that of drawing inferences mediately (as distinct from immediate inferences, *consequentis immediatis*)” (A299), must stand under what could universally yield immediate inferences prior to drawing inferences mediately.

We, acknowledging that the immediate inferences, *consequentis immediatis* have something to do with the first faculty “where reason abstracts from all content of cognition” (A299), have to say that 1) what could universally yield the immediate inferences, is a something = X , i.e., the “transcendental object” (A250) and a third thing, i.e., the “transcendental schema” (A138/B177) – first-order logic – 2) first, a something = X which compels reason to abstract from all content of cognition, comes as a thing “necessary *a priori* in relation to the original unity of apperception” (A118), 3) a something = X and a third thing which rests on the sensation itself and the “distinction of the intuitions” (A118) are to arise in “contradictorily opposed determinations in the existence of one and the same thing” (B291) and in “contradictorily opposed predicates...in one and the same object” (B48), 4) a third thing which is “represented in me that could not be thought at all” (B132), namely the instantaneous and simultaneous reciprocity-converse or supersymmetry, concerns “nothing but the connection of the manifold *a priori*” (A118), i.e., the connection of “determinations” and “predicates,” yielding “a thing’s being in a place and the not-being of the very same thing in the same place” (B48), 5) thus a third thing could pertain to “immediate inferences, *consequentis immediatis*” or “a principle of understanding *a priori*” (A175). Since a number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – the mathematical categories – is commensurate with metaphysical axioms, namely first-order logic, it is obvious that a number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$, therefore $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) has already attained “ ω -consistency” (GÖDEL 2004: 5-38), which might lead us to the solution of the “incompleteness of every formalism” (GÖDEL 2004: 84-88). Gödel himself suggests how the “incompleteness” can be eliminated, saying, “the undecidable sentences which have been constructed here always become decidable through adjunction of sufficiently higher types (e.g., of the type ω to the system P). A similar result holds for the axiom systems of set theory” (GÖDEL 2004: 5-38). We say that “adjunction of sufficiently higher types (e.g., of the type ω to the system P)” is meant to be a something = X , i.e., the instantaneous and simultaneous null-reciprocity (thereby the instantaneous and simultaneous reciprocity-converse). Since it is the “reason” that can reach the “sufficiently higher types,” which are to be adjoined to “the undecidable sentences,” we listen to what Kant refers to. Accordingly, “all our cognition starts from the senses, goes from there to the understanding, and ends with reason, beyond which there is nothing higher to be found in us to work on the matter of intuition and bring it under the highest unity of thinking” (B355-A299) – a principle of understanding *a priori* and synthetic *a priori* cognition.

7. LOGIC, NUMBER, PARALLEL LINES AND A MERELY DIALECTICAL CONFLICT

Once it has been found that the metaphysical categories or the dynamical categories in the domain could be correspondent to a metaphysical figure itself, i.e., one and itself, it becomes possible for us to say that they are homogeneous with “prime number.” In view of the facts that 1) “prime number” in the domain and that in the converse domain have a one-one relation, 2) prime number in the domain signifies beings of sense (*phaenomena*) or objects of possible experience while “prime number” in the converse domain signifies “a pure image of sensibility” (B377) or beings of understanding (*noumena*) or an object of pure understanding, we can think that 1) prime number in the domain is, in a manner of “instantaneous and simultaneous reciprocity-converse,” equivalent to prime number in the converse domain, 2) the metaphysical categories or the dynamical categories are, in a manner of “instantaneous and simultaneous reciprocity-converse,” equivalent to the mathematical categories, indicating that the mathematical categories – a number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) – could take the place of the metaphysical categories (i.e., the dynamical categories), e.g., real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) or

