

KANT ON DYNAMISM, MATTER, AND THE LAWS OF MECHANICS

BRYAN HALL

Abstract. Dynamism is the *Leitfaden* that is woven throughout Kant's everchanging concept of matter over the course of his career. Although he always maintained that matter consists fundamentally of *force* (rather than compositional stuff), he oscillates between viewing these forces as ultimately *discrete* (spheres of force) or *continuous* (plenum of force). As I will argue, this has implications for his explanation of matter's lawfulness. This paper is broken into three sections. The first section will examine Kant's pre-Critical theory of matter and, in particular, his affirmation of a discrete dynamism in the *Physical Monadology* to a transition away from this view in the *Inaugural Dissertation*. I will argue that the reasons for this transition undermine the justification for his pre-Critical Conservation of Reality principle. The second section examines Kant's Critical era construction of matter in the *Metaphysical Foundations of Natural Science* and how it underpins his Critical era conservation principle, *viz.* the First Law of Mechanics. Kant faces a dilemma, however, that threatens the First Law and with it the other Laws of Mechanics. The third section examines Kant's post-Critical conception of matter in the *Opus postumum* as a way of resolving this dilemma and so safeguarding his Critical era Laws of Mechanics.

Keywords: Kant; matter; substance; dynamism; mechanism; laws of nature.

Dynamism is the *Leitfaden* that is woven throughout Kant's everchanging concept of matter over the course of his career. Although he always maintained that matter consists fundamentally of *force* (rather than compositional stuff), he oscillates between viewing these forces as ultimately *discrete* (spheres of force) or *continuous* (plenum of force). As I will argue in the paper, this has implications for his explanation of matter's lawfulness. In the *Metaphysical Foundations of Natural Science (MA)*, Kant holds that the fundamental lawfulness of nature can be understood in terms of our ability to construct the concept of nature *a priori* through the categories (*MA* 4:470). Kant takes himself to have done this in *MA*. Starting from the fundamental concept of matter as the "movable in space" (*MA* 4:480), Kant goes on to construct this concept *a priori*

Bryan Hall ✉
Regis University, Colorado, USA

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through the categories¹. What results is a concept of matter that is fundamentally discrete. Material nature consists of discrete spheres of dynamic activity that stand in causal community with one another. Based on a review of *MA*, Kant comes to reconsider his argumentative transition from motion to moving force. This concern, *inter alia*, leads him to reconceptualize matter, in the *Opus postumum (OP)*, as a *plenum* of attractive and repulsive forces. The problem he now faced, however, was how to construct this plenum *a priori* through the categories. As I will argue, the only way Kant can do it is *indirectly*, i.e., demonstrating how the plenum of force is a necessary condition for the *a priori* construction of the concept of matter in *MA*. I will show this, in particular, using Kant's First Law of Mechanics (conservation of matter). This is where the history of Kant's dynamism is relevant. Whereas the plenum is viewed as an *alternative* to the discrete view pre-Critically, Kant comes to view these two concepts as *complementary* post-Critically which allows him to shore up his Critical era First Law of Mechanics, the law upon which all the others depend².

This paper is broken into three sections. The first section will examine Kant's pre-Critical theory of matter and, in particular, his affirmation of a discrete dynamism in the *Physical Monadology (PM)* to a transition away from this in the *Inaugural Dissertation (ID)*. I will argue that the reasons for this transition undermine the justification for his pre-Critical conservation principle. The second section examines Kant's Critical era construction of matter in *MA* and how it underpins his Critical era conservation principle, *viz.* the First Law of Mechanics. Kant faces a dilemma, however, that threatens the First Law and with it the other Laws of Mechanics. The third section examines Kant's post-Critical conception of matter as a way of resolving this dilemma and so safeguarding his Critical era Laws of Mechanics.

SECTION ONE: KANT'S PRE-CRITICAL DYNAMISM AND CONSERVATION LAW

Matthew Rukgaber, in his recent book, argues convincingly that Kant possessed a dynamic theory of matter from the start of his career. For instance, in *PM* from 1756, simple substances should not be understood as physically present in space, but rather as "virtually present"³. The simple substances have temporal character by virtue of their

¹ Unless otherwise noted, all translations of Kant come from the Cambridge University Press series of translations. With the exception of *CPR* for which I use the A/B notation, all citations to Kant's work refer to the *Akademie* edition of *Kants gesammelte Schriften*.

