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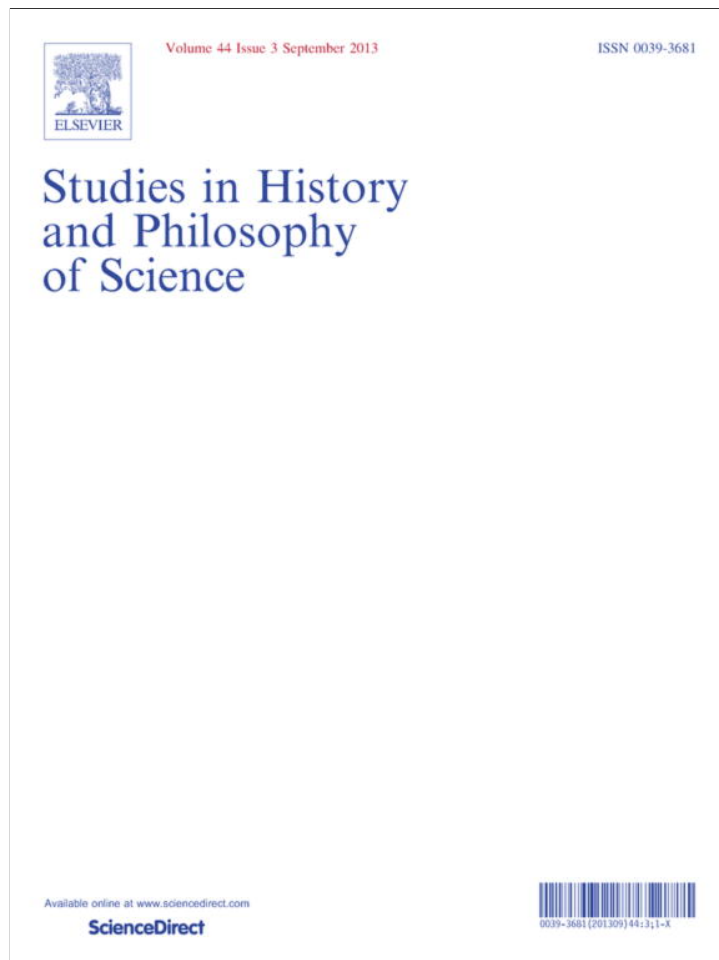
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The early Kant's (anti-) Newtonianism

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ABSTRACT

It is well known that during his pre-Critical period, Kant was a major proponent of Newtonian physics, for the project of the *Universal Natural History* explicitly uses “Newtonian principles” to explain the formation of the various bodies that constitute our solar system as well as those that lie beyond. What has not been widely noted, however, is that the early Kant also developed a major criticism of Newton, one that is based on subtle metaphysical issues pertaining to God, which are most at home in philosophical theology. Interestingly, this criticism is neither an inchoate precursor of his later criticisms of Newton's account of absolute space, nor isolated to the abstract realm of metaphysics, but has a wide range of implications for the way in which a scientific account of the formation and constitution of the heavenly bodies ought to be developed, that is, for the kind of argument Newton offered in the *Principia*. That Kant remained interested in this set of issues later in his Critical period suggests that, alongside the revolutionary changes that comprise transcendental idealism, there are deep continuities not only in his Newtonian commitments, but in his anti-Newtonian tendencies as well.

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1. Introduction

It is widely agreed that throughout his mature works Kant is, in some nontrivial sense, both a Newtonian and an anti-Newtonian. On the one hand, he is heavily indebted to Newton insofar as main aspects of his account of the natural world reveal broadly Newtonian features. Not only does he accept universal gravitation and the notion of action at a distance that is naturally, though not unavoidably, thought to accompany it, but major components of his metaphysics and philosophy of science are also fundamentally Newtonian. In the *Metaphysical Foundations of Natural Science*, in particular, he develops extended arguments for both Newtonian forces of attraction and repulsion and three laws of mechanics that bear striking parallels to (though also notable differences from) Newton's three laws of motion.¹ Moreover, Michael Friedman has recently argued that in the *Metaphysical Foundations* Kant even adopts, with some modification, Newton's main argument of the *Principia* in such a way that the highly abstract principles of Kant's

transcendental philosophy can be realized only by an essentially Newtonian world.²

On the other hand, in his mature works Kant is also quite critical of Newton. Near the beginning of the *Critique of Pure Reason*, Kant famously criticizes both Newton's and Leibniz's accounts of space and time. Specifically, space and time cannot, he argues, be “actual entities” that are absolute, as Newton maintains, nor can they be merely “determinations or relations between things... that would pertain to them even if they were not intuited by us” (A23/B37) and thus relational, as Leibniz holds, but rather must be merely subjective forms of intuition, which is one of the core claims of Kant's most distinctive and foundational philosophical doctrine, transcendental idealism. That is, Kant fundamentally rejects Newton's (and Leibniz's) metaphysics of space and time in favor of his own idealistic system.

What has received much less attention, however, is Kant's relation to Newton *prior* to the publication of the *Critique of Pure Reason* in 1781 and the *Metaphysical Foundations* in 1786.³ To the

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¹ See, for example, (Friedman, 1992; Warren, 2010; Watkins, 1998; Smith, 2012).

² See (Friedman, 1992), chaps. 3 and 4.

³ Exceptions to this are (Adickes, 1924; Harman, 1983; Laywine, 1993; Lefevre, 2001; Polonoff, 1973; Schönfeld, 2000; Waschkies, 1987; Watkins, 2003).

extent that the reception of Newton in Kant's pre-Critical works is discussed at all, it is typically noted that the early Kant is sympathetic to Newton's position in natural science. His most important innovations are described as lying in his attempt at reconciling his Newtonian views in natural science with a more Leibnizian metaphysics, where the project of reconciliation is not supposed to require a rejection of any particularly fundamental Newtonian doctrines. In this context, the following points are often acknowledged: (1) early in the pre-Critical period Kant accepted Newtonian attractive and repulsive forces and the law of universal gravitation, (2) by 1756, he came to accept a physical monadology that included both atoms and the force of inertia, which can be seen as deriving, in part, from Newton (though also, in part, from Leibnizian considerations), and (3) in 1768, on the basis of incongruent counterparts, he is typically viewed as arguing for a Newtonian conception of absolute space (though later, in the *Prolegomena*, he used incongruent counterparts to support transcendental idealism instead). These points are certainly important since they establish that the early Kant had deep Newtonian commitments.

