

PHYSICS FOR HUMANS: KANT, NATURAL SCIENCE, AND THE NEO-ARISTOTELIAN NATURAL POWER GRID

ROBERT HANNA

Abstract. In *Kant, Science, and Human Nature*, I argued that for Kant and for contemporary Kantians, mathematics is not only an objectively true a priori science (*Wissenschaft*), but also an irreducibly human or moral science (*Geisteswissenschaft*): I called that thesis *mathematics for humans*. In this essay, I want to argue the same thing, mutatis mutandis, for natural science or physics: for Kant and for contemporary Kantians, natural science or physics is not only an objectively true a priori science, but also an irreducibly human or moral science: I call this thesis *physics for humans*.

Keywords: Kant; natural science; physics; natural laws; causal powers; Neo-Aristotelianism.

1. INTRODUCTION

In his recent book, *Science Wars: The Battle Over Knowledge and Reality*¹, Steven L. Goldman compellingly argues that modern natural science, especially including physics, in its various attempts to ground itself philosophically, has tragically driven itself into a seemingly irresolvable Scylla-&-Charybdis-style dilemma:

1. *on the one hand* (the Scylla side of the dilemma), ever since the 17th century and the rise of modern natural science, the philosophy of physics has postulated *a noumenal and inherently mind-independent physical world* as the object of natural science's truth-claims and true theories, which, however, makes it impossible for human beings ever to cognize or know that object, thereby becoming an eminently easy, slow-moving target for radical skepticism; but then

2. *on the other hand* (the Charybdis side of the dilemma), ever since Thomas Kuhn's *Structure of Scientific Revolutions* (Kuhn, 1970), the philosophy of physics

¹ Steven L. Goldman, *Science Wars: The Battle Over Knowledge and Reality*, Oxford, Oxford University Press, 2021.

Robert Hanna ✉
Independent philosopher, USA

Rev. Roum. Philosophie, **66**, 2, pp. 197–216, București, 2022

has postulated that scientific theories, their truth-claims, and the physical world they purport to describe, are one and all *phenomenal, socially-constructed, and wholly relativistically mind-dependent*, thereby becoming yet again, although by a seemingly diametrically opposed route, an eminently easy, slow-moving target for radical skepticism.

Of course, the dialectical structure of this two-horned dilemma is thoroughly Kantian in nature: on the first horn of the dilemma, there is failed *noumenalistic and classical Rationalist-style, God's-eye-view metaphysical scientific realism*; and on the second horn of the dilemma, there is failed *phenomenalistic and classical Empiricist-style, anti-realist communitarian scientific relativism*. And in this way, modern natural science, especially including physics, like a hapless matador, has tragically impaled itself on both horns of the philosophical bull. Hence the interminable and unresolvable “science wars”.

But in my opinion, *all is not lost*, because there is a distinctively different, arguably true, and above all thoroughly anti-skeptical, *contemporary Kantian third alternative*.

In *Kant, Science, and Human Nature*², I argued that for Kant and for contemporary Kantians, *mathematics* is not only an objectively true a priori science (*Wissenschaft*), but also an irreducibly human or moral science (*Geisteswissenschaft*): I called that thesis *mathematics for humans*³. In this essay, I want to argue the same thing, *mutatis mutandis*, for *natural science or physics*: for Kant and for contemporary Kantians, natural science or physics is not only an objectively true a priori science, but also an irreducibly human or moral science: I call this thesis *physics for humans*.

2. KANT'S THEORY OF NATURAL SCIENCE OR PHYSICS REVISITED

Here is what Kant says about natural science or physics in the B edition Preface to the *Critique of Pure Reason*⁴:

² Robert Hanna, *Kant, Science, and Human Nature*. Oxford, Clarendon, Oxford University Press, 2006.

³ *Ibidem*, ch. 6.

⁴ For convenience, I cite Kant's works in parentheses. The citations include both an abbreviation of the English title and the corresponding volume and page numbers in the standard “Akademie” edition of Kant's works: *Kants gesammelte Schriften*, edited by the Königlich Preussischen (now Deutschen) Akademie der Wissenschaften (Berlin: G. Reimer [now de Gruyter], 1902—). I generally follow the standard English translations of Kant's works, but have occasionally modified them where appropriate. For references to the first *Critique*, I follow the common practice of giving page numbers from the A (1781) and B (1787) German editions only. Because the Akademie edition contains only the B edition of the first *Critique*, I have also consulted the following German composite edition: *Kritik der reinen Vernunft*, ed. W. Weischedel, Immanuel Kant Werkausgabe III (Frankfurt: Suhrkamp, 1968). Here is a list of the relevant abbreviations and English translations, along with the dates of their original 18th century German publication followed by their Akademie volume numbers and page ranges:

– *CPJ* for *Critique of the Power of Judgment*, trans. P. Guyer and E. Matthews. Cambridge, Cambridge Univ. Press, 2000. [1790, Ak 5: 165–485];

It took natural science much longer [than mathematics] to find the highway of science; for it is only about one and a half centuries since the suggestion of the ingenious Francis Bacon partly occasioned this discovery and partly further stimulated it, since one was already on its tracks—which discovery, therefore, can just as much be explained by a sudden revolution in the way of thinking. Here I will consider natural science only insofar as it is grounded on empirical principles. When Galileo rolled balls of a weight chosen by himself down an inclined plane, or when Torricelli made the air bear a weight that he had previously thought to be equal to that of a known column of water, or when in a later time Stahl changed metals into calx and then changed the latter back into metal by first removing something and then putting it back again,* a light dawned on all those who study nature. They comprehended that reason has insight only into what it itself produces according to its own design; that it must take the lead with principles for its judgments according to constant laws and compel nature to answer its questions, rather than letting nature guide its movements by keeping reason, as it were, in leading-strings; for otherwise accidental observations, made according to no previously designed plan, can never connect up into a necessary law, which is yet reason what reason seeks and requires. Reason, in order to be taught nature, must approach nature with its principles in one hand, according to which alone alone the agreement among appearances can count as laws, and, in the other hand, the experiments thought out in accordance these principles—yet in order to be instructed by nature not like a pupil, who has recited to him whatever the teacher wants to say, but like an appointed judge who compels witnesses to answer the questions he puts to them. Thus even physics owes the advantageous revolution in its way of thinking to the inspiration that what reason would not be able to of itself and has to learn from nature, it has to seek in the latter (though not merely ascribe to it) in accordance with what reason itself puts into nature. This is how natural science was first brought to the secure course of a science after groping about for so many centuries. *Here I am following exactly the thread of the history of the experimental method, whose first beginnings are not precisely known. (*CPR* Bxii-xiv and n.)