² Although the terms (and meanings) of "pre-Critical" and "Critical" are generally accepted in the literature, there is some disagreement over whether there is a "post-Critical" period of Kant's thought. I will be assuming there is for the purposes of this paper. I aim to underscore how certain themes/problems persisted throughout Kant's entire career notwithstanding the many other things that changed over time. For a perhaps unsurprising position on this question (given the title of the book), see Bryan Hall, *The Post-Critical Kant* (Routledge, 2015), Introduction.

³ Matthew Rukgaber, *Space, Time, and the Origins of Transcendental Idealism*, Cham: Palgrave Macmillan, 2021, p. 88.

inner activity. This inner activity is not itself in space through its external expression – dynamic force – is in space⁴. This activity generates spheres of force that can be compounded into bodies but are also infinitely divisible since there is nothing simple in space. As we will see below, although Kant’s reasons for adopting the discrete spheres of force view in *PM* is quite different than the reasons he provides in *MA*, the views themselves are strikingly similar. Discrete physical bodies ultimately consist of discrete locomotive spheres constituted through attractive and repulsive forces.

According to Rukgaber, *ID* from 1770 initiates a significant turning point in Kant’s thinking about substance. His first subreptic axiom is “whatever is, is somewhere and somewhen” (*ID* 2:413–414). This leads Kant to reject that space and time can be determinations of objects of the understanding. Kant is no longer entitled to claim that his simple substances are active since such activity is temporal. Without this inner activity, however, these simple substances lose not only their essential property but also the means by which they would be virtually present in space. Once Kant eliminates time from these simple substances, Rukgaber acknowledges that virtual presence becomes a “vague, unintelligible cop-out”⁵. Although one might think that this is the birth of Kant’s distinction between appearances and things-in-themselves, it is really only the birth of his epistemic humility with regard to things-in-themselves. The distinction itself is already implicit in the doctrine of virtual presence⁶.

Without the virtual presence of simple substance, however, there is no reason for Kant to keep a discrete conception of dynamic force. Put differently, there is no longer any metaphysical ground for discrete spheres of dynamic (attractive and repulsive) force. This does not entail, however, that Kant needs to abandon dynamism. Even if they are not discrete, these forces could still be continuous. To be clear, Kant does not argue that a plenum of attractive and repulsive forces constitutes matter in the pre-Critical period, but there are several works that talk about space as a plenum. This includes his first published work, the 1749 *Thoughts on the True Estimation of Living Forces* where he says that “space is a plenum in which bodies move freely” (1:156). Here, he seems to be thinking of this as a subtle though inert material, but later in his 1754 *Aging Earth* essay he talks about a “subtle though universally active matter” (1:211).

The other consequence of Kant’s new-found epistemic humility, one that will have ramifications in the Critical period, is that the epistemic foundation is removed for his principle of the conservation of reality. In the pre-Critical period, Kant uses the principle of a determining ground or sufficient reason to underpin the conservation of reality. For example, in Proposition X of the *New Exposition* of 1755, Kant uses the

⁴ Rukgaber, provides some evidence from Kant’s 1755 *Universal Natural History* (1:340) suggesting that his pre-Critical view is that virtually present substances only produce attractive force. Although repulsion is another primitive force, its source need not be the virtually present substances. For simplicity of presentation, I am assuming that substances are virtually present through both attractive and repulsive forces whose balance results in a sphere of force that occupies space. See Rukgaber, *Space, Time, and the Origins of Transcendental Idealism*, 35 and 94.

⁵ M. Rukgaber, *Space, Time, and the Origins of Transcendental Idealism*, p. 182.

⁶ *Ibidem*, p. 10.

principle that “there is no more in that which is grounded than there is in the ground itself” to establish that “the quantity of absolute reality in the world does not change *naturally*, neither increasing nor diminishing” (1:407). Kant considers the example of divine creation where God is the ground but contains in himself an infinite amount of reality as compared to the finite creation that is grounded in his creative acts. Kant squares this circle by saying that the “creative act of God” is proportioned in its reality to what it grounds even if God himself is not similarly limited (1:406).