What has not been seen clearly enough, however, is that and how the early Kant also developed a major criticism of Newton, one that is ultimately based on subtle metaphysical issues pertaining to God that are most at home in philosophical theology.⁴ Moreover, this criticism is neither a precursor of his later criticisms of Newton's account of absolute space, nor isolated to the abstract realm of metaphysics, but has a wide range of implications for the way in which a scientific account of the formation and constitution of the heavenly bodies ought to be developed, that is, for the kind of argument Newton offered in the *Principia*. That Kant remained interested in this set of issues later in his Critical period suggests that, alongside the revolutionary changes that comprise transcendental idealism, there are deep continuities not only in his Newtonian commitments, but in his anti-Newtonian tendencies as well.

In Section 2, I describe how a pro-Newtonian interpretation of Kant's views early in his pre-Critical career could seem attractive. Specifically, I first show how, in his attempt to reconcile Cartesian and Leibnizian positions on the *vis viva* debate in the late 1740s, Kant initially rejected one central aspect of Newton's position, the law of inertia, (albeit without seeming to have given the matter careful thought), while accepting another and trying to develop further consequences from it, which end up being fundamentally anti-Newtonian, though Newton is not the primary focus of Kant's attention. I then describe how one might view Kant as coming to adopt a much more Newtonian position in the *Universal Natural History* in 1755. For even though Kant explicitly notes several differences between Newton's position and the one he develops, the temptation to gloss over these differences as superficial is clear, making it easy to stress that what is most central to Kant's overall project at this time—his basic position and argument for it—is fundamentally Newtonian.

In Section 3, I argue against this kind of pro-Newtonian reading by showing that his broad and deep Newtonian commitments notwithstanding, Kant breaks from Newton in the *Universal Natural History* by lodging a substantive criticism of Newton's position on God's governance of the world and offering a major alternative to it. Specifically, I show that Kant proposes to explain the harmonious order of nature not by appealing to the immediate will of God (which would, he thinks, unnecessarily render his position vulnerable to a serious line of criticism), but rather through re-

course to matter and its necessary laws. Kant can avoid the heretical implications one might attribute to this kind of "naturalist" view by denying that explanations of the order of nature must invoke either God or matter, since he understands God as the ground not only of the existence of matter, which is a commonly held view, but also of the very possibility of matter and its necessary laws, which is a not a standard position at the time. For such a position to be coherent, however, Kant must be able to explain how God could ground possibilities. I describe how Kant holds that God grounds the possibilities of things not through his will (which would, he thinks, be viciously circular), but rather through his essence as a self-sufficient being with a distinctive kind of intuitive intellect. I conclude by showing that the conception of God that Kant ends up adopting coheres much better with a number of structural features of the constitution of the universe than does a conception that would appeal directly to the will of God. As a result, though Kant is critical of Newton's position on this fundamental point, he has reason to think that the position he develops actually provides strong support for the empirical world that Newton had described with such incredible precision and genius. In this way, one can, I hope to show, appreciate how the early Kant can simultaneously and consistently be both for and against Newton in fundamental respects.

2. The emergence and character of the early Kant's Newtonianism

2.1. Kant's earliest stance towards Newton

In his first publication, *Thoughts on the True Estimation of Living Forces* (1746/49), Kant's main goal is to reconcile the Cartesian and the Leibnizian positions on the *vis viva* debate. His argument, in brief, is that the Cartesian estimation of force (according to which 'dead force', or mv , is conserved in nature) is mathematically correct for bodies that require an external stimulus for their continued motion, but that the Leibnizian estimation (according to which 'living force', or mv^2 , is conserved in nature) is correct for bodies that move without requiring any external cause to sustain their motion. Though Newton's position agrees with Descartes's on this point, Kant always pits Descartes (or the Cartesians) against Leibniz (or the Leibnizians); neither Newton nor any of the Newtonians who are involved in the debate plays any explicit role in Kant's discussion. As a result, Newton is not directly involved in the main topic of this work, as Kant frames it.

Nevertheless, Newton's position is relevant to the *True Estimation* in three ways. First, Kant makes the well-known point that it is unseemly for God to have to continually add motion to the universe to keep it from coming to a standstill, as Newton maintains (1:58).⁵ At the same time, this particular criticism seems, *prima facie*, to be an isolated and relatively minor point; Kant acknowledges borrowing it from Leibniz and nowhere in the rest of his work does he explicitly indicate that any significant consequences follow from it.

Second, immediately after presenting the main contours of his resolution of the *vis viva* debate, Kant explicitly recognizes that his position entails the rejection of Newton's law of inertia (1:155). Since bodies endowed with a certain kind of motion have 'dead' rather than 'living' forces, they are not capable of sustaining themselves in motion; that is, their motion will diminish of itself

⁴ Waschkies and Schönfeld are more attuned than others to the way in which features of God are relevant to the order of nature in the early Kant's views. For example, Waschkies notes that Kant's intent in the *Universal Natural History* is to show "dass eine konsequente Anwendung der Newtonschen Physik zu einem physikotheologischen Gottesbeweis führt, der die Existenz eines Gottes Leibnizscher Prägung sicherstellt" (Waschkies, 1987, p. 18). As we shall see below, Kant develops his conception of God in ways that go well beyond Leibniz's position, at least on certain crucial points.

⁵ References to Kant's works will be noted by volume and page number in parentheses from the *Akademie* edition of Kant's works (Kant, 1900). Translations will be from Kant's (1992, 1996, 2012).

and they will come to be at rest without any external body acting on them, a clear violation of Newton's law of inertia. Interestingly, Kant gives no indication that this disagreement should be thought of as particularly fundamental. Given his penchant throughout his career for attempting to synthesize diametrically opposed views into delicately balanced intermediate positions, he may well have held at this time that Newtonian and Leibnizian physics could be made compatible.