composite (*compositum reale*), without loss of truth. We take note of the fact that prime number itself – one and itself – is to signify a combination of contradictorily opposed predicates and of contradictorily opposed determinations. From this it follows that it becomes possible to say that “prime number” pertains to the “instantaneous and simultaneous reciprocity-converse” in virtue of $\zeta(s) = 0$ in Riemann zeta function, which could operate when x in $\zeta(s)$ is “1” and there is no free floating $i^2 = -1$ (YAMAMOTO 2019: 43-70). “Prime number” – one and itself – can be thought to signify A thing = A, which is something = B, i.e., the unconditioned, which is conditioned by oneness – the *a priori* categories, namely *realitates phaenomena et substantia phaenomenon*, which is parallel to what is possible in all respects in every relation. In view of the fact that prime number in the domain belongs to the dynamical categories in which “Unity,” e.g., the unity of the categories, corresponds to “Totality,” e.g., the category of allness, which indicates that “one Unity” is commensurate with “one Totality,” we think that 1) the category and the categories, which signify the unconditioned, which is conditioned by oneness, e.g., $\{i^2 \cdot e^{i\pi}\} = 1$, is to correspond to “prime number,” 2) A thing = A, which is something = B, i.e., the Dedekindian series having Cantorian continuity – $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$ – which is nothing but “an in itself infinite whole” (A505/B533), appears to signify “an in itself finite whole” (A505/B533). Furthermore, in view of the facts that 1) the unconditioned, which is conditioned by oneness, e.g., the moment of gravity and *gravitational mass* is in a reciprocal and converse parallel to the converse moment of gravity and *inertial mass*, and 2) prime number (e.g., prime number 5), which arises through the rules of a mathematical synthesis of *realitates phaenomena*, i.e., the reciprocity-converse which ceases in nothingness ($= 0 = negatio$) (e.g., “1”), the sum (e.g., “1” + “1” + “1” + “1” + “1”) is still equivalent to the reciprocity-converse which ceases in nothingness ($= 0 = negatio$) (e.g., “1”), namely the unconditioned, which is conditioned by oneness as “a whole,” we can say that “prime number,” i.e., the unconditioned, which is conditioned by oneness is to be the parts which appear to be an in itself finite whole, and “a whole” which signifies an in itself infinite whole. “Prime number” in the converse domain can be thought to belong to “a pure category, in which abstraction is made from any condition of sensible intuition” (B304), while “prime number” in the domain, which arises through “the mathematical connection of series of appearances” (A530/B558), can be thought to belong to the *a priori* categories such as “perceptions themselves” (B219), or the moment of gravity or $i^2 = -1$ or the light itself, or pure *a priori* cognitions or the Dedekindian series having Cantorian continuity or a series of one thing (*numerica identitas*), i.e., $\{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \cdot \{|i^2 \cdot e^{i\pi}\} \dots\}$ – *realitates phaenomena* (the series of appearances). The *a priori* categories could signify aggregates (multitudes of antecedently given parts) or an aggregate of many appearances, namely the contingent existence of a substance itself, which would be correspondent to the unconditioned in the series of appearances, namely natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$). Here, we have to take note of the facts that 1) *realitates phaenomena*, e.g., real opposition and *realitas noumenon*, i.e., no opposition between realities are to be revealed in virtue of the regress in *infinitum* (wavefunctions) and a *regressus in indefinitum* (*Planck’s constant*) upon the breaking of supersymmetry or the dynamical antinomy, 2) the same thing could occur in prime number, 3) therefore, prime number, which signifies A thing = A, which is something = B or “something to be and not to be at the same time” (A152) at the same place or the gravitational and inertial mass is to be revealed, in virtue of wavefunctions and *Planck’s constant*, upon the breaking of itself. In other words, “prime number,” being homogeneous with supersymmetry, can be called “natural necessity” (B447) – “the unconditioned necessity of appearances” (B447). In regard to this