As Michael Friedman notes, in the Critical period, Kant rejects the idea that the principle of sufficient reason – a purely conceptual principle – can have a legitimate synthetic use in amplifying our cognition⁷. Consequently, one cannot use it to demonstrate the conservation of reality (pre-Critical) or matter (Critical). Rukgaber argues that by the time Kant publishes *Negative Magnitudes* in 1763, however, he has started to move away from this principle. As Kant says, “I would have been completely misunderstood, if I had been taken to be using the first principle to mean that the sum of reality, in general, is neither increased nor diminished by changes in the world” (2:198). For Rukgaber, this is because Kant has already started to view the cognition of things-in-themselves with skepticism⁸. If one cannot cognize the determining grounds that ostensibly conserve empirical reality, one cannot establish that this reality is, in fact, conserved. By the time we get to *ID*, the discrete relationship between grounded (virtual presence) and ground (simple substance) has been eliminated. Consequently, one cannot demonstrate the conservation of empirical reality, the sum total of virtually present substances, through this grounding relationship.

SECTION TWO: A DILEMMA FOR THE FIRST LAW OF MECHANICS

The main purpose of *MA* is to articulate a “*special* metaphysical natural science” which determines the empirical concept of matter (the movable in space) in accordance with the “transcendental part” of the metaphysics of nature (*MA* 4:469–470). In *MA*, Kant characterizes the transcendental part as that which deals with “the laws that make possible the concept of a nature in general, even without relation to any determinate object of experience” (*MA* 4:469). In the *Critique of Pure Reason* (*CPR*), Kant makes clear that these laws should be understood in terms of “the understanding and reason itself in a system of all concepts and principles that are related to objects in general” (*CPR* A845/B873). In other words, the transcendental part of the metaphysics of nature is the Transcendental Analytic of *CPR* (the categories and their corresponding principles). Each chapter of *MA* adds a “new determination” (4:476) to the moveable in space utilizing a different set of categories. Phoronomy considers the *quantity* of motion. The Dynamics consider the *quality* of motion. The Mechanics considers the *relations* of matter. Finally, the Phenomenology determines motion in relation to the *modality* of representation.

⁷ Michael Friedman, *Kant's Construction of Nature: A Reading of the Metaphysical Foundations of Natural Science*, Cambridge, Cambridge University Press, 2013, 326.

⁸ Rukgaber, *Space, Time, and the Origins of Transcendental Idealism*, 118.

If one accepts Rukgaber's interpretation of *PM*, Kant's discussion of how matter is constituted in the Dynamics chapter of *MA* echoes important aspects of this pre-Critical work. Kant argues in the Dynamics that matter is constituted through the interplay of original attractive and repulsive forces. If there were only attractive forces, matter would reduce to a physical point, but if there were only repulsive forces, matter would disperse itself to infinity⁹. Attractive force is a penetrating force constant across all materials. Repulsive forces vary by material, but are only surface forces that account for impenetrability (solidity according to the mechanist) and that limit original attraction. The interplay of original attractive and repulsive forces determines "the degree of the filling of a space with determinate content" (*MA* 4:525) or, put differently, the amount of matter within a given volume. The result of this balancing of attractive/repulsive forces are spheres of force that are not dissimilar in their physical manifestation from Kant's pre-Critical monads, though the underlying metaphysics (original dynamic forces vs. virtually present simple substances) could not be more different¹⁰. Just as in the pre-Critical *PM*, in the Critical *MA* discrete physical bodies are constituted through the aggregation of these spheres of force.

This is not the only conception of "substance" operative in the Critical period, however, and I have argued elsewhere that Kant requires two mutually irreducible conceptions of "substance"¹¹. The problem comes out most clearly in the First Analogy of Experience. The principle of the A-edition of the First Analogy (*CPR* A182) seems to require only (a) substances (plural, small-s) which are relatively enduring empirical objects that persist through the alteration of their properties (e.g. a leaf changing its color). In contrast, the conservation of substance law that Kant introduces in the B edition of the First Analogy (*CPR* B224) seems to require the stronger conception of (b) Substance (singular, capital-S) which is sempiternal, omnipresent, and neither increased nor diminished in nature.