Third, at the beginning of the first part of the *True Estimation*, Kant undertakes a clarification of the basic metaphysical framework that he uses in the rest of this work, one that contains an explanation of its concept of force. Though he claims to be following Leibniz in calling force active (rather than motive, as Wolff had), it turns out that the position he commits himself to maintains (with Newton, but also with many others) that substances can act externally on each other causally, which contrasts starkly with Leibniz's pre-established harmony.⁶ Moreover, his position is clearly Newtonian in a more distinctive sense insofar as he explicitly states that "substances in the existing world act on each other in such a way that the strength of the action is inversely proportionate to the square of the distances" (1:24). That is, he accepts a version of Newton's law of universal gravitation (though without explicitly crediting him by name). Kant even puts this Newtonian idea to further use, however, by attempting to derive the three-dimensionality of space from the inverse-square law. Since space and its features are absolute for Newton and not derivative from the interactions of substances, Kant's proof actually reveals a basic disagreement with Newton. At the same time, insofar as Kant shows no explicit awareness of Newton's position on the point, what stands out most is the point of agreement on Newton's law of universal gravitation.

Taking these three points into account, we can see that Kant's overall attitude toward Newton in the *True Estimation* is already complex (if not incoherent). On the one hand, his primary focus in this work is not Newton's natural philosophy, but rather essential features of Descartes's and Leibniz's positions. There is no indication that his rejection of Newton's law of inertia is the result of a detailed examination of Newton's *Principia* or of its argument; it is more plausibly understood as a consequence of his interest in attempting to retain central components of Leibnizian physics. On the other hand, he accepts Newton's inverse-square law as a universal, though not completely fundamental, principle of the world and attempts to think through in an original way what might follow from it. Accordingly, he displays some important sympathies with aspects of Newton's position, though the ultimate metaphysics at its foundation is inconsistent with Newton's. In short, in this early work, Kant might be thought of as a Newtonian, but only in a very tenuous sense.

2.2. A pro-Newtonian interpretation of Kant's *Universal Natural History*

By 1755 the focus of Kant's attention has turned squarely to Newton and it is tempting to view him as having converted to Newtonianism.⁷ For in his *Universal Natural History and Theory of the Heavens or Essay on the Constitution and the Mechanical Origin*

of the Whole Universe according to Newtonian Principles he provides what he explicitly calls a Newtonian account of the formation of the universe ("Weltgebäude"). And he praises Newton's accomplishment in the highest of terms:

Of all the tasks facing research into nature, none has been resolved with greater accuracy and certainty than the true constitution of the universe on the large scale, the laws of motion, and the internal mechanism of the orbits of all the planets into which Newtonian philosophy can give such insights as can be found in no other part of philosophy. (1:229)

Yet this treatise is Newtonian not simply in virtue of its title and its praise of Newton, but also in terms of its basic content. For in it Kant not only relies heavily on the detailed observations found in Newton's *Principia*, but also attempts to explain how the main elements of the entire observable universe—including the constitution and regular motions of the Sun, the Earth and the other planets, the moons, comets, and even other solar systems—can be explained on the basis of three assumptions: (1) a certain initial state—a chaos in which matters endowed with different densities are distributed throughout space in the form of various indeterminate nebula, (2) Newtonian mechanical principles—primarily attractive and repulsive forces, coupled with the law of universal gravitation, and (3) the motions that these matters would have initiated and the states that they would eventually come to be in due to these motions and mechanical principles. Kant's summary of his account states the first two assumptions explicitly:

I have, after I placed the world in the simplest chaos, made use of no forces other than those of attraction and repulsion to develop the great order of nature, two forces which are equally certain, equally simple, and equally original and universal. They have both been borrowed from Newtonian philosophy. The former is now a law of nature that is beyond doubt. The second, which Newtonian science is unable to provide with as much clarity as it has for the first, I will assume here only in the sense that no one rejects it. (1:234–5)

Even if the core of Kant's argument is based on analogies and hypothetical reasoning rather than the kind of sophisticated derivations and empirical observations Newton used, it is still clearly Newtonian in its essential views.⁸ As Kant sees it, Newton is responsible for "the mathematical half" of natural philosophy with his description of the motions and primary features of the celestial bodies on the basis of the laws of motion and universal gravitation, while Kant purports to contribute to "the physical part of cosmology" (1:230) by explaining how purely mechanical principles could allow for a causal explanation of the origin of those features that Newton describes mathematically. This contribution firmly establishes Kant as a Newtonian, in spite of, or perhaps precisely because of, the division of labor he proposes for Newton (mathematical) and himself (physical).

At the same time, one should not overlook three differences that Kant explicitly points out between his own position and Newton's.⁹ The first concerns the exact status of repulsive forces. Kant never wavers at all in accepting attractive forces, which are clearly an

⁶ Leibniz's pre-established harmony denies inter-substantial in favor of intrasubstantial causation. For detailed discussion of this issue in Leibniz and the pre-Critical Kant, see (Watkins, 2005, chaps. 1–2).

⁷ See, for example, (Schönfeld, 2000, chap. 4).

⁸ Scholars have speculated about why Kant's argument is qualitative rather than quantitative. Some, such as Adickes (1924), suggest that Kant's mathematical abilities were too limited, while others, such as Krafft (who produced a German edition of the *Universal Natural History*), hold that the empirical data were not detailed enough to tackle the questions Kant hoped to address, and yet others, such as Schönfeld (2000), argue that a purely qualitative argument is appropriate for identifying the causes of the phenomena whose laws Newton had described mathematically.

⁹ There is, however, at least one other point on which Kant is critical of Newton's position, though he does not explicitly mention Newton by name. It is likely that Kant has Newton's position in mind when he remarks (extending the criticism he had articulated earlier in the *True Estimation*): "A world constitution that could not sustain itself without a miracle does not have the character of permanence that is a feature of God's choice; thus it is far more appropriate if we were to make one system out of the whole of creation, one that relates all worlds and world-orders that fill the entirety of infinite space to a single centre point" (1:311).

essential feature of Newtonianism in this period. However, in this work, he commits himself decisively to repulsive forces as well, even though such a commitment is, as he notes, less firmly established by Newtonians.¹⁰ It turns out that this first difference has not been viewed as particularly significant for Newton's explicit purposes in the *Principia* and for Kant's position in the *Universal Natural History*.¹¹ For one, Kant thinks that repulsive force is explicitly revealed in a relatively limited context, namely "in the elasticity of vapors, in the emission of strong-smelling bodies, and in the dispersion of all spirituous matter," though this force is also, he notes, "an undisputed phenomenon of nature" (1:265). For another, repulsive force is required in only one highly circumscribed place in Kant's argument, whereas the necessity of attractive force is ubiquitous in his account.¹²

The more important question on this issue, though, is why Kant thinks that both attractive and repulsive forces should be viewed as core Newtonian principles, when Newton refers to other kinds of forces much more frequently, such as *vis impressa* and *insita* and centrifugal, centripetal, and inertial forces, which Kant uses either infrequently or not at all in the *Universal Natural History*.¹³ My suspicion is that Kant's reason for characterizing Newtonian forces as attractive and repulsive derives from a philosophical advantage that he makes explicit only later, in the *Metaphysical Foundations*, namely that characterizing motive forces in terms of the two possible directions of the motions they bring about—motion *towards* the force that is active for attractive force and motion *away* from the force that is active for repulsive force—guarantees, he thinks, that there can be no more than two fundamental forces and one need not be concerned about having omitted any others (at 4:498–9). Indeed, one might even claim to find hints of this line of argument in Kant's reference to the simplicity, originality, and universality of these forces found in the extended quotation above. Kant's commitment to repulsive force is thus firmer and more explicit than Newton's, but it does not reveal any particularly significant fault line that would fundamentally separate the two thinkers.