According to Kant, then, natural science or physics, like mathematics, entered the “highway of science” (*Heeresweg der Wissenschaft*), by virtue of a “sudden revolution in the way of thought” (*CPR* Bxii). This thought–revolution, again like mathematics, consisted in shifting from the idea that our rational human a priori knowledge of necessary or essential properties of objects is derived by induction from individual or collective samples, to the idea that a priori knowledge is generated by *self-knowledge*

- *CPJFI* for *First Introduction to the Critique of Judgment*, trans. P. Guyer and E. Matthews, in *Critique of the Power of Judgment*, pp. 1–51. [1789, Ak 20: 20: 192–251].
- *CPR* for *Critique of Pure Reason*. trans. P. Guyer and A. Wood. Cambridge, Cambridge Univ. Press, 1997. [1781, 1787, Ak 3, 4: 1–252].
- *MFNS* for *Metaphysical Foundations of Natural Science*, trans. M. Friedman. Cambridge, Cambridge University Press, 2004. [1786, Ak 4: 465–565].
- *Prol* for *Prolegomena to Any Future Metaphysics*, trans. G. Hatfield. Cambridge, Cambridge University Press, 2004. [1783, Ak 4: 253–383].
- *TPP* for “Toward Perpetual Peace”, trans. M. Gregor. in Imm. Kant, *Immanuel Kant: Practical Philosophy*. Cambridge, Cambridge University Press, 1996, pp. 317–351. [1795, Ak 8: 341–386].

of the spontaneous cognitive activity of human theoretical reason in non-empirically introducing formal features into its mental representations of objects.

This is an absolutely fundamental epistemic point that needs to be re-emphasized, because it attaches to *all* kinds of a priori knowledge, whether in logic, mathematics, natural science or physics, or metaphysics:

[R]eason has insight (*Einsicht*) only into what it itself produces (*hervorbringt*) according to its own design (*Entwürfe*). (*CPR* Bxiii)

Crucially, rational insight has its own characteristic *cognitive phenomenology*⁵: that is, rational insight has its own consciously-experienced *specific character*. So a priori knowledge for Kant is how human reason consciously experiences and self-consciously recognizes the results of its own cognitive activity in the structured non-empirical products of that very activity, in such a way that the apparent, phenomenal, or manifestly real natural world also necessarily conforms to those very non-empirical structures. That, in turn, is the essence of Kant's and contemporary Kantian *transcendental idealism*⁶.

Insofar as this relationship obtains, then not only are the necessity and non-empirical character of human rationality exported from the cognizing subject to the form of the manifestly real natural world, but also the *purposiveness* and *categorical normativity* of human rationality are correspondingly exported from the cognizing subject to the form of the manifestly real natural world. Via this subject-to-world exporting, the manifestly real natural world is thereby also constituted as *a meaningful world* in all the relevant senses of that phrase. By that I mean that the manifestly real natural world, for Kant and contemporary Kantians, is an “enchanted” world shot through with logical form, mathematical structure, informative modes-of-presentation, truth-value, logical consequence, synthetic a priori consequence, counterfactuals and other subjunctive conditionals, especially those relating to: (i) choice and free will (for example, “If Lincoln had not finally resolved to end American slavery by means of The Emancipation Proclamation, then he would not have been assassinated by Wilkes Booth”), (ii) law-governed natural causal necessitation, (iii) organismic life, (iv) purposiveness of all kinds, (v) aesthetic value, and (v) moral value. Hence the manifestly real natural world, for Kant and contemporary Kantians, is *a fully human-mind-apt and human-rationality-apt world*, for better or worse, and and NOT a “*fundamentally physical*” and *naturally mechanistic world* that inherently excludes life, consciousness, beauty/sublimity, freedom, and non-instrumental value⁷.

⁵ See R. Hanna, *Kant, Science, and Human Nature*, ch. 7, and also R. Hanna, *Cognition, Content, and the A Priori: A Study in the Philosophy of Mind and Knowledge. The Rational Human Condition*, Vol. 5, Oxford, Oxford University Press, 2015, chs. 6–8.

⁶ See R. Hanna, *Kant and the Foundations of Analytic Philosophy*, Oxford: Clarendon, Oxford University Press, esp. ch. 2; R. Hanna, *Kant, Science, and Human Nature*; R. Hanna, *Cognition, Content, and the A Priori: A Study in the Philosophy of Mind and Knowledge*, esp. section 7.3; R. Hanna, “Directions in Space, Non-Conceptual Form, and the Foundations of Transcendental Idealism”, in D. Schulting (ed.), *Kantian Nonconceptualism*, London, Palgrave-Macmillan. pp. 99–115.

⁷ See R. Hanna, “Kant's Anti-Mechanism and Kantian Anti-Mechanism”, in *Studies in History and Philosophy of Biological and Biomedical Science* 45, 2014, and R. Hanna, *The Philosophy of the Future*:

Of course, the necessary-conformity component is precisely what mediates this exporting, and is also precisely what smoothly carries over our cognitive phenomenology and self-knowledge into our non-empirical knowledge of the manifestly real natural world. The built-in limitation of human cognition to manifestly real natural objects alone, together with the necessary conformity component, jointly constitute transcendental idealism. So this Kantian theory of a priori knowledge works *if and only if* transcendental idealism is true.

But a second crucial feature of Kant's theory of natural science or physics is not so very clear and distinct, and needs to be teased out. Kant says explicitly that "here I will consider natural science only insofar as it is grounded on **empirical** principles" (*CPR* Bxii, boldfacing in the original). This is *prima facie* puzzling, for two reasons.

First, by his own explicit admission, Kant is attempting to show how logic, mathematics, and natural science or physics are all authentic a priori sciences, in order to compare and contrast them with metaphysics. But how could this be consistent with focusing on how natural science or physics is grounded on *empirical* – and thereby *a posteriori* – factors?

Second, the very notion of a "principle" (*Grundsatz, Prinzip*) for Kant carries the *prima facie* sense of apriority (hence also the *prima facie* senses of necessity, non-sensory character, purposiveness, and categorical normativity). But how could there then be anything like an *empirical* principle? The very phrase "empirical principles" (*empirische Prinzipien*) seems to be an oxymoron.

Sorting out and then explaining these two *prima facie* puzzling features will take us to the very heart of Kant's theory of natural science or physics. More precisely, we need to understand the texts surrounding the crucial "reason has insight..." text at Bxiii. Here is Kant's basic line of argument, as I understand it.