Since these are different and mutually irreducible conceptions of substance, Kant faces a dilemma when applying the schematized category (or *a priori* concept) of substance. Briefly stated, if the category of substance applies to Substance, then although this would ensure that experience takes place in a common spatiotemporal framework, one could not individuate substances and perceive their alterations. If the category of substance applies to substances, however, then although one could individuate these substances and perceive their alterations, the category would not pick out a common spatiotemporal framework for one's experience of substances. In neither case, would there be a unified spatiotemporal experience of substances.

Within the context of *MA*, this dilemma is particularized from one about "substance(s)" to one about "matter." In other words, the subject changes from the persistent of the real in time to the moveable in space. As Michael Friedman notes, furthermore, the

⁹ See *MA* 4:508 and 511.

¹⁰ Kant does criticize his former view in *MA* (4:504-505) with regard to divisibility, so the views are presumably not identical in their empirical consequences.

¹¹ Hall, *The Post-Critical Kant*, chapter 1.

reformulation of the principle of the First Analogy in the B edition of *CPR* is precipitated by Kant's statement of the First Law of Mechanics in *MA*¹². The latter appeared in 1786, in between the publication of the A-edition of *CPR* in 1781 and the B edition in 1787. This is a crucially important change insofar as the success of Kant's proof for the First Law of Mechanics depends upon the success of Kant's argument in the B-edition First Analogy¹³. If the argument for the First Analogy fails, so too fails the argument for the First Law of Mechanics. If Kant is unable to show that substance neither arises nor perishes absolutely (i.e., arising from or perishing into an empty time), he will not be able to establish that the total quantity of matter remains the same. In fact, this is the very first step of his proof for the First Law of Mechanics¹⁴. His failure here, I submit, would have far wide-ranging consequences. Both the Second and Third Laws of Mechanics presuppose their corresponding Analogies, but the Second and Third Analogies require the success of the First Analogy under a Substance interpretation.

Substance ensures the unity of *spatiotemporal* experience by precluding the possibility of experiencing empty times or spaces. It serves as the common framework within which the subject experiences objective succession (Second Analogy) as well as simultaneity (Third Analogy). The sempiternality of Substance safeguards the causal principle of the Second Analogy by insuring that everything that happens will in fact follow from *something* (rather than *nothing*) and the omnipresence of Substance is a condition for causal community of substances in the Third Analogy since it ensures that these substances will occupy the same spatial framework. Finally, the omnipresence of Substance allows one to distinguish between the objective succession and simultaneity of substances.

The proof of the Second Law of Mechanics assumes the truth of the Second Analogy of Experience in its first premise. Proving that every change in matter has an external cause (Second Law of Mechanics) assumes that every event (of which a change in matter would be an instance) has a cause. In the A-edition principle of the Second Analogy, Kant says that "everything that happens (begins to be) presupposes something whereupon it follows according to a rule" (*CPR* A189). That any coming to be (i.e. arising) presupposes *something* (i.e. prior existence) rather than *nothing* (i.e. empty time) is required for the causal principle to function. Substance, which is omnipresent and sempiternal (First Analogy), ensures that there is always something from which anything comes to be.

Finally, the proof of the Third Law of Mechanics assumes the truth of the Third Analogy of Experience in its first premise. Proving that in all communication of motion action and reaction are equal (Third Law of Mechanics) assumes that all external action is interaction (Third Analogy). The equality of action and reaction would be an instance of this interaction. In the Third Analogy, Kant holds that without 'matter everywhere' perceptions would be "broken off" from one another (*CPR* A213–214/B260–

¹² M. Friedman, *Kant's Construction of Nature*, 315n.

¹³ *Ibidem*, p. 318.

¹⁴ *MA* 4:541.

261), i.e., we would not be able to experience the interaction of spatially discrete substances¹⁵. Substance precludes the possibility of experiencing empty space and consequently the possibility of perceptions being broken off from one another.