A second point of difference concerns the proper explanation of the densities of the planets relative to their distance from the Sun. In Book 3, Proposition viii, Theorem viii, Corollaries 3 and 4 of the *Principia*, Newton argues that the relative density of the planets varies according to their distance from the Sun such that, e.g., the Earth is denser than Jupiter and Jupiter denser than Saturn. His reason for this claim is that the degree of density of the planets must vary inversely with distance so that the effect of the Sun's powers (of gravity) at the surface of each planet will be roughly equal. Newton illustrates his reasoning with an example: If water were on Mercury, it would "fly off" and turn into a vapor almost immediately, whereas if it were on Saturn, it would turn into ice.¹⁴ In Chapter 2 of Part 2 of the *Universal Natural History*, Kant objects to Newton's position on several counts. For example, Kant distinguishes between the specific densities of the materials that are at the planets' surfaces and those that are underneath the surface, and suggests that it would be a mistake to infer from the former to the latter (as Newton implicitly does). He also objects that Newton's explanation is inconsistent with the differences between the Earth's

and Moon's densities, since they are located at virtually the same distance from the Sun (1:271).

Instead, Kant holds that the differences in the relative densities of the planets and their moons can be given a purely mechanical explanation, in line with the fundamental principles already laid out earlier in the *Universal Natural History*. Because particles whose original positions are closer to the mass that will form the Sun must have a greater velocity and density if they are not to fall into the Sun, those planets that are able to form close to the Sun must have a greater density, while those that form farther out need not have as great a density to maintain their orbit. What is to be noted about the disagreement between Newton and Kant on this point, however, is that they agree about the phenomena, but disagree simply on how best to account for it on the basis of principles both parties fully endorse. As a result, Kant's criticism of Newton here is not particularly fundamental, but more a difference of detail.

Matters are more complicated when we consider the third passage in which Kant explicitly notes a disagreement with Newton, namely in Chapter 7 of Part 2 in the *Universal Natural History*, where he argues for a cyclical history of the universe. According to Kant, not only does the universe form over time in accordance with mechanical principles, but it also contains the seeds of its eventual demise such that the process can begin again. That is, given the infinity of space and time, the emergence of suns, planets, moons, and comets out of a chaotic and unformed matter that is initially dispersed throughout space in the form of nebula through a finite time period must at some point be followed by their eventual return to a chaotic state that mirrors its initial state. At this point, the universe will re-emerge just like a "phoenix of nature, which burns itself only to rise rejuvenated from its ashes to new life through all infinity of time and space" (1:321). This picture contrasts with Newton's static model, according to which God adds motion to the universe so as to keep its store of motion from becoming depleted with time and to maintain the universe exactly as it is now. Regarding this difference, Kant remarks: "We must not lament the end of a world structure as a true loss of nature. Nature shows its bounty in a kind of extravagance, which, while some parts pay their tribute to transience, maintains itself through countless new creations in the whole extent of its perfection" (1:318). Though there is a genuine difference here between Kant's and Newton's views, someone who is motivated to emphasize Kant's Newtonianism would be tempted to view it as concerning a rather speculative issue—whether God will or will not act to keep the universe from collapsing into chaos—rather than a core part of Newton's project and views in natural philosophy. This issue alone is not, one might think, substantive enough to think of Kant as anti-Newtonian.

Yet it is certainly true that Kant's overall project in the *Universal Natural History* is decidedly anti-Newtonian in the sense that it directly contradicts Newton's official account of the formation of the universe. For in the General Scholium added to the second and third editions of the *Principia*, Newton explicitly rejects the possibility of the kind of cosmogony Kant gives. He asserts that planets and comets "will indeed persevere in their orbits by the laws of

¹⁰ See Massimi (2011).

¹¹ For a dissenting view on the significance of repulsive force, see (Massimi, 2011).

¹² In explaining how the originally dispersed matter moves and is formed into the sun or else into bodies that orbit the sun, Kant asserts that repulsive force is required only when "the elements descending to their attraction points are deflected from the straight line of their motion to one side, and the vertical descent ultimately changes into orbital motions encompassing the centre point of the descent" (1:265). However, if one broadens the context to include, for example, the *Physical Monadology*, then repulsive forces take on a much more central role in Kant's view, since there he argues for the necessity of both attractive and repulsive forces in a way that displays some similarities with his argument in the *Metaphysical Foundations*.

¹³ The term that Kant uses more frequently than either centripetal or centrifugal force is *Schwungkraft*, which, in context, is best translated as tangential force.

¹⁴ He does not, however, make clear either why the Sun's effects ought to be roughly equal for the different planets nor why it would be inappropriate for ice to be on Saturn or vaporized water on Mercury.

gravity, but they certainly could not originally have acquired the regular position of the orbits by these laws.” (Newton, 1999, p. 940, emphasis added).¹⁵ His justification for this claim is the relatively brief remark that “all these regular motions do not have their origin in mechanical causes, since comets go freely in very eccentric orbits and into all parts of the heavens” (*ibid.*). Instead of positing a mechanical origin of the motions of the celestial bodies and viewing comets as exceptions requiring additional explanations, Newton takes recourse to a divine cause: “This most elegant system of the sun, planets, and comets could not have arisen without the design and dominion of an intelligent and powerful being” and he goes on to describe what kind of deity would be responsible for the world that we live in (*ibid.*). According to Newton, God would rule all things, not as the world soul, but as the lord of all. He would be an eternal, infinite, and absolutely perfect being with dominion over man and nature (in the form of the divine omnipotence and omnipresence).