Manifestly real material or physical nature is rationally comprehensible via natural scientific investigation, and thereby knowable a posteriori, only to the extent that it is governed according to principles or laws that have the epistemic, modal, non-sensory, purposive, and normative properties of necessary a priori truths, but are nevertheless also *empirical*, in that these principles and laws bind together apparent, phenomenal, or manifest material or physical objects and states-of-affairs that are themselves actual-world bound, and contingent. Indeed, it's precisely the principle-governedness or causal-law-governedness of manifestly real actual-world bound, contingent material or physical nature that makes it *objective*, and therefore a proper subject for the authentic objectual a priori science of physics. So, odd as it might at first seem, even an *empirical* science like physics is an authentic science only and precisely to the extent that it has a *non-empirical* foundation that of course includes both logic and mathematics, but also extends *beyond* the purely logico-mathematical part of its foundation into the necessary and objectual a priori law-governed *causal* connections between actual-world bound, contingent mani-

festly real material things and states-of-affairs. Otherwise put, according to Kant, natural science/physics is on the secure path of science only and precisely to the extent that it tracks the penetration of the necessary, non-sensory, purposive, and categorically normative structures of human rationality into the actual-world bound, contingent manifestly real material or physical world, *all the way down*. Kantian naturalism is therefore a *liberal naturalism* in these three senses: (i) nothing in the manifestly real world exists outside of space and time, (ii) everything in the manifestly real world has efficacious causal powers in spacetime, and (iii) mental properties are as essential to the basic architecture of manifestly real nature as physical properties are.

Now, the causal natures of these manifestly real material or physical objects and states-of-affairs are knowable a posteriori in all their specificity by means of experimental investigations that involve not only Baconian (that is, simple colligative, descriptive, and generalizing) induction, but also another method only partially anticipated by Bacon, namely, what I call *Kantian abduction*, aka *Kantian inference-to-the-best-explanation*. What Kant calls *reflecting judgment* in the third *Critique*, what Charles Sanders Peirce later calls *abduction*, and what is nowadays also called “inference to the best explanation,” all describe a non-monotonic⁸ inference from given particulars to a newly-created general conception or theory that adequately comprehends those particulars⁹. The theory of Kantian abduction was worked out both the Critical period and also the post-Critical period, via Kant’s scattered and all-too-brief remarks on “the method of those who study nature” (*CPR* Bxviii-Bxix n.), “the empirical affinity of the manifold” (*CPR* A113-114), “empirical laws” or “particular laws” (*CPR* A127-128 and B163-165) (*Prolegomena* 4: 318-322), and also under the rubrics of what he calls the “regulative use of the ideas of pure reason”, the “hypothetical use of reason” and above all, “reflecting judgment” (*CPR* A642-668/B670-696) (*CPJFI* 20: 211-217, *CPJ* 5: 179-181).

Kantian abduction, as exemplified by Galileo, Torricelli, and Stahl – Kant’s own cases-in-point – is not itself *merely* an empirical or a posteriori method, but in fact systematically closes the epistemic and semantic gap between empirical/a posteriori generalizations and non-empirical/a priori principles and causal natural laws. It *doesn’t* do so, however, by what classical Logical Empiricist philosophy of science calls *the hypothetico-deductive method*, according to which general propositions about the material or physical world, originally derived by induction, are laid down, more or less arbitrarily, like extra axioms added to first-order classical logic, and then particular propositions about empirical consequences deduced from these axioms, which in turn are tested by observations. For such a procedure would be unable to distinguish between, on the one hand, inductive hypotheses that are *noumenal*, and therefore humanly unknowable and anthropo-

⁸ An argument or inference is *monotonic* if and only if adding new premises to the original set of premises of that argument or inference does *not* change the set of logical consequences of those premises; and an argument or inference is *non-monotonic* if and only if adding new premises to the original set of premises of that argument or inference *does* change the set of logical consequences of those premises.

⁹ See Peter Lipton, *Inference to the Best Explanation*. London, Routledge, 1991, and I. Douven, “Abduction”, in E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*, Summer Edition, available online at URL = <<https://plato.stanford.edu/archives/sum2017/entries/abduction/>>.

centrically meaningless, and, on the other hand, humanly knowable *empirically meaningful* hypotheses that are specifically grounded on the objectively valid and objectively real transcendental idealism-based real metaphysics of rational human experience. By sharp contrast to the hypothetico-deductive method, Kantian abduction doesn't operate by induction + analytic stipulation + deduction + observation, but instead it operates by *synthetic a priori "counterfactual" or subjunctive conditional reasoning*.

More precisely, according to the contemporary Kantian modal semantics of subjunctive conditionals that I am using, a Kantian abduction is a conditional proposition of this form,

$$\Gamma(X_1, X_2, X_3, \dots X_n) \rightarrow Y$$

which in English says:

Necessarily, if Γ , a set of propositions $X_1, X_2, X_3, \dots X_n$, jointly constituting a general conception or theory, *were to be true*, then Y , another proposition that describes an actual fact, *would also be true*.

This subjunctive conditional, in turn, is true if and only if

given the smallest restricted class of logically possible worlds, each member of which has the same basic transcendental structure as the manifestly real actual natural world, namely, *the class of experienceable worlds*, and is also consistent with the truth of all the propositions in Γ , then, in every member of this class of worlds, the truth of Γ synthetically necessitates the truth of Y .

Granting this truth-definition, then according to Kantian abduction, natural science advances inferentially

FROM

(i) the complete set of schematized synthetic a priori Principles of the Pure Understanding, which, in turn, collectively specify the basic transcendental structure of the apparent, phenomenal, or manifestly real actual natural world, and thereby determine the smallest restricted class of logically possible worlds—namely, *the class of experienceable worlds*, each member of which has the same basic transcendental structure as the manifestly real actual natural world, and is also consistent with the truth of some general empirical *natural causal law* proposition NCL,

TOGETHER WITH

(ii) NCL, which is partially derived by induction, but which also specifically reflects the creative and imaginative capacity for insight (aka the capacity for "genius") of the individual natural scientist who formulates NCL, in whom "[genius] gives the rule to **nature**" (*CPJ* 5: 308), and which is postulated as the hypothetical antecedent of a subjunctive conditional of the form

If, given the schematized Principles of Pure Understanding, NCL *were true* in the experienceable worlds $W_1, W_2, W_3, \dots W_n$,

TO

(iii) a synthetically a priori entailed factual proposition Y in all those experienceable worlds, as the consequent of that same subjunctive conditional, of the form