Some commentators uncritically assume something approaching a Substance interpretation of matter in the First Law of Mechanics¹⁶. Other commentators do not uncritically assume a Substance interpretation but rather provocatively assert it¹⁷. The fundamental problem in both cases, however, is that Substance is no more sufficient for the Analogies than it is for the Laws of Mechanics. Discrete physical bodies function as substances in the other two Analogies. Although there are many examples, I will mention only one from the Third Analogy. There Kant intends to establish the principle that “all substances, insofar as they can be perceived in space as simultaneous, are in thoroughgoing interaction” (*CPR* B256). The example that Kant gives to illustrate this principle is of the Earth and the Moon standing in causal community with one another. Just as with the burning wood of the First Analogy (*CPR* A185/B228), it seems that one could experience the annihilation of either the Earth or the Moon. Notwithstanding their size, they are still merely physical bodies. Given what Kant says about the incineration of wood (i.e., that the wood itself perishes and is not a substance), however, should this imply that the Earth and the Moon are not substances? If so, Kant’s example in the Third Analogy seems like a non-starter and, furthermore, it is difficult to conceive what a good example would be without recourse to a substances interpretation.

Kant also requires substances in *MA*. In the Preface, Kant claims that “the basic determination of something that is to be an object of the outer senses had to be motion, because only thereby can these senses be affected” (*MA* 4:477). This is what leads him to define “matter” as the movable in space. Although Kant believes that the senses can be immediately affected only by pressure or impact, both of which require “the approach [motion] of one matter to another” (*MA* 4:510), Friedman argues that Kant’s point is more fundamental¹⁸. To understand this point, Friedman suggests examining two of Kant’s other works: *Concerning the Ultimate Ground of the Differentiation of Directions in Space* (1768) and *What is Orientation in Thinking* (1786) In the former, Kant says “concerning the things that exist outside ourselves: it is only in so far as they stand in relation to ourselves that we have any cognition of them by means of the senses at all” (2:378)¹⁹. In both works, Kant suggests that the subject must be embodied so that it can

¹⁵ Kant holds that there is no experience of empty space or empty time elsewhere during the Critical period. See *CPR* A172/B214, A487/B515, A521/B549 and *MA* 4:559.

¹⁶ For example, Friedman consistently says that matter is both continuous and permanent, e.g., Friedman, *Kant’s Construction of Nature*, pp. 319, 322, 324. Friedman mistranslates “Beharrliche” as “permanent” rather than “persistent.” In *OP*, however, Kant describes the ether (Kant’s post-Critical conception of Substance) as “*alldaurend*” which demonstrates that he recognizes the difference between being permanent and being persistent. See *OP* 21:584.

¹⁷ For example, Kenneth Westphal claims that all three Analogies of Experience can be explained simply in terms of Substance. See Westphal, *Kant’s Transcendental Proof of Realism* (Cambridge, Cambridge University Press, 2004), pp. 147–166.

¹⁸ See Friedman, *ibidem*, pp. 40–44.

¹⁹ See also Kant, *What is Orientation in Thinking?* (8:134–135).

occupy a relative space which serves as the center of a three-dimensional framework. Keeping in mind that the concepts of relative space and relative motion are intertwined, the subject is affected only by objects that can be precisely located within this framework, i.e., objects that occupy discrete regions of space that move relative to the space that the subject occupies.

Consider Kant's definition of "matter" in *MA* as the moveable in space. Since Substance is omnipresent, it cannot be locomotive. It is not the right kind of thing to serve as the moveable in space. Only substances can be locomotive, discrete, communicate motion to one another, and stand in relations of equality of interaction. Imagining the situation as a bridge where the Analogies are one foot, the Laws of Mechanics are the other and the empirical concept of matter is the span that connects them, Kant requires a substances interpretation of the Analogies so that the empirical concept of matter can connect the Analogies to the Laws of Mechanics.

The stakes are quite high if Kant's proofs for the Laws of Mechanics fail since he has such a dim view of our knowledge of particular natural laws outside of *MA*. For example, in the *Critique of the Power of Judgment* (*CJ*), Kant claims that we can have no knowledge of particular laws of nature insofar as they would have to be known *a posteriori* and so would, from that perspective, be contingent (*CJ* 5:184–185). Building off of his definition of "laws" as a necessary rules in *CPR* (A 113), Kant delimits these for the material world in *MA* by saying that they are "principles of the necessity of what belongs to the existence of a thing" (4:469). As James Kreines convincingly argues, *MA* seems to be a special case where Kant allows for a mixed empirical/*a priori* case since the concept of matter is general enough to provide the empirical expression of our forms of intuition as such, i.e., *everything* that can appear to us in outer sense is movable²⁰. Put differently, *motion* fundamentally belongs to the existence of a thing (in outer sense). If Kant's project in *MA* fails, however, then we would not have any knowledge of the particular laws of nature.