issue, we have already made synthetic *a priori* propositions, namely the proposition in regard to “pure *a priori* intuitions” (B73) – the instantaneous and simultaneous reciprocity-converse – saying, “such a proposition as ‘A thing = A, which is something = B, cannot at the same time be *non-B*’ should be formulated such as that ‘appearance itself = appearance, which is filled space-elapsing time, cannot at the same time be non-appearance itself, i.e., empty space-nullified time.’ Since empty space-nullified time is commensurate with nullity in space-time, which permeates ‘appearance itself = appearance,’ nullity in space-time – space-time itself – can at the same time be ‘appearance itself = appearance,’ without being affected by the condition of time. Therefore, we would say, ‘It is possible for something to be and not to be at the same time,’ and ‘A thing = A, which is something = B, can at the same time be *non-B*’” (YAMAMOTO 2017b: 72-81). We can rephrase it as follows: 1) it is possible for a prime number to be and not to be at the same time, and 2) a prime number in the domain = a prime number in the converse domain, which is another prime number in the converse domain, can at the same time be another prime number in the domain. We think that the “pure *a priori* intuitions,” being homogeneous with supersymmetry or the dynamical antinomy, is congruent with the parallel lines in Euclid’s fifth postulate. This is the “metaphysics as a natural predisposition (B22) – “*metaphysica naturalis*” (B21) – which “has actually been present in all human beings as soon as reason has extended itself to speculation in them, and it will also always remain there” (B21). When Russell explains “the definition of propositions in which descriptions occur,” saying, “There is a term *c* such that (1) ϕx is always equivalent to ‘*x* is *c*,’ (2) ψc is true” (RUSSELL 1971: 167-180), we have proved it in such a way that: “There is Euclid’s fifth postulate such that (1) parallel lines are always equivalent to ‘reciprocity-converse is null-reciprocity,’ (2) the instantaneous and simultaneous reciprocity-converse is true,” or “There is ‘number’ such that (1) natural number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$) is always equivalent to ‘a number is $i^2 = -1$,’ (2) a composite (*compositum reale*) is true.”

Furthermore, “a singular judgment (*judicium singulare*)” (A71) in regard to “prime number” can be enhanced to “generally valid judgments (*judicia communia*)” (A71) in regard to an in itself infinite whole and an in itself finite whole on account of the fact that “we compare a singular judgment with a generally valid one, merely as cognition, with respect to quantity, then the former relates to the latter as unity relates to infinity” (A71). We should like to put it another way, saying, “we compare a singular judgment such as the supersymmetry with a general valid one such as parallel lines in Euclid’s fifth postulate, with respect to quantity, then the instantaneous and simultaneous reciprocity-converse (supersymmetry) relates to parallel lines in Euclid’s fifth postulate as *judicium singulare* relates to *judicia communia*. “In regard to logical domain, therefore this infinite judgment is merely limiting with regard to the content of cognition in general” (A73). Here, the infinite judgment is homogeneous with “the impossibility” (A221) which rests on “the conditions of space and its determinations” (A221), namely the instantaneous and simultaneous null-reciprocity. When Frege makes a discourse in regard to “the content of a concept,” saying, “The content of a concept diminishes as its extension increases; if its extension becomes all-embracing, its contents must vanish altogether” (FREGE 1980: 39-67), we, acknowledging that “cognition” in regard to parallel lines in Euclid’s fifth postulate could be diluted as its extension increases; if its extension becomes infinite, “cognition” in regard to parallel lines would vanish altogether in “a regress to infinity” (A518/B546), i.e., the *regressus in infinitum*, or become invisible in “an indeterminately continued regress” (A518/B546), i.e., a regress *in indefinitum*, while the content of a concept in regard to forces or the active power could not be diluted as their extension increases; even if its extension becomes infinite,