... then Y *would be* true in the experienceable worlds $W_1, W_2, W_3, \dots W_n$,

THEN

(iv) compares and contrasts that synthetic a priori subjunctive conditional implication Y with what is supplied by direct observational evidence in the manifestly real actual natural world,

AND THEN

(v) also compares and contrasts the physical explanation provided by the subjunctive conditional proposition $\Gamma[X_1, X_2, X_3, \dots NCL, \dots X_n] \rightarrow Y$ with all the other relevant possible sufficiently good physical explanations of the same actual apparent, phenomenal, or manifestly real natural facts, thus ruling out the worry that the explanation provided by $\Gamma[X_1, X_2, X_3, \dots NCL, \dots X_n] \rightarrow Y$ is only “the best of a bad lot,” and not the best *overall* explanation,

AND THEN FINALLY

(vi) asserts the general conception or theory Γ , constituted by the propositions $X_1, X_2, X_3, \dots X_n$, *including* the general empirical natural causal law proposition NCL , as the true synthetic a priori representation of how a given natural causal law governs dynamic interactions and processes in the manifestly real actual natural world,

by Kantian inference-to-the-best-explanation.

3. KANT'S NEO-ARISTOTELIAN NATURAL POWER GRID¹⁰

Kant and the Laws of Nature, edited and with an Introduction by Michela Massimi and Angela Breitenbach, is a recent collection of thirteen uniformly excellent essays on Kant's philosophical views on the nature and (metaphysical or epistemic) status of laws of nature, produced under the aegis of a three-year international research network running from 2012–2015¹¹. But as *contemporary Kantian philosophers of nature and science*, and not merely as *Kant-scholars*, why should we care about Kant's theory of the laws of nature? In my opinion, there are at least four good reasons.

¹⁰ An earlier version of this section appeared in the now-discontinued online journal *Critique* in 2018, under the title “Kant's Neo-Aristotelian Natural Power Grid: On *Kant and the Laws of Nature*”.

¹¹ M. Massimi and A. Breitenbach, (eds.) *Kant and the Laws of Nature*, Cambridge, Cambridge University Press, 2017.

First, from the standpoint of an alethic or truth-based contemporary Kantian philosophy of nature and science, natural laws reveal to us *the necessary theoretical rules and basic factual structures* of a causally efficacious, manifestly real physical world.

Second, from the standpoint of a *pro-scientific* yet also *anti-scientistic* contemporary Kantian philosophy of nature and science, natural laws fix the inherent metaphysical and epistemic *limits* of the natural sciences.

Third, from the standpoint of a contemporary Kantian philosophy of nature and science that operates *beyond* the limits of the natural sciences, natural laws also reveal, by negation and categorical contrast, *the necessary teleological or practical rules and basic normative structures* of a causally efficacious, manifestly real physical world that's fundamentally enchanted and transformed by organismic life and goal-directed natural processes, consciousness, feeling and desire, cognition, rationality, agency, freedom, personhood, and dignity.

And **fourth**, from the standpoint of a contemporary Kantian philosophy of nature and science that operates *within* the realm of that fundamental enchantment and transformation, it's further revealed to us that natural laws have their own special kind of *alethic or truth-based normativity, operating by means of a set of necessary, enabling constraints on animal life and agential activity*, an alethic normativity that's inherently constrained by, although not entailed by, the normative laws of pure logic.

What however, according to Kant himself, are laws of nature?

There are various classical, orthodox Kant-scholarly accounts all saying that for Kant, natural laws are fundamentally *epistemological* in nature. Generally characterized, according to these classical, orthodox, epistemologically-driven Kant-scholarly accounts, natural laws are synthetic *a priori* transcendental principles imposed on subjective appearances by our cognitive faculties, by means of the absolutely spontaneous power of *prescription* contained in the faculty of pure reason, together with the egocentric, synthesizing, and unifying power of pure or transcendental apperception, inherently under the Categories and also inherently guided by the rational Idea(s) of the systematic unity of nature. So, for these accounts, Kantian natural laws are nothing more and nothing less than subjectively-idealistic general laws of phenomena that are prescribed-a-priori-by-the-rational-transcendental-ego-precisely-in-order-to-be-known-in-phenomenal-nature-by-its-very-own-cognitive-faculties-operating-under-its-very-own-Categories-and-Ideas, as per the famous remark in the B Preface, that I've discussed in section II above, "reason has insight only into what it itself produces according to its own design" (*CPR* Bxiii), and as per the only slightly-less-famous remark in the *Prolegomena*, that "*the understanding does not draw its (a priori) laws from nature, but prescribes them to it*" (*Prolog* 4: 320, italics in the original).

In turn, however, there are at least five important problems for those classical, orthodox accounts.

First, exegetically speaking, a subjective-idealist reading of Kant's theory of natural laws cannot be smoothly combined with Kant's own empirical (or "manifest") realism, because in that case, the very idea of "empirical laws," discovered a posteriori via

empirical scientific investigation, then seems modally *self-contradictory*, since, other things being equal, “empirical” entails *contingency*, whereas “laws” entails *necessity*.

Second, in a closely-related way, assuming that empirical natural laws *are* in some sense genuinely universal and necessary, then how can Kant *explain* their universality and necessity? On the subjective-idealist reading, the way in which particular empirical laws *inherit* their restricted kind of universality-and-necessity from strictly universal and unconditionally necessary a priori laws seems metaphysically mysterious.

Third, extra-exegetically speaking, any form of subjective idealism applied to natural laws seems philosophically implausible, since it entails that, *necessarily, if all actual minds go out of existence, then the nomologically-governed natural world goes out of existence too*.

Fourth, epistemically-speaking, as Kant himself noted in the First Introduction to the third *Critique*, a subjective-idealist approach to natural laws is *prima facie* consistent with a *global skepticism* not only about our ability to know particular, specific natural laws by means of judgment and concepts, but also, as a consequence, about the very existence of such particular, specific natural laws.

And **fifth** and finally, metaphysically speaking, even allowing for the radical philosophical *Gestalt*-shift implied by Kant’s Copernican Revolution in metaphysics, the subjective-idealist approach to Kant’s theory of natural laws overlooks various essentialist, organicist or processual, non-reductively naturalistic, *broadly Aristotelian* elements in Kant’s and/or Kantian metaphysics.