SECTION THREE: MATTER AND THE CHALLENGE OF LAWFULNESS IN *OP*

The first chronological page of *OP* contains a very critical anonymous review of *MA* from the *Göttingische Anzeigen* copied out in Kant's own hand²¹. The reviewer criticizes Kant's attempt, in the first proposition of the Dynamics section of *MA*, to ascribe a moving force to matter simply on the basis of phoronomical considerations, in this case, that "nothing can abolish motion save motion in the opposite direction" (*OP*

²⁰ James Kreines, "Kant on the Laws of Nature: Restrictive Inflationism and Its Philosophical Advantages," in *The Monist*, 2017, vol. 100, pp. 326–341, especially p. 433.

²¹ The reviewer was Abraham Kästner. See Oscar Fambach, *Die Mitarbeiter der Göttingischen Gelehrten Anzeigen, 1769–1836* (Universitätsbibliothek, 1976), p. 134, cited by Förster in *Kant's Final Synthesis: An Essay on the Opus postumum* (Harvard, Harvard University Press, 2000), p. 183n17.

21:415)²². In the Dynamics, Kant defines matter as “the *movable* insofar as it *fills* a space” (*MA* 4:496). Matter must resist motion into the space that it fills (resistance to penetration) through an opposite motion. Kant accounts for this opposite motion in terms of an original repulsive force that matter possesses. It is difficult to see, however, how a claim concerning moving force (original repulsion) could follow from a claim concerning mere phoronomy. According to the mechanical philosophy, a fundamental characteristic of any object is its motion or rest. This does not entail, however, that matter *must* be understood dynamically in terms of moving forces.²³ Matter can be in motion in accordance with natural law, without matter filling space through moving forces (e.g., one could be a corpuscularian). Unsurprisingly, the reviewer challenges Kant’s inference from impenetrability to moving forces: “*Must* one think of a moving force in a wall, because, at the wall, one cannot progress further? It is not even clear how Phoronomy, which merely treats of motion without considering force (from which motion arises) could lead to moving force” (*OP* 21:415). It stands to reason that when Kant begins *OP*, he has begun to ask himself the same question. Whereas, according to Rukgaber, the onset of epistemic humility led Kant to abandon his pre-Critical conception of discrete spheres of force (virtual presence), this reviewer’s criticism may have led Kant to abandon his Critical conception of the same (mutually limiting attractive and repulsive forces). If Kant’s concept of substances is again in peril in *OP*, where does this leave his concept of Substance?

Although the goals and scope of the *OP* change over time, Kant consistently argues for something he calls “ether”²⁴. It is not entirely unlike the plenum he discusses in the pre-Critical and Critical periods, but also goes beyond these earlier conceptions in important ways. In *MA*, it possesses only a regulative status and allows one to think of something that occupies space while lacking quantity since it possesses only repulsive force. This provides a thinkable alternative to empty space (*MA* 4:534) and offers a possible explanation for cohesion (*MA* 4:564). Post-Critically, however, the ether becomes far more both in terms of its metaphysical status and function:

There exists a matter, distributed in the whole of space as a continuum, penetrating all bodies uniformly (so not subject to displacement) which may be called the ether, the caloric, or whatever, but which is no hypothetical material (in order to explain certain phenomena, and more or less ostensibly imagining the causes for given effects) but can rather be recognized and postulated *a priori* as a part belonging necessarily to the transition from the metaphysical foundations of natural science to physics... It is to be acknowledged as a primordially moving material – not hypothetically invented, but one whose forces give it reality and which underlies all motion of matter; a continuum

²² For the phoronomical proposition, see *MA* 4:490.

²³ The fundamental difference between mechanism and dynamism is that the former conceives of matter as irreducibly given with forces as its properties whereas the latter reduces matter into relationships of original forces. For a good summary of the differences between the two views, see Giovanni Pietro Basile, *Kants Opus postumum und seine Rezeption* (De Gruyter, 2013), p. 397.