Again, if one is predisposed to stress Kant's agreement with Newton, it is tempting to think that although Kant is clearly critical of Newton on this point, the main thrust of his criticism is best taken as a friendly amendment to Newton's main argument in the *Principia*. Specifically, because Newton could not see how to account for the formation of the eccentric orbits of comets in a purely mechanical fashion, the formation of the entire universe ultimately had to be understood non-mechanically, and the most obvious option on that point is to invoke God. However, had Newton seen that one could explain the origin of the various celestial bodies in a purely mechanical fashion, it is tempting to think, as Kant explicitly does in *The Only Possible Argument*, that he would have happily accepted this kind of account, given that it significantly increases the explanatory scope and power of his most basic commitments in the *Principia*.¹⁶ As a result, through this elegant act of cooptation, Kant's disagreement with Newton on whether a purely mechanical cosmogony is possible could be turned into a point of fundamental agreement and we would have further reason to view Kant's self-description of his project in the *Universal Natural History* as Newtonian as accurate.

Throughout much of the rest of his pre-Critical period, Kant continues to work out the details of a fundamentally Newtonian picture, even as he innovates on topics that extend beyond the scope of Newton's primary contributions to natural philosophy. Thus in the *Physical Monadology* of 1756, Kant attempts to reconcile a broadly Newtonian atomistic theory of matter with a Leibnizian metaphysics of physical monads endowed with forces that are more Newtonian than Leibnizian. It is true that Kant's *New Doctrine of Motion and Rest*, published in 1758, represents a significant complication for this narrative. For in this short paper Kant developed an argument that seems to be a defense more of Leibnizian than of Newtonian physics.¹⁷ Yet, if one puts this complication aside as a temporary aberration, the most significant development regarding Newton that occurs in Kant's pre-Critical period lies in the so-called *Inaugural Dissertation*, with its rejection of Newton's absolute space (after he might seem to have accepted Newtonian absolute space a

mere two years earlier on the basis of incongruent counterparts). But it is easy enough to maintain that this point is no longer fully pre-Critical, given that it contains arguments that are nearly identical to those that Kant presents in the *Critique of Pure Reason's* Transcendental Aesthetic. As a result, one can marshal quite a few texts in support of the view that, overall, the early Kant is engaging with Newton's position and argument in profitable and sympathetic ways, and that his apparent differences are best understood as attempts to improve on certain features of Newton's account where it might need supplementation or correction.

3. Kant's criticism of Newton in the *Universal Natural History*

This kind of pro-Newtonian interpretation of Kant overlooks, however, a crucial and deep anti-Newtonian strand in his thought, one that is found in several places in the *Universal Natural History* and then is developed further shortly thereafter in *The Only Possible Argument*. To see how Kant introduces and articulates this line of thought, it is helpful to return to the very beginning of the *Universal Natural History*, where he notes that he expects opposition to his project on two counts. The one concern is that providing a comprehensive and accurate account of the formation of the entire universe would require insights that extend beyond the cognitive capacities of human beings. While Kant is sensitive to the (a priori) limitations of our cognition later in his career, at this point he simply expresses his confidence that optimism in our cognitive powers will be vindicated in the present case. That is, he seems to think that the argument he offers in the *Universal Natural History* will speak for itself.

The other concern, to which Kant devotes almost all of his attention in the Preface, stems from religion and is based on the idea that one should not attribute to nature what ought to be attributed to God, lest theologically unacceptable consequences follow.¹⁸ He formulates this second concern more specifically as follows:

If the universe (“*Weltbau*”) with all its order and beauty is merely an effect of matter left to its general laws of motion, if the blind mechanism of the powers of nature knows how to develop so magnificently and to such perfection all of its own accord: then the proof of the divine Author, which one derives from the sight of the beauty of the universe, is entirely stripped of its power, nature is sufficient in itself, divine government is superfluous, Epicure lives again in the middle of Christendom, and an unholy philosophy tramples faith under foot, which hands philosophy a bright light to illuminate it [i.e., philosophy]. (1:222)

That is, if a purely mechanical account of the origin and development of the cosmos is advanced, it might seem that a series of heretical consequences follow, such as a rejection of a major proof of God's existence and of God's omnipotence along with it, an assertion of the superfluity of divine providence, and the admission of the inevitability of a non-Christian Epicurean position.¹⁹ In the face

¹⁵ Though Kant owned a copy of the second edition, it is relevant to note that Newton expressed a similar thought in the first edition as well (in corollary five of proposition eight of book three).

¹⁶ Kant makes exactly this point in *The Only Possible Argument*: “It can thus surely be supposed that Newton, in attempting to explain the structure of the planets, their revolutions and the position of their orbits, would not have had immediate recourse to an explanation in terms of a divine provision, unless he had judged that a mechanical explanation was impossible. [...] [If Newton had considered the line of thought that Kant did in constructing his purely mechanical account] it is certain that Newton would, in a philosophically proper manner, have sought the grounds of the constitution of the structure of the universe in the universal laws of mechanics” (2:121).

¹⁷ See Stan (2009, 2011).

¹⁸ For an instructive discussion of the theological dimension of Kant's discussion, see (Schönfeld, 2000, pp. 96–113).

¹⁹ Kant repeats this same kind of criticism in many other places. In the transcripts from his lectures on the philosophical doctrine of religion, Kant is reported to have said: “for a long time the idea of an independent matter persisted in the heads of philosophers, even of the orthodox. Hence there were zealous outcries against anyone who ventured to explain part of the world's order and beauty from universal laws of nature. For some were concerned that in this way such arrangements would be snatched away from God's supreme rule. But this could be believed only by someone who thinks of matter as independent of God, like a coordinated principle. If, on the contrary, it is assumed that every substance receives its origin from God, then all matter is subordinated to God and all its laws in the last analysis have their origin in him” (28:1094–5).

of such a major objection, Kant immediately reassures his readers of his piety; he is so firmly convinced of the infallibility of the divine truths that if this objection could be sustained, he would immediately reject the purely mechanical account of the origin of the universe he offers and even consider it thoroughly disproved. At the same time, he does not believe that such a step is at all necessary.