they cannot vanish altogether, entirely agree with him. Then, a question of what “the content of cognition in general” (A73) means arises. The answer is that while a singular judgment (*judicium singulare*), namely the content of cognition in regard to forces is to arise through empirical cognition or empirical synthesis, the generally valid judgments (*judicia communia*), namely the content of cognition in regard to the active power is to arise, as synthetic *a priori* propositions, through “*a priori* intuitions” (B147) and resultant synthetic *a priori* cognition. The synthetic *a priori* propositions could be commensurate with the *a priori* categories, e.g., pure *a priori* cognitions, being equivalent to “a pure *a priori* intuition” (A48), i.e., supersymmetry – a composite (*compositum reale*). Thus, the *a priori* categories – “all pure *a priori* cognitions” (B25) and a pure *a priori* intuition – correspond to supersymmetry, namely a composite (*compositum reale*), indicating that the instantaneous and simultaneous reciprocity-converse belongs to synthetic cognitions which Kant calls “principles absolutely” (B358). In view of the fact that supersymmetry is to signify a merely dialectical conflict, we dare to say that a merely dialectical conflict, which is both positive and negative, signifies “a determinate cognition” (A252) – “an organon of pure reason” (A11) – which “would be a sum total of all those principles” (A11-B25) such as the *principle of equivalence*, the principle of continuity, the principle of contradiction, and the principles of modality, “in accordance with which all pure *a priori* cognitions can be acquired and actually brought about” (B25), enabling us to attain the principle of causality (under the analogies of experience). Here we have to take note of the fact that the *a priori* categories, e.g., pure *a priori* cognitions such as a composite (*compositum reale*), or prime number, appear to be “pure” since they rest on the impossibility of experience or the possibility itself of possible experience in regard to “thought-entities” (A469/B497) such as “the cosmological idea” (A489/B517) (e.g., the entire universe) or “two eternal and infinite self-subsisting non-entities (space and time)” (B56) (e.g., the void and nothing or a *vacuum*) or a pure category, in which abstraction is made from any condition of sensible intuition (e.g., the death itself). The synthetic *a priori* cognitions (thereby the pure *a priori* cognitions) would be correspondent to MILL’s “inductive truth” (FREGE 1980: 12-24) – synthetic cognitions. In view of “LEIBNIZ’s axiom” which speaks that “If equals be substituted for equals, the equality remains” (FREGE 1980: 12-24), we should like to say that if prime number be substituted for a composite or if the instantaneous and simultaneous reciprocity-converse be substituted for parallel lines in Euclid’s fifth postulate, the equality remains. They are to be “established through their complete coincidence with the universal logical functions of thinking” (B159), which speaks that if *inertial mass* and *gravitational mass* be substituted for such realities as *realitas noumenon* and *realitates phaenomena*, the equality remains. The universal logical functions of thinking – the equality of *inertial mass* and *gravitational mass*, which is homogeneous with the equality of the instantaneity-simultaneity and the reciprocity-converse (thereby null-reciprocity) is nothing other than “the given concepts” (B322), which Kant calls “logical matter (for judgment)” (B322). The logical matter (for judgment) is to correspond to an organon of pure reason; “A thing = A, which is something = B, can at the same time be *non-B*” or “the instantaneous and simultaneous reciprocity-converse.” Thus, “Zermelo’s axiom” (RUSSELL 1971: 117-130) has been proven to be true. We should like to stress that, here, “Zermelo’s axiom” is homogeneous with “the multiplicative axiom” (RUSSELL 1971: 117-130). When Russell refers to “this axiom” and “Zermelo’s theorem,” saying, “Thus by twice using this axiom, we can prove that, if the axiom is true, every non-inductive cardinal must be reflective. This could also be deduced from Zermelo’s theorem, that, if the axiom is true, every class can be well ordered; for a well-ordered series must have either a finite or a reflexive