²⁴ For more on Kant’s Ether Deduction, see Hall, *The Post-Critical Kant*, chapter 3.

which, taken in its own right, forms a whole of moving forces, whose existence is known *a priori*. (*OP* 21:218 and 223–224)

Although Kant uses the term “matter” in the above passage, he also says that its “forces give it reality” and that it “underlies all motion of matter”. It is a “continuum” and one which forms a “whole of moving forces”. As Kant makes clear, the name that one calls this material whole is not important, but what is important is the material whole’s function which depends on it possessing certain properties. Its dynamic activity is the ultimate source of perceptual affection and the material ground for physical bodies that subjects experience in space and time²⁵. Mechanical forces (locomotion in space) depend upon these dynamic forces (internally moving)²⁶. Since it is omnipresent and sempiternal, it precludes the experience of empty space and time²⁷. Kant believes the ether is a collectively moving unified material whole, continuously expanded, and a constantly agitating plenum of dynamic (attractive and repulsive) forces. As one can see in the above quote, matter is itself realized through this plenum of attractive and repulsive forces.

Unlike the concept of matter in *MA* which is ostensibly *a posteriori* given its empirical provenance, Kant views the concept of the ether as *a priori*. Within the context of his Ether Deduction, Kant discovers this concept by analyzing the concept of the unity of experience. As Kant says elsewhere, “the concept of a system of agitating forces of matter lies already in the concept of the unity of experience *a priori*” (*OP* 21:596). This difference is important since it suggests that Kant thought of the ether concept as on-par with a category (*a priori* concept) rather than as an empirical concept (*a posteriori*).

Even so, in its determination, Kant treats the *a priori* concept of the ether in *OP* similarly to how he treats the empirical concept of matter in *MA*. Whereas Kant takes the empirical concept of matter in *MA* and determines it in accordance with the categories (with each chapter corresponding to a different set of categories), he now takes an *a priori* concept of matter (internally moving forces) in *OP* and then determines it, in accordance with the categories, to generate an *Elementarsystem* of the moving forces of matter. Immediately before introducing the concept of an *Elementarsystem* for the first time, Kant sketches his project: “Quantity ponderable or imponderable — Quality coercible — incoercible — Relation cohesible (*coalescibel*) — incohesible (*incoalesc*) — Modality exhaustible — inexhaustible” (*OP* 21:531.5–9)²⁸.

In accordance with the categories of quantity, the moving forces of matter can be either ponderable or imponderable. Kant considers the act of weighing simply as the way one determines the quantity of matter that a given object possesses²⁹. Consequently, it is quite easy to understand why Kant places the ponderable/imponderable dyad under the category of quantity. Why does Kant characterize the ether, however, as either ponderable or imponderable? Although the ether is not itself ponderable, it is what

²⁵ See *OP* 22:194 and 22:378.

²⁶ See *OP* 22:239–242.

²⁷ See *OP* 21:219–220 and 21:584.

²⁸ Translation is mine.

²⁹ See *OP* 22:559.

makes the ponderability of bodies possible. The easiest way to think about it is that the ether is imponderable considered in itself, but ponderable considered in its effects (the dynamic physical analogue of Kant's pre-Critical creative God), i.e., the object that is weighed, as well as the instrument of weighing. As Kant says:

Thus the ponderability of matter is not a property knowable *a priori* according to the mere concept of the quantity of matter; it is, rather, physically conditioned and requires the presupposition of an *internally* moving matter which results in the immobility of the parts in contact with one another [in the lever-arm], by itself being mobile inside this matter. We know of no other matter to which we have cause to attribute such a property, except caloric. Thus, even ponderability (represented subjectively as the experiment of weighing) will require the assumption of a matter which is not ponderable (*imponderabilis*); for, otherwise, the condition for ponderability would be extended to infinity, and thus lack a foundation. (*OP* 22:138)

The same point goes for the other categories. Although Kant constantly struggles with explaining how these various property dyads fall under their respective categories, the general point remains the same.³⁰ For any given set of categories, the positive/negative property dyad that falls under the set of categories in question reflects the idea that the ether can only be negatively characterized in itself relative to these properties, but can be positively characterized relative to these properties through its effects in the phenomenal world, *viz.* the constitution of bodies. Although the ether (or Substance) is a sempiternal and omnipresent plenum of attractive and repulsive forces and does not possess any of the properties that physical bodies (or substances) possess, it is nonetheless a transcendental condition for these properties.