In the course of his complex response to this objection, developed throughout much of the Preface and then in detail in Chapter 8 of Part 2 of the *Universal Natural History*, Kant pursues a two-fold strategy. On the one hand, he wants to show that and why the heretical consequences that the objection purports to draw from a purely mechanistic account of the formation of the universe do not in fact follow. To that end, a more accurate and detailed conception of God's relation to matter and to the mechanical laws that govern it is required. On the other hand, he tries to show that those who attempt to defend religion by appealing to God as the immediate cause of the contingent order and beauty of the universe and who raise the objection against a fully mechanistic cosmology, actually open themselves up unnecessarily to attack from naturalists or atheists.²⁰

Kant pursues the second strand of this strategy in the Preface by raising two criticisms. His first criticism is that those who appeal to God as the immediate cause of the harmonies found in nature have an inadequate conception of God, since on this account God would be "great yet not infinite, powerful yet not entirely self-sufficient" (1:223). That is, if God is supposed to impose on matter an order that is foreign or extrinsic to it and its laws (in the sense that matter would not have had that order otherwise), then matter and its necessary laws must be prior to and thus independent of God's power. For if matter already had such an order, God would not need to impose it on matter. But if matter and its laws are independent of God, then they constrain what God can do. This entails both that God is not omnipotent with respect to them and that God would not be self-sufficient in carrying out his divine plan given that he would depend on their independent contribution.

Kant's second criticism takes issue with an assumption that underlies the objection commonly raised against any purely mechanical explanation of the formation of the universe. The assumption is that "if natural causes can be discovered for all the order in the world that can be brought about by the most general and most essential properties of matter, then it is not necessary to invoke a highest governing power" (1:223). This assumption is central to that objection, because it permits the move from a purely mechanistic account of the world to the dispensability of God as creator. Kant counters that accepting this assumption actually opens the theist up to attack. For as soon as the atheist can show that there are countless cases in which a purely mechanistic explanation suffices to account for harmonious or orderly phenomena in the world—Kant cites several examples, including that of the alternating onshore and offshore winds during the night and day over islands at the equator—then it turns out that God is not in fact required to account for a wide range of phenomena in the world. That is, even if God would be required to account for those events that cannot be accounted for by mechanistic explanations, all of the rest would not require God's providential activity. In that case, much of the world could, for all that the theist can show, be independent of God, which directly contradicts orthodox conceptions of God's omnipotence and creative activity. By accepting the assumption in question, the theist is thereby forced into a position of weakness, not strength. Though Kant does not concede that the theist is destined to lose this argument, the prospect of having to confront the atheist on this front generates a non-trivial

(albeit purely strategic) reason to reject the assumption that leads to it.

Kant's rejection of this assumption is crucial, however, insofar as it also provides insight into the first strand of his strategy for responding to the objection. For if he rejects this assumption, it is then open to him to deny that the necessary laws that govern the mechanical motions of matter are in fact independent of God. As he puts it in the Preface: "If the universal laws of causation of matter are also a result of the highest plan, then they can presumably have no purpose other than that which strives to fulfill of their own accord that plan which the highest wisdom has set itself" (1:223). The crucial idea here is that Kant views the mechanical laws as the result of God's "highest plan" despite the fact that they are necessary. For if one does not set mechanistic principles and God's providence in opposition to one another, then explaining a range of phenomena (e.g., harmony, order, beauty, etc.) through recourse to the one does not preclude an explanation that also appeals to the other. Accordingly, a fully mechanistic explanation of whatever phenomena are found in the universe does not preclude invoking God to the same end. As a result, the consequences that were alleged to follow from a fully mechanistic explanation of the origin of the universe no longer follow. For if matter and its necessary laws follow from God, then (1) God's omnipotence is not threatened by the order that follows from them, since matter and its laws are subject to God's power, and can thus still provide a basis for a proof of God's existence, (2) God's providential activity is enhanced, since it still controls the order that follows from matter and its laws, and (3) the Epicurean philosophy that emerges need not be either unholy or unchristian, since God is at the heart of this philosophical account of the world.

However, this move is not as easy as it might at first seem, given that it faces a significant philosophical obstacle. For it is quite natural to think that if the laws that govern matter are necessary, they cannot depend on God. For example, given that these laws are necessary, God could not have chosen different laws. So it is not immediately obvious how Kant could maintain that such laws depend on God given their necessity. He returns to this issue at the beginning of Chapter 8 in Part 2 of the *Universal Natural History*, by summarizing the opposing positions that he had already laid out in the Preface:

It is simply a matter of deciding whether the design of the arrangement of the universe had already been placed in the essential determinations of the eternal natures and planted into the universal laws of motion by the highest understanding so that it developed out of them naturally in a manner proper to the most perfect order, or whether the general properties of the constituent parts of the world have a complete incapacity for harmony and not the slightest reference to any combination and definitely required an external hand to acquire that limitation and co-ordination that shows perfection and beauty in it. (1:332)

He then argues in support of the first option on the following grounds:

If one considers that nature and the eternal laws that are prescribed to substances for their interaction, are not a principle independent and necessary without God, that precisely because of the fact that it shows so much correspondence and order in what it produces through universal laws, we can see that the essences of all things must have their common origin in a certain primitive being ("*Grundwesen*") and that for this reason

²⁰ Waschkies (1987, pp. 565–577) provides a helpful description of the historical context in Germany in the 1740s and 1750s, including, in particular, the reception of Newton's physico-theological argument by Maupertuis in his *Essai de Cosmologie* and in the Berlin Academy of Sciences in general and possible reasons that Leibniz is never mentioned in the *Universal Natural History*.

they reveal many reciprocal relationships and much harmony because their properties have their source in a single highest understanding, whose sage idea designed them in constant proportions and implanted in them that ability by which they produce much beauty, much order in the state of activity if left to themselves. (1:332)²¹

Two features are especially striking about Kant's position here. First, Kant rejects the assumption that different things (or substances) should be conceived of as completely independent of each other and self-sufficient; instead, they are necessarily related to each other and this is possible only because of their common origin in God.²² Such a view contrasts with a conception of the essences of things according to which God first conceives of the different possible essences of things and then, in a separate act, has to figure out how they should be related to each other in creation (i.e., what order to impose on them).