number of terms in its field” (RUSSELL 1971: 117-130), we entirely agree with him, thinking that though “this axiom” appears to be grounded in “undecidable problems in the system P ” (GÖDEL 2004: 5-38), it is possible to prove, “by twice using this axiom,” namely by means of the instantaneous and simultaneous reciprocity-converse, i.e., $\{i^2 \cdot e^{i\pi}\}$, that the axiom is true. This is what the “Riemann zeta-function” (CONREY 2003: 341-353) really means. The “SENTENCES a such that neither a nor the NEGATION of a is a PROVABLE FORMULA” (GÖDEL 2004: 5-38) contravene “a recursively definable ω -consistent class of axioms” (GÖDEL 2004: 5-38). We dare to say that “prime number” – “a recursively definable ω -consistent class of axioms” – signify *a priori* principles of the possibility of experience – parallel lines in Euclid’s fifth postulate – which is equivalent to an organon of pure reason. From this it becomes clear that “cardinal numbers 0, $i^2 = -1$, and 1” (YAMAMOTO 2017d: 19-29), namely “prime number,” and the cardinality; “ $0 \rightarrow i^2 = -1 \rightarrow 0$,” or “prime number \rightarrow prime number (one and itself) \rightarrow prime number,” which is to be homogeneous with parallel lines in Euclid’s fifth postulate, are the “fundamentals of logic” (RUSSELL 1971: 194-206) – first-order logic.

From the discourse so far it follows that we can say that “traditional logic” (RUSSELL 1971: 194-206) is nothing other than first-order logic. Traditional logic speaks: “All men are mortal, Socrates is a man, therefore Socrates is mortal” (RUSSELL 1971: 194-206). Frege, who says that “the notion of unity is not, as LOCKE holds, ‘suggested to the understanding by every object without us, and every idea within,’ but becomes known to us through the exercise of those higher intellectual powers which distinguish men from brutes” (FREGE 1980: 39-67) seems to have had a premonition of it. We have to say that “a proposition of pure logic” (RUSSELL 1971: 194-206) which speaks: “If all men are mortal and Socrates is a man, then Socrates is mortal” is necessarily subject to traditional logic since they have “logical constants” (RUSSELL 1971: 194-206). What do logical constants mean? The fact that traditional logic must be parallel to a metaphysical figure itself or humans indicates that logical constants are to correspond to “the Number of figures of the syllogism” (FREGE 1980: 24-39) – “prime number” – which signifies the instantaneous and simultaneous reciprocity-converse (an invariant, i.e., oneness). We should like to add, saying that 1) “prime number” is homogeneous with Maxwell’s demon, which is to signify a merely dialectical conflict – the absolutely unconditioned and the absolute totality of conditions, namely the entire universe – 2) “prime number” can be thought to be correspondent to Frege’s infinite Number ∞_1 , 3) “prime number” is to “serve as the major premise in a syllogism” (A300), which could be commensurate with “the given judgment” (A330), which affirms that a number ($\mathbb{N} = \{1, 2, 3, 4, \dots\}$, therefore $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) would signify the instantaneous and simultaneous reciprocity-converse. Therefore, when Kant makes a discourse in regard to first-order logic (B360-A304), we have to think that 1) the given judgment that “all men are mortal,” namely, “ $A - B = 0$ ” (B329) and “ $3 - 3 = 0$ ” (A265), which belongs among the given concepts – logical matter (for judgment) – must be posited prior to a proposition of pure logic, 2) since the given judgment already lies in a singular judgment (*judicium singulare*), “a singular judgment (*judicium singulare*)” could be equivalent to “generally valid judgments (*judicia communia*),” being drawn from the major premise in a syllogism, i.e., first-order logic, “without the mediation of a third representation” (B360), i.e., without “an intermediate judgment” (A304). Therefore, we say that traditional logic is “a proposition that serves as a ground, and another, namely the conclusion, that is drawn from the former, and finally the inference (consequence) according to which the truth of the conclusion is connected unfailingly with the truth of