Correspondingly, in view of these five important problems, it seems to me that a new, exciting, and philosophically important post-classical and post-orthodox contemporary Kantian *metaphysical* and *non-epistemic* conception of the laws of nature has begun to emerge, and also that it’s nicely supported by the several essays in *Kant and the Laws of Nature*. Bounded in a nutshell, this nomological conception is all about how, according to Kant, natural laws are nothing more and nothing less than essential immanent structures (as per classical Aristotelian essentialism and hylomorphism) of a totality of manifestly real causal-dynamic processes that, in turn, are individuated as objects of experience by virtue of a multitude of many-termed temporally asymmetric (cause→effect, as per the Second Analogy of Experience) or simultaneous (causal reciprocity, as per the Third Analogy of experience) efficacious natural relations in space and time, specified as sets of active causal powers (to bring about effects or trigger causal reciprocity networks) and receptive causal powers (to be brought about as effects or to be triggered as causal reciprocity networks). Natural laws in this sense are ontologically defined and modally-constituted solely by their positions in the manifestly real, systematically unified, total natural power grid consisting of all these essential immanent structures, real causal-dynamic processes, objects of experience, and causal-power-relations, namely, “Nature in general” (*CPJ* 5: 183), so they are not independently given apart from the whole – and holistic – grid. And in turn, the whole and holistic natural power grid is non-reductively mind-dependent on the innately-specified non-empirical capacities of the human mind, and, in a necessarily complementary way, also non-reductively world-dependent on the

specific essential constitution of physical matter – whether it be (i) inert, mechanical, purposeless matter, or (ii) living, organismic, purposive material processes—as an independently-given fact. Just to give this new, exciting, and philosophically important post-classical and post-orthodox contemporary Kantian conception of the laws of nature the sort of jazzy name you could put on a T-shirt or use as a bumper-sticker slogan, thereby at once impressing your philosophical friends and confounding your philosophical enemies, I’ll call it *Kant’s Neo-Aristotelian Natural Power Grid*¹².

But there is much, much more to Kant’s Neo-Aristotelian Natural Power Grid than even that. Indeed, the fully-elaborated version of it can be formulated as a set of no less than fourteen theses, the first three of which I’ve already mentioned, but will include again for the sake of clarity, distinctness, and completeness, as follows.

KANT’S NEO-ARISTOTELIAN NATURAL POWER GRID

(Thesis 1) Natural laws are nothing more and nothing less than essential immanent structures of a totality of manifestly real causal-dynamic processes that, in turn, are individuated as objects of experience by virtue of a multitude of many-termed temporally asymmetric (cause→effect, as per the Second Analogy of Experience) or simultaneous (causal reciprocity, as per the Third Analogy of experience) efficacious natural relations in space and time, specified as sets of active powers (to bring about effects or trigger causal reciprocity networks) and receptive powers (to be brought about as effects or be triggered as causal reciprocity networks).

(Thesis 2) Natural laws in this sense are ontologically defined and modally constituted solely by their positions in the manifestly real, systematically unified, total natural power grid consisting of all these immanent essential structures, real causal-dynamic processes, objects of experience, and causal-power-relations, namely Nature in general, so they aren’t independently given apart from the whole – and holistic – grid.

(Thesis 3) The whole and holistic natural power grid is non-reductively mind-dependent on the innately-specified non-empirical capacities of the human mind, and, in a necessarily complementary way, also non-reductively world-dependent on the specific essential constitution of physical matter – whether it be (i) inert, mechanical, purposeless matter, or (ii) living, organismic, purposive matter – as an independently-given fact.

(Thesis 4) Laws of nature have weak or counterfactual transcendental ideality, in that they necessarily conform to the innately-specified, non-empirical structures of our basic cognitive capacities or powers, and are thereby such that, necessarily, if the natural laws exist, then if rational human animals were to exist, they would be able to know those laws objectively via the world-enabled operations of their cognitive capacities, at least to some significant extent; and not only are those laws *not* imposed by the operations of those cognitive capacities, but also those laws *did* exist, do exist, and will continue to exist in the manifestly real natural world of objects of experience, even if no

¹² See also R. Hanna, *Kant, Science, and Human Nature*, esp. part 1 and ch. 8.

rational human animals ever actually existed, do exist, or will exist, provided that, necessarily, at any time, it's really possible for that specific kind of animals to exist.

(Thesis 5) Moreover, laws of nature in this sense correspond, one-to-one, to sets of synthetic a priori truths, which, in turn, are progressively narrowed in their modal scope by increasingly strong (that is, richly specific) existential assumptions about the specific essential constitution of physical matter – whether it be (i) inert, mechanical matter or (ii) living, organismic matter – as an independently-given fact, and thereby, insofar as they apply to the manifestly real world of causal-dynamic processes and objects of experience, give rise to distinctively different grades and types of natural universality-and-necessity.

(Thesis 6) In direct proportion as laws of nature correspond to increasingly strong material existential assumptions about the specific essential constitution of physical matter – whether it be (i) inert, mechanical, purposeless, matter, or (ii) living, organismic, purposive matter – as an independently-given fact, and incorporate distinctively different grades of natural universality-and-necessity, then the more empirically-grounded they are, and the more correctly they are to be called specifically *empirical* laws of nature, even though they remain irreducibly universal, necessary, and a priori, although in a specially restricted way.

(Thesis 7) Manifestly real physical matter is essentially constituted by attractive and repulsive dynamic forces, hence manifestly real physical matter is essentially processual and active, hence phenomenally substantial, mechanical, and static only in an ontologically derivative, relative, and strongly supervenient sense¹³ under the First Analogy of Experience, and not noumenally substantial and static in the absolute Cartesian or Leibnizian senses.

(Thesis 8) Furthermore, there's a fundamental difference between (i) laws of nature that are grounded on the strong material existential assumption that the attractive and repulsive forces constitute processual matter as passive and inert, mechanical, and inherently Turing-computable¹⁴ as regards its quantitative properties, and are, thereby, deterministic – or for that matter, indeterministic and probabilistic/statistical/stochastic, although Kant himself wouldn't have been in a good historical-theoretical position to recognize that, since the very idea of indeterminism and probabilistic/statistical/stochastic laws was a 19th century discovery or invention¹⁵ – mechanistic, non-teleological laws of physical nature, aka *laws of mechanistic physics*, and (ii) laws of nature that are grounded on the strong material existential assumption that the attractive and repulsive forces constitute processual matter as spontaneous, purposive, and self-organizing, inherently uncomputable as regards their quantitative properties, and purposive, hence

¹³ See R. Hanna, *The Philosophy of the Future: Uniscience and the Modern World*, section 2.4, ch. 4, and “Appendices” 1–5.

¹⁴ Alan Turing, “On Computable Numbers, with an Application to the Entscheidungsproblem”, in *Proceedings of the London Mathematical Society*, vol. 42, 1936/1937, pp. 230–265, with corrections in vol. 43, pp. 644–546.