Second, Kant maintains that God is responsible not only for the origin of things, but also for the origin of the essences of things. Thus God is the cause not only of the existence, but also of the very essence of matter, which contains its necessary and possible properties. Accordingly, the essence of matter dictates that it is necessarily extended and infinitely divisible and can be found in a wide range of possible states of motion or rest. Shortly thereafter, he clarifies this point as follows:

From this it follows that the essential properties [of things] can have no independent necessity, but rather that they must have their origin in a single understanding as the ground and source of all beings, and in which they have been designed under mutual relations. All things that relate to one another in a reciprocal harmony must be combined with each other in a single being on which they all depend. Therefore there is a being of all beings, an infinite understanding and self-sufficient ("selbständige") wisdom, out of which nature also draws its origin in the entire sum total of its determinations, even according to its possibility. (1:333–4)

In other words, what Kant is insisting on here is that God is the cause not only of the things found in nature, but also of their very possibility. Moreover, God is in a position to be the ground of the possibility of things in virtue of these possibilities somehow being contained in his infinite understanding and his self-sufficiency, though what these claims could mean must be rather unclear at this point, given how little he develops them.

4. God as the Ground of Possibility

In *The Only Possible Argument*, published in 1763, Kant goes on to use this basic idea to articulate in explicit fashion what he takes to be the only possible theistic proof.²³ In the same work that presents criticisms of the three traditional theistic proofs on grounds that are very similar to those in the *Critique of Pure Reason* that would later become famous, Kant argues that just as there must be a sufficient reason (or ground) for whatever things actually exist in the world, there must also be a sufficient reason (or ground) for their

very possibility. For just as one asks why anything rather than nothing actually exists, so too one can ask why anything is at all possible. While formal consistency serves as the logical ground of possibility, there must, Kant argues, also be a real ground of possibility, since something must be given if formal consistency is to be determined. The real ground that supplies the material element of possibility must actually exist (since if it were merely possible, no complete explanation of possibility would have been given) and that existing thing must, according to Kant's argument, be God if it is to be the ground of all possibility.²⁴

The crucial question that Kant must face here, however, is exactly how God grounds possibility. One might think that God grounds the different possibilities through his will, just as God's will serves as the ground of the actual world. That is, just as God creates substances in the actual world by willing them into existence, so too, one might think, God creates all possibilities through his will. However, this kind of voluntarist interpretation of Kant's position cannot be sustained. For one, Kant explicitly rejects it:

But wise as this arrangement [of the earth's axis with respect to its spheroid shape] is, I may not derive it straightway from the divine will, as something contingent, but I must rather consider it as a necessity of the earth's nature [...] Yet this takes nothing away from God's majesty as creator of the world; for since he is the original being from whose essence the nature of all things is derived, the necessity of this natural arrangement is also derived from his essence, not from his will. (28:1035)

For another, the position is viciously circular if standard assumptions about willing are granted. In general, the act of willing presupposes the (logical) possibility of the object of the will, but if, as is the case here, the object of willing is itself a possibility, then the act of willing would presuppose the very possibility that is to be brought about by God's will in the first place.²⁵ Since the will presupposes the understanding, which represents the possibilities in question, the will cannot be causally responsible for them.

In ruling out the dependence of possibilities on God's will, Kant clearly states that possibilities follow from God's essence. But how exactly should one understand an account based on this idea? In transcripts from his lectures on the philosophical doctrine of religion, Kant describes God in terms of three fundamental concepts: as the original being, as the highest being, and as the being of all beings (28:1013).²⁶ God is an original being insofar as he depends on no other and thus stands in community with no other. God is the highest being insofar as he has every reality in an unlimited way and is an *ens realissimum*. God is the being of all beings insofar as he is the ground of all others and thus the highest ground. As the being of all beings, God is said to be self-sufficient. All other predicates ascribed to God are to have one of these three concepts as their foundation.

In the context of explaining what he means by God's self-sufficiency, Kant discusses Spinoza's position, since Spinoza holds more explicitly than most that God is self-sufficient and that everything else—actualities, possibilities, and necessities—follows immediately from God's essence necessarily. Thus one might think that

²¹ For another expression of these points: "But if we find that a great deal of the order and perfection in nature has to be derived from the essence of things themselves according to universal laws, still in no way do we need to withdraw this order from God's supreme governance; but rather these universal laws themselves always presuppose a principle connecting every possibility with every other" (28:1070).

²² See Kant's explanation of the *New Elucidation's* Principle of Coexistence (e.g., 1:414).

²³ Though *The Only Possible Argument* is published eight years after the *Universal Natural History*, it was written only a short while later. The delay in its publication was due to the Russian occupation of Königsberg during the Seven Years War, which started in 1756.

²⁴ This raises the complicated question of how God's own possibility is grounded. For discussion of this issue, see (Watkins, in press).

²⁵ Kant even acknowledges that the will cannot be fundamental (as would be required on this account) when he remarks that "the causality of the highest being as regards the world, or the will through which he makes it, rests on his highest understanding" (28:1061).

²⁶ These transcripts do not necessarily reflect exactly what Kant said and they stem from Kant's Critical rather than his pre-Critical period. However, insofar as transcripts from throughout Kant's career reveal considerable continuity in the content (despite the Critical turn), they may reflect views that Kant held earlier in his career.

Spinoza provides a model for Kant's position on this point.²⁷ However, Kant is explicit in his rejection of Spinoza's idea that possibilities follow immediately, or blindly, from God's essence. For if everything were to follow immediately from God's essence, there would, Kant thinks, be nothing distinct from God, just as Spinoza maintains.²⁸ Since Kant is committed to God's being an original being, one that is distinct from and prior to what he creates (28:1041), he must offer a different explanation of God's self-sufficiency and a different conception of how God's essence grounds possibility. In the context of explaining his differences with Spinoza's position, Kant notes that "it is impossible to think God's causality, his faculty of actualizing things external to himself, otherwise than as in his understanding; or in other words, a being which is self-sufficient can become the cause of things external to itself only by means of its understanding" (28:1061). That is, one cannot conceive of possibilities as following from God as "a blindly working eternal root of all things" (28:1061), as Spinoza does. Instead, he continues, "the self-sufficiency of God, connected to his understanding, is *all-sufficiency*. For in cognizing himself, he cognizes everything possible which is contained in him as its ground" (28:1061). In short, God's understanding is essential to Kant's account of God's grounding of possibility.

Yet at least one way of understanding this kind of position does not provide any additional clarity. If one merely says that possible worlds are contained in the divine understanding and that the divine will selects from among those possibilities present in his understanding the best one for actualization, then no real explanation has been given of *how* God grounds the possibilities. They simply exist in the divine understanding, but one has gained no insight into why these possibilities exist and why they have the features they do.