the first proposition” (B360), namely, the “categorical syllogisms, whose major premise, as a principle, states the relation of a predicate to a subject” (A406-B433). Since “the inferred judgment” (B360), being equivalent to the given judgment, “already lies in the first one” (B360), the conclusion can be derived from it without the mediation of a third representation. First-order logic – this tautology or “oneness in unity-plurality-totality” – in which “no cognition can contradict it without at the same time losing all content, i.e., all relation to any object” (B87-A63) is homogeneous with the “transcendental analytic, and at the same time a logic of truth” (B87). First-order logic is equivalent to “logical constants” or “logical matter (for judgment)” – “prime number,” i.e., the Number of figures of the syllogism. A proposition of pure logic is necessarily equivalent to traditional logic, thereby to first-order logic. If it were not for logical constants, i.e., prime number or the Number of figures of the syllogism, which is a major premise itself, there is no “recursively definable ω -consistent class of axioms.” We have to stress that once the major premise itself manifests, this is enough for everything in the universe. “Prime number” is the “first order language L ” (SNAPPER 1979: 207-216) or the foundation for the “Hilbert program” (SNAPPER 1979: 207-216). We have to rephrase Gödel’s first theorem (GÖDEL 2004: 5-38) in such a way that “since there exists no undecidable problems in the system P , there exist SENTENCES a such that a and the NEGATION of a is a PROVABLE FORMULA.” If Gödel’s second theorem had said that “No sentence of L which can be interpreted as asserting that T is free of contradictions can be proven formally within the language L ” (SNAPPER 1979: 207-216), we think that the theorem, which seems to consist in the absolutely unconditioned and the absolute totality of conditions, signifies a merely dialectical conflict.

The synthetic *a priori* propositions, i.e., “ $0 \rightarrow 1 \rightarrow i^2 = -1 \rightarrow 0$ ” or “ $0 \rightarrow i^2 = -1 \rightarrow 0$,” which signifies traditional logic; “All men are mortal, Socrates is a man, therefore Socrates is mortal” is correspondent to first-order logic; “ $e^{i\pi} + 1 = 0 = i^2 + 1 \rightarrow |\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots| \rightarrow |\{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \cdot \{i^2 \cdot e^{i\pi}\} \dots| \times i^2 = -1$ or $e^{i\pi} = -1 \rightarrow e^{i\pi} = -1 = i^2$.” According to Russell, “the theory of classes...reduces itself to one axiom and one definition...The axiom is: *There is a type τ such that if φ is a function which can take a given object a as argument, then there is a function ψ of the type τ which is formally equivalent to φ .* The definition is: *If φ is a function which can take a given object a as argument, and τ the type mentioned in the above axiom, then to say that the class determined by φ has the property f is to say that there is a function of type τ , formally equivalent to φ , and having the property f* ” (RUSSELL 1971: 181-193). We would like to elaborate on “one axiom” as follows: There is Euclid’s fifth postulate such that if the reciprocity-converse is a function which can take parallel lines as argument, then there is a function of Euclid’s fifth postulate – null-reciprocity – which is formally equivalent to the instantaneity-simultaneity, and on “one definition” as follows: If the reciprocity-converse is a function which can take parallel lines as argument, and Euclid’s fifth postulate mentioned in the above axiom, then to say that parallel lines determined by the reciprocity-converse has the property of null-reciprocity is to say that there is a function of Euclid’s fifth postulate, namely the instantaneity-simultaneity, formally equivalent to the reciprocity-converse, and having the property of null-reciprocity. Obviously “one axiom” is congruous with “one definition.” Thus “one axiom-definition” is homogeneous with the Russell’s “similarity of relations” (RUSSELL 1971: 52-62), which, we think, is equivalent to the saying; “the instantaneity = the simultaneity, which is something = the reciprocity-converse, can at the same time be null-reciprocity” or “the simultaneity = the instantaneity, which is null-reciprocity, can at the same time be the reciprocity-converse.” The relations, namely the instantaneous and simultaneous reciprocity-converse

are similar to those as revealed in the Möbius's inversion formula (TANTON 2005: 338-339) or a Möbius band (TANTON 2005: 339-340). Therefore, when Kant makes a discourse in regard to the "final intent" (B445) – "the unconditioned, whether of the whole series or one part of it" (B445), i.e., "number" – taking "the path of proceeding from the idea of a totality" (B445), he relies on "the logical procedure in hypothetical syllogisms" (A335) and "the mere form of the disjunctive syllogism" (B393). We think that it could be wrong. We have to proceed from "one and itself," i.e., "singularity" (A216/B263) or a singular judgment (*judicium singulare*) to "the particular" or "particular determinations" (B279), i.e., particular cognitions and furthermore to the universal cognition or the "universal judgments" (A262) through sensibility, and synthesis – the synthesis of intuitions, in accordance with the categories and the pure synthesis, in accord with a rule of unity according to concepts in general, which the category expresses. We should like to put what Kant refers to (B224) in regard to "possible experience" (A181) another way, as follows.