¹⁵ Ian Hacking, *The Taming of Chance*, Cambridge, Cambridge University Press, 1990.

not passive and inert, and inherently non-mechanical, and are, thereby, non-deterministic (and for that matter, inherently non-indeterministic and non-probabilistic/statistical/stochastic), organismic, teleological laws of nature, aka *laws of biology*.

(Thesis 9) Spontaneous and vital, self-organizing, purposive, processual matter is every bit as manifestly real as passive and inert, mechanical, computable, non-purposive, processual matter, hence the manifestly real, systematically unified, total natural power grid, aka Nature in general, *globally* contains *both* kinds of causal processes, even despite their being *locally incompatible* – for example, in non-animal organisms, in minded animals, and at the source of rational human agency.

(Thesis 10) Rational human animals, like all minded animals, are made out of manifestly real spontaneous, purposive, self-organizing, organismic processual matter, and immanently governed by its biological laws of self-organization, hence their agency is locally incompatible with the causal processes of passive and inert, mechanical, computable, non-purposive, non-processual matter.

(Thesis 11) Therefore, as transcendently free, practically free, autonomous, self-determining animals, rational human animals are immanently self-governed by moral laws that are themselves *also* a special kind of biological laws.

(Thesis 12) Natural laws are in-principle knowable (even if not actually known) by us, by means of transcendental counterfactual arguments that employ abductive reasoning, aka inference-to-the-best-explanation, aka reflective judgment, as per section II above.

(Thesis 13) Such reasoning is inherently guided by the rational Idea(s) of a systematic unity of nature.

(Thesis 14) And this reasoning, in turn, transcendently presupposes both the subjective and also objective purposiveness of manifestly real nature for our cognitive faculties, in order to ward off the global skeptical possibility that nature might have presented an anarchic, chaotic mass of particular appearances to our faculties, thereby making it in-principle impossible to apply empirical judgments to nature.

The thirteen essays in *Kant and the Laws of Nature* are helpfully organized by the editors into five groups of two or three, under the following general headings, the names of their authors, and the titles of their essays:

Part I. THE LAWFULNESS OF NATURE

1. Eric Watkins, “Kant on the Unity and Diversity of Laws”
2. Karl Ameriks, “On Universality, Necessity, and Law in General in Kant”
3. Paul Guyer, “Imperfect Knowledge of Nature: Kant, Hume, and Laws of Nature”

Part II. THE SYSTEMATICITY OF NATURE

4. Hannah Ginsborg, “Why Must We Presuppose the Systematicity of Nature?”
5. Rachel Zuckert, “Empirical Scientific Investigation and the Ideas of Reason”
6. Thomas Teufel, “Kant’s Transcendental Principle of Purposiveness and the ‘Maxim of the Lawfulness of Empirical Laws’”

Part III. NOMIC NECESSITY AND THE METAPHYSICS OF NATURE

7. James Messina, “Kant’s Necessitation Account of Laws and the Nature of Natures”
8. Michela Massimi, “Grounds, Modality, and Nomic Necessity in the Critical Kant”
9. Daniel Warren, “Kant on Mathematical Force Laws”

Part IV. LAWS IN PHYSICS

10. Michael Friedman, “Kant’s Conception of Causal Necessity and Its Legacy”
11. Marius Stan, “Metaphysical Foundations of Neoclassical Mechanics”

Part V. LAWS IN BIOLOGY

12. Angela Breitenbach, “Laws in Biology and the Unity of Nature”
13. Catherine Wilson, “The Building Forces of Nature and Kant’s Teleology of the Living”

In the rest of this section, I’ll refer to any of the essays in the collection by using the relevant author’s last name and page numbers only.

To be sure, the several essays in *Kant and the Laws of Nature* do philosophically differ from one another somewhat, sometimes even to the point of substantive disagreement or local incompatibility; and, correspondingly, they also each contribute to Kant’s Neo-Aristotelian Natural Grid in somewhat differing or sometimes even locally incompatible ways. Still, the essential thing for my constructive philosophical purposes in this essay, is my overarching thesis that the several essays in the volume, taken all-in-all, do indeed philosophically interact in complex, original, and productive ways so as to yield one and the same philosophically important global doctrine, namely, Kant’s Neo-Aristotelian Natural Power Grid.

As we’ve seen above, **Thesis 1** says that natural laws are neither directly derived from, nor instantiations of, a priori principles about causality, and in particular from the Second Analogy of Experience. Instead, they have a weakly mind-independent grounding in the manifestly real world, and express causal powers that are globally determined and individuated, and also modally-constituted, as **Thesis 2** specifies, by an equally weakly mind-independent, but also formal and unified, global *structuralist* network or system of universal-and-necessary causal relations. We can find significant support for both of these theses in Messina’s and Massimi’s essays, each of which defends a slightly different version of what Messina calls “the Necessitation Account” (p. 132, following James Kreines’s terminology), according to which, for Kant, particular natural laws, aka “empirical laws”, are grounded in relatively mind-independent *real essences or natures*:

[The Necessitation Account’s] core metaphysical thesis is that Kant conceives of particular laws in terms of particular empirical natures, the positing of which necessitates certain regular behaviors.... [T]ranscendental laws of nature ... are similarly associated with natures. In the case of transcendental laws, the nature in question is Nature in general, which might be thought of as a completely general

nature common to and contained in all particular empirical natures. The positing of this nature brings with it the transcendental laws and indeterminate causal power associated with it. In this respect, Kant has a uniform metaphysics of nature.... Kant holds that natures cannot exist apart from their associated laws, and those laws cannot exist apart from (must be realized within) their associated natures. This is the sense in which laws are inherent in natures and Kant's model of laws is bottom-up.... Laws do not reduce to the causal powers that define a given nature [or essence] but are a separate aspect of that nature, albeit one no more detachable from the nature than the causal power is. The law of a given nature ... acquires its content from the a priori grounds of the possibility of that nature. (pp. 147–148)

Given this grounding, the Necessitation Account is a “bottom-up” account, as opposed to a priori entailment/instantiation accounts like Friedman's, which are “top-down”. As Massimi points out (pp. 157–160), in his *Metaphysics* lectures from the early 1790s, Kant carefully distinguishes between “essences” which are either (i) *logical* essences (of concepts) or (ii) metaphysical, *real* essences (of things, and (iii) “natures”, which presuppose metaphysical, real essences, yet are also spatiotemporally embedded and thus *causal*; but for my purposes here I won't heed that special refinement. In any case, both Messina and Massimi construe Kant's account as versions of *dispositional* essentialism, which locates the determining and individuating features of nomological causal powers *internally to things*. But as Messina rightly points out (pp. 133 and 144–146), following Stephen Mumford, this yields a worry, especially for reductive versions of dispositional essentialism like Brian Ellis's, about the ontological status of natural laws over and above the dispositions of things. The worry is that, given a reductive dispositional grounding, arguably, it follows that laws are ontologically *superfluous*. Messina's promising solution to this nomological-ontological-superfluity problem is to appeal to Kant's notion of “Nature in general” as a global system of causal natural laws grounded in a global system of manifestly real natures; and this is further strengthened by Guyer's important observation that the transcendental principle of the systematic unity of nature guarantees that “[a particular natural law's] position in a system is what makes any particular law of nature necessarily true” (p. 61).