Kant takes an important additional step by maintaining that God's understanding is intuitive rather than discursive and that it produces its objects rather than requires that objects be given to it from without, as is the case with the finite understanding of human beings.²⁹ While the human understanding can infer the particular only from the universal, God knows the particular immediately, i.e., intuitively everything through his understanding, but because he does this immediately, he also cognizes everything at once. God needs neither to compare things to each other to understand them nor to use general rules to grasp their distinguishing features. Moreover, because God is an independent being, these cognitions are not the result of external things acting on him, but rather derive from the activity of his understanding. Specifically, "God cognizes all things by cognizing himself as the ground of all possibility" (28:1052). Thus, God's self-sufficiency includes his cognition of himself and his powers, including his intuitive understanding as well as how he is the source of the possibilities of things. Since the possibilities arise from God, they are not independent, but since they emerge from his self-understanding as a self- and in fact all-sufficient being and not from his will, they are necessary. It is true that we have a poor grasp of what God's self-consciousness would be like (from the inside, so to speak), but even an incomplete notion of some of its essential features can help us to see how God could be the ground of possibility.³⁰

But enough seemingly abstruse metaphysical speculation! How do any of these claims bear on the early Kant's acceptance or rejection of Newton? In Chapter 8 of Part 2 of the *Universal Natural History*, which contains a general summary of his overall argument (for which reason Kant recommends, in the Preface, that his readers turn to it first), Kant directly relates these metaphysical issues

to an argument against a certain view of God's role in creating and maintaining the universe. Specifically, Kant argues that attributing the constitution of the universe and the origin of the motions of the different heavenly bodies to the direct hand, or rather will, of God flatly contradicts the order found in the universe on at least six important points.

First, without a mechanical reason that would explain why the planets in our solar system all orbit the sun in the same direction, Kant argues that there would be no reason for God to select a single direction for them all, but would exercise his freedom in selecting "all sorts of variations and differences" (1:336). That is, if it were simply up to God's discretion, the Earth would orbit in one direction, and Mars in another. Second, whereas a mechanical origin of the solar system can explain why the orbits of the planets all lie on a common plane, no direct appeal to God's will can do the same, since God could have decided to have their orbits lying on two planes or on as many planes as there are planets. Third, if God were to determine the motions of the planets directly, they would lie exactly on the same plane rather than only nearly so, as is actually the case and which can be explained by a mechanical origin. Fourth, if God were to decide the issue with complete freedom, the orbits of the planets ought to be perfect circles rather than elliptical, especially given that there seems to be no benefit to selecting the one orbit over the other as far as the potential uses or advantages of the world order is concerned. Fifth, if God practiced geometry when creating the world by way of his immediate will, the wildly eccentric orbits of comets would have to be viewed as inexplicable rather than as necessary byproducts of a mechanical origin. Indeed, given that they "neither can serve to provide comfortable dwelling places for rational beings nor become useful to the best of the whole system by serving the Sun as fuel at some stage," comets would have to be "imperfect members of creation" (1:338), which is obviously unacceptable. Sixth, if God were to select the masses of the planets himself, there would be no reason for them to increase with their distance from the Sun, whereas this fact is easily explicable according to mechanical principles. In short, a multitude of reasons establishes, Kant maintains, the superiority of the mechanical origin of the constitution and motion of the universe over one that would attribute it all immediately to God's will. Though Kant mentions Newton by name only once in his lengthy discussion in this chapter, he must have assumed that his intended audience was sufficiently familiar with Newton's views that no explicit identification was necessary. As a result, what Kant presents here is a sustained criticism of Newton's position.

Even if Kant's criticism of Newton is correct, that is, even if a mechanical explanation of the creation, constitution, and motions of the heavenly bodies that are observed in our solar system and beyond is superior to those that invoke the immediate efficacy of God's will, Kant's criticism is vulnerable unless he can clarify what role God plays in the natural world so as to avoid the charge of atheism. It is here that the seemingly abstruse metaphysical reflections described above are crucial. For Kant's reflections on metaphysics show that God must be the ground of possibility, since no finite thing in the world could serve as the ground of all possibility, but once one has established that God is required for the very possibilities of things, it is easy to see that certain universal or structural features of the universe can be rendered intelligible, without having to appeal to the immediate will of God. That is, it puts Kant in a position to maintain that although God is not the sole or direct cause of the various motions of the planets, moons,

²⁷ See (Chignell, in press).

²⁸ See (Brewer & Watkins, 2012).

²⁹ Though Kant discusses this notion at length in §§76–77 of the *Critique of the Power of Judgment*, he also discusses it earlier in his lectures (e.g., at 28:1017, 28:1051).

³⁰ Kant's *Only Possible Argument* (esp. Reflection Eight, 2:151) emphasizes God's all-sufficiency.

and comets, he is nonetheless involved in an absolutely essential way, given that without God the world as we find it would not even be possible, much less actual.

5. Conclusion

A closer look at Kant's early pre-Critical publications reveals that as long as one keeps the necessary qualifications in mind, the early Kant is rightly considered to be both a Newtonian and an anti-Newtonian. His Newtonian commitments in this period are not surprising, given his acceptance of basic Newtonian scientific principles, such as the law of universal gravitation and attractive and repulsive forces, and his project of extending Newton's explanatory framework beyond the contexts in which Newton thought it possible. Less expected and more interesting, however, are his anti-Newtonian elements, since they are based not on criticisms of Newton's account of the nature of space and time, as they would be later, in the *Critique of Pure Reason*, but rather on his metaphysical conception of how God relates to creation. For Kant consistently rejects scientific explanations that invoke God's immediate will in favor of accounts that are based on more general features of God's understanding and self-sufficiency. Though Kant's "Critical turn" later in his career involves a broad range of fundamental epistemological moves, such that he explores the conditions of the possibility of experience, it is striking that his interest in providing an explanation of how things are possible continues to invoke God.³¹ As a result, even though the Critical turn brings with it many radical changes never even dreamt of earlier, this one anti-Newtonian element of his pre-Critical period survives as an important line of continuity.³²

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³¹ See, for example, his discussion of the principle of thoroughgoing determination in the *Critique of Pure Reason's* Ideal of Pure Reason.

³² I thank Moti Feingold, Chris Hitchcock, Gideon Manning, Michela Massimi, Sheldon Smith, Marius Stan, Clinton Tolley as well as audience members at a colloquium talk I gave at Cal Tech in October 2010.