Taking the *Elementarsystem* and the Ether Deduction in *OP* together with *MA*, I think what Kant is offering in *OP* is a revision of the Dynamics chapter, one that reworks the argument to avoid the objections that the anonymous reviewer posed in his review of *MA*. What Kant is proposing in *OP* is a fundamentally different account of how basic matters/substances form that does not rely on the balancing of counteracting attractive and repulsive forces³¹. These matters/substances rather emerge from the dynamic activity of the ether³².

Taking the *a priori* concept of the ether in *OP* together with the categorically determined concept of matter in the Mechanics, one can, I believe, formulate a resolution to the dilemma introduced in the last section. The *a priori* concept of the ether applies to Substance which ensures that experience takes place in a common spatiotemporal framework. At the same time, the schematized category of substance applies to substances which ensures that one can individuate substances and perceive their altera-

³⁰ For an excellent discussion of the various problems Kant faced in trying to formulate the *Elementarsystem*, see Förster, *Kant's Final Synthesis*, pp. 11–23.

³¹ Here, I agree with Burkhard Tuschling's characterization of the problem with *MA* and how it provides impetus for *OP*. At the same time, I have a more optimistic view of the success of Kant's project in *OP*. See Tuschling, *Metaphysische und Transzendente Dynamik* (De Gruyter, 1971), p. 88 and pp. 175–178.

³² For more discussion of this emergence relation as well as how it differs from supervenience or reduction, see Hall, *The Post-Critical Kant*, chapter 2.2.

tions. Within the context of *MA*, matter stands in for substances and the concept of matter is the most general empirical interpretation of the schematized category of substance. In the First Law of Mechanics, the empirical concept of matter applies to discrete locomotive bodies. Matter, so understood, can neither arise nor perish absolutely, however, because the ether is sempiternal. There is no empty time (sempiternal) from which matter could either arise or perish. This ensures that the total quantity of matter remains the same. Deploying these two distinct concepts has ramifications for the other two Laws of Mechanics as well. In the Second Law of Mechanics, whereas the empirical concept of matter applies to the bodies that change as well as the external cause of that change, the ether ensures that any change arises out of something rather than nothing. In the Third Law of Mechanics, the empirical concept of matter applies to the bodies that interact by communicating their motion to one another. The omnipresence of the ether, however, precludes the experience of empty space and so ensures that this interaction of spatially discrete bodies can be perceived. Consequently, Kant's argumentative (e.g., Ether Deduction) and conceptual (e.g., the *Elementarsystem*) advances in *OP* allow him to rescue his proofs for the Laws of Mechanics in *MA*.

CONCLUSION

This paper has argued that although Kant is committed to dynamism throughout his career, he oscillates between continuous and discrete views of substance/matter. Both in the pre-Critical and Critical periods, Kant's repeated attempts to explain how these discrete substances are governed by natural law are flummoxed by problems with his metaphysics of substance. I have argued that Kant finds a promising solution post-Critically, one that required developing two distinct concepts of substance and demonstrate *a priori* that one of these concepts (the ether) has an extension. With the *a priori* concept of the ether (what I call "Substance") as well as the schematized category of substance or the empirical concept of matter (what I call "substances"), Kant is able to safeguard the Analogies and so also the Laws of Mechanics that depend on the Analogies. Whereas the *a priori* concept of the ether (*OP*) refers to a *continuous* plenum of attractive and repulsive forces, the schematized category of substance (*CPR*) or the empirical concept of matter (*MA*) refer to *discrete* substances or bodies. The total quantity of matter remains the same (First Law of Mechanics) since bodies cannot arise or perish from an empty time. They cannot arise or perish from an empty time because the ether is sempiternal. Insofar as these two concepts of substance resolve the dilemma in the First Analogy and so safeguard Kant's proof for the First Law of Mechanics, they also safeguard the other two Analogies and with them the corresponding Laws of Mechanics. Given Kant's general pessimism concerning our knowledge of particular natural laws outside the context of *MA*, any knowledge of particular natural laws may well hinge on the success of his proofs for the Laws of Mechanics.