So in view of the nomological-ontological-superfluity problem and Guyer's observation, I think that Messina's and Massimi's arguments for a Kantian *dispositional* essentialism about natural laws are in fact better accommodated by a Kantian *structural* essentialism about natural laws, according to which the manifestly real natures and causal laws are all metaphysically *constituted* by their positions or roles in the global system. This in turn makes possible an elegant explanation of the various distinct kinds of universality-and-necessity of all laws for Kant – nicely sorted and catalogued by Ameriks (p. 37), obviously including natural laws, but also logical laws, synthetic a priori metaphysical principles, moral principles, and even political principles – in terms of *structure-based relationships of various kinds*. This in turn entails that the explanation of the universality-and-necessity of laws is *not* to be framed in terms of what Watkins calls the “no law without a lawmaker” slogan, according to which “Kant requires that a law be established by a spontaneous act” (p. 16). On the contrary, although it's true that there are *no*

laws without the necessary and real possibility of minds like ours, endowed and pre-equipped with the unified system of innately-specified cognitive and practical capacities that jointly constitute our minds – which in turn, when appropriately primed and triggered, are indeed capable of carrying out various kinds of absolutely or relatively spontaneous acts – nevertheless, *most laws and most kinds of laws do not require occurrent lawmakers*, and therefore *most laws and most kinds of laws do not require spontaneous acts*. At the same time, as both Messina and Massimi rightly point out, an appropriately modified version of the a priori derivation/instantiation view, as represented by Friedman, is also available to the Neo-Aristotelian Natural Power-Grid conception, if we assume that every particular natural law, even though it is weakly mind-independently grounded in a global structuralist network of laws, *also necessarily conforms to the Second Analogy*, even though it is neither directly derived from it or entailed by it, nor merely an instance of it.

This point, in turn, provides a smooth segue to **Thesis 3** and **Thesis 4**, which together spell out the way in which natural laws are only *weakly* transcendently ideal, not *strongly* transcendently ideal. In view of the structural essentialist version of the Necessitation Account that I've just sketched, with the help of Messina's, Massimi's, and Guyer's essays, then it follows that, just as, on the worldly side, natural laws are partially grounded in a universal network of manifestly real essences or natures with relational causal powers, so too they are *also* partially grounded, by virtue of a priori principles flowing from the Categories, in the necessary real possibility of minds like ours, endowed and pre-equipped with the unified system of innately-specified cognitive and practical capacities that jointly constitute our minds.

Thesis 5 and **Thesis 6** address the **first** and **second** problems noted above for the classical, orthodox, accounts of Kant's theory of natural laws, about the very idea of an "empirical law", and how its necessity can be explained. As Ginsborg, Zuckert, and Teufel all recognize, the solution to these problems is intimately bound up with the nature and status of Kant's a priori principles of the systematicity of nature and its *as-if* purposiveness for our cognitive faculties, which are also directly addressed in **Thesis 12**, **Thesis 13**, and **Thesis 14**. In my opinion, everything here turns on how we think about natural laws in relation to Kant's *theory of judgment*, whether analytic or synthetic judgments, and whether synthetic a priori or synthetic a posteriori judgments¹⁶. Correspondingly, a sharp distinction is needed between (i) *the logico-semantic and metaphysical dimension* of judgments, on the one hand (i.e., their truth, consequence or validity, meaning, and modality), and (ii) *the cognitive-semantic and epistemic dimension* of judgments, on the other (their intentionality, cognitive phenomenology, and justification or warrant). Natural laws correspond to synthetic a priori judgments, all of which are necessary and strictly underdetermined by contingent facts and sensory experiences, which is the same as their apriority or "experience-independence". In my opinion, the correct account of the modal semantics of synthetic a priori judgments specifies their truth-conditions in terms of increasingly restricted classes (or "spaces")

¹⁶ See R. Hanna, "Kant's Theory of Judgment", 2017.

of possible worlds¹⁷. And the corresponding restrictions on classes or spaces of worlds for the purposes of the semantics of the “material necessity” of synthetic a priori judgments about natural laws, as spelled out in the Postulates of Empirical Thought, are various more-or-less richly specific (aka strong) existential assumptions about the specific character of matter and its causal powers: let’s call these *material existential assumptions*. For example, as Stan correctly and ingeniously points out, if we formulate our material existential assumptions carefully enough, and “ascribe... to Kant mass-points as the best ontological explanation of all determinate phenomena of motion in a Galilean regime”, then there’s a promising case that Kant’s “‘special metaphysics of material nature’ remains viable and relevant” for the “vast swath of determinate experience [that] still unfolds at speeds and scales for which classical [physical] theory remains indispensable” (p. 233), namely, “the ‘classical belt’ of the world, where masses and speeds are slow enough that relativistic theory is not needed” (p. 214). Synthetic a priori judgments about natural laws are then necessary, precisely because they *hold for all and only the possible worlds in the relevant class or space of worlds corresponding to the relevant material existential assumptions of varying degrees of strength*. Hence no matter how *strong* the material existential assumptions are, and therefore no matter how *small* the corresponding class or space of worlds is, then the modal character of the judgments is exactly the same, i.e., they’re all genuinely *necessary*. Moreover, all necessary truths, no matter how small their modal scope, are a priori precisely because their meaning and truth are strictly underdetermined by all actual and possible contingent facts and sensory experiences.