Number, by analogy with the disjunctive syllogism, is to justify us in compounding the appearances only in accord with an analogy with the logical and general unity of concepts, and hence in the principle itself we make use of the category, but in its execution (its application to appearances) we set its schema, namely the instantaneous and simultaneous reciprocity-converse in its place, as the key to its use, or rather we set the latter alongside the former, as its restricting condition, under first-order logic or parallel lines in Euclid's fifth postulate.

The analogy with the disjunctive syllogism is meant to be "number" – "an instantaneous and simultaneous reciprocity-converse, e.g., the regress of the decomposing synthesis or the regressive synthesis itself" (YAMAMOTO 2019: 43-70). We think that "number," which signifies the metaphysical categories (thereby the mathematical categories), such as real numbers ($i^2 = -1$ and $\mathbb{R} = \{1, 2, 3, 4, \dots\}$) or a composite (*compositum reale*), or prime number is "the foundations of a science" (HILBERT 1902: 437-479), which can "set up a system of axioms which contains an exact and complete description of the relations subsisting between the elementary ideas of that science" (HILBERT 1902: 437-479).

Our whole discourse could parallel Kant's whole metaphysics, if Kant's mistake is corrected. We should like to rephrase what Kant refers to (A559/B587-A560/B588), that "1) appearances signify things in themselves, and so just for this reason their condition always belong to one and the same series of intuitions, 2) therefore a necessary being could occur as a condition of the existence of appearances themselves in the world of sense." What does "a necessary being" mean? It means "the unconditioned, whether of the whole series or one part of it" – namely the instantaneous and simultaneous reciprocity-converse – which is to be homogeneous with number in mathematics or the gravitational and inertial mass in physics. We should like to put it another way, saying that since prime number, which represents "the existence of things (in appearance)" (A186) or *essentialia*, could signify, in its "persistence" (A186), the analogy of realities in the world, of substances, causality, and necessity, so just for this reason persistence always belongs to all prime number, therefore a necessary being, namely persistence could occur as prime number in "pure mathematics" (A39) and as *essentialia* in physics. Since persistence (*essentialia* in physics) is to signify the gravitational and inertial mass in "natural science (*Physica*)" (B17), which is parallel to the quantity of matter, prime number which is to remain unaltered in all alterations of the corporeal world, could signify effect and

counter-effect which is always equal in all communication of motion. We had wanted to prove these analogies analytically, “namely, that everything that exists will only be encountered in that which persists; that every occurrence presupposes something in the previous state, which it follows in accordance with a rule; finally, that in the manifold that is simultaneous the states are simultaneous in relation to each other in accordance with a rule (stand in community)” (A216/B263-B264-A217), and “dogmatically, i.e., from concepts” (A216/B263). In other words, we have proven these analogies – the instantaneous and simultaneous reciprocity-converse ($\{i^2 \cdot e^{i\pi}\} = 1$) and the instantaneous and simultaneous null-reciprocity ($e^{i\pi} = -1 = i^2$ or $e^{i\pi} + 1 = 0 = i^2 + 1$) – from “transcendental laws of nature, and about its singularity” (A216/B263), namely from a composite (*compositum reale*) or prime number or Euclidean geometry (parallel postulate). Since “the absolute totality of conditions” (B383), i.e., the entire universe or “the absolute totality in the synthesis of conditions” (A326), i.e., the instantaneous and simultaneous reciprocity-converse is nothing but “an object that can be given nowhere but in our thoughts, namely the absolutely unconditioned totality of the synthesis of appearances” (A481/B509), it cannot be “refuted by the fact” (B128).

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