In this way, the problem about the prima facie contingency of so-called “empirical laws” disappears. What makes them “empirical” laws is just *their dependency on material existential assumptions*, and *not* their dependency on contingent facts or sensory experiences. Indeed, Kant should have called them *material laws*, not *empirical laws*, and then the confusion about the nature and status of these natural laws would have been avoided. This recognition, in turn, adequately captures Warren’s otherwise very well-argued points about Kant’s theory of attractive and repulsive forces in *Metaphysical Foundations of Natural Science (MFNS)* simply by substituting the term “material existential assumptions” for the terms “experience” and “data of experience” in the following quotation:

The argument of the Dynamics chapter is that if matter is endowed with repulsive force, then it must also be endowed with an attractive force. And this attractive force must act immediately at a distance, and on all bodies, no matter how distant. The reality of the repulsive can be given only through [material existential assumptions]. But once that is given, the reality of this attractive force is guaranteed as well. What I am suggesting here is that in the case of attractive force, unlike repulsive force, there is a further role for [material existential assumptions] in establishing the specific mathematical form (the inverse-square character) of the relevant force law. (pp. 191–192)

¹⁷ R. Hanna, *Kant and the Foundations of Analytic Philosophy*, 2001, ch. 5.

Now what about the transcendental principles of the systematicity of nature and its as-if purposiveness for our cognitive faculties? Here, the issue is how correctly to construe the *cognitive semantics* and *epistemology* of empirical conceptualization and empirical or synthetic a posteriori “judgments of experience”¹⁸ about nature, including empirical generalizations following from inductive inferences, and general hypotheses following from abductive inference-to-the-best-explanation. Ginsborg, Zuckert, and Teufel are undoubtedly correct that the transcendental principles of the systematicity of nature and of its as-if purposiveness for our cognitive faculties are *regulative*, not *constitutive*, and thereby function as necessary epistemic presuppositions for the purposes of guiding empirical scientific investigation and theorizing, and also warding off global epistemic skepticism both about knowing particular natural laws and also about the existence of particular natural laws. But it also seems to me that there’s something deeper going on here, not at the level of *concepts* and *determining judgments*, but instead at the level of essentially non-conceptual *intuitions* about systematic unity and essentially non-conceptual *feelings* about the beautiful in nature, especially as these have a bearing on reflective judgments. What I mean is that it’s perfectly consistent to hold that a transcendental principle can at once have a *regulative use for concepts and judgments*, and also a *constitutive use for essentially non-conceptual intuitions and feelings*.

This point plays out in two especially important ways.

The **first** way is that empirical conceptualization and empirical or synthetic a posteriori “judgments of experience” about nature, including empirical generalizations following from inductive inferences, and general hypotheses following from abductive inference-to-the-best-explanation, receive a relatively *weak* epistemic justification or warrant via the regulative use of the transcendental principles of the systematicity of nature and its as-if purposiveness for our cognitive faculties, because regulative principles do not entail truth or existence. But at the same time, these principles can also be *epistemically super-charged* via the constitutive use of these transcendental principles in an essentially non-conceptual *cognitive faith* in systematicity and *feelings of anti-skeptical confidence*, both of which flow directly from the disinterested pleasure we experience in the harmonious free play of our cognitive faculties of imagination and understanding in representing beautiful forms in nature (*CPJFI* 20: 208–216). Here the principles are constitutive because the intuitions and feelings falling under them entail *the real or actual existence* of that which is intuited and felt.

And the **second** way is collectively captured by **Thesis 7**, **Thesis 8**, **Thesis 9**, **Thesis 10**, and **Thesis 11**, all of which bring out various aspects and implications of Kant’s anti-mechanism or organicism. As Breitenbach correctly points out, the standard reading of Kant’s views on teleological natural laws in biology says that such laws are strictly regulative, for the purposes of forming teleological concepts and teleological judgments with relatively weak epistemic justification or warrant, in order to supplement the constitutive natural-scientific enterprise of discovering deterministic, mechanistic laws of empirical nature. But she also argues that

¹⁸ See R. Hanna, “On Kant’s Term ‘Experience’”, 2021.

the teleological conception of the organism would guide the study of living beings even if we had a fully naturalistic organism concept. It carves out a part of nature as an object of study in its own right. It highlights a level of organization in the hierarchy of kinds on which to focus scientific investigations. (p. 254)

In other words, there's at least *theoretical space* in Kant's philosophy of nature for a constitutive reading of teleological natural laws in biology.

And here's how we can begin *to populate that theoretical space*, as per Kant's Neo-Aristotelian Natural Power Grid. If we sharply distinguish between teleological natural laws in biology as they're (i) used *regulatively* for empirical conceptualization and empirical judgments, and also (ii) used *constitutively* for essentially non-conceptual intuitions and feelings, then it is easy to see how Kant's anti-mechanism or organicism is not *merely epistemic*, but also *robustly metaphysical*, as Wilson correctly points out:

It is commonly held that Kant maintained a strict and productive distinction between a "constitutive" mechanical science based on the Newtonian forces of nature and a "regulative" teleological account.... [T]his is not quite right. Kant maintained a "constitutive" belief in active, organizing forces resident in matter throughout his career. (p. 257)

Where I would disagree slightly although also substantively with Wilson's otherwise well-supported account, is only with respect to her further claim that organisms and organismic processes can be real only *noumenally*, not *phenomenally* (p. 270). Yet this cannot be right, since Kant says explicitly (i) that we essentially non-conceptually intuit ourselves as living organisms, aka "natural purposes," via "the feeling of life" (*CPJ* 5: 204) and (ii) that "mind for itself is entirely life," hence we have a fully constitutive cognitive awareness of natural purposes or organisms *really or actually existing in the manifest or phenomenal physical world*, by subjectively experiencing our own living animal bodies from the inside:

[L]ife without the feeling of the corporeal organ is merely consciousness of one's existence, but not a feeling of well- or ill-being, i.e., the promotion or inhibition of the powers of life; because the mind for itself is entirely life (the principle of life), and hindrances or promotions must be sought outside it, though in the human being himself, hence in combination with his body. (*CPJ* 5: 278)

Kant famously and explicitly pointed out that there could never be "a Newton who could make comprehensible even the generation of a blade of grass according to natural laws that no intention has ordered" (*CPJ* 5: 400). But even more to the point, in view of Kant's anti-mechanism or organicism, there could never be a Newton *of Newton himself*, the rational human animal. And it's only one short step from that insight, via the constitutive use of teleological natural laws in biology for essentially non-conceptual intuitions and feelings, to a fully realistic non-reductive, anti-mechanistic approach to organismic biology, such as Francisco Varela's theory of *autopoiesis* (Varela, Maturana, and Uribe, 1974; Varela, 1979). Add to this the weak or counterfactual transcendental

idealist Kantian structural essentialism spelled out above in Theses 1, 2, 3, and the philosophical result is recorded in **Theses 7, 8, 9, 10, and 11**.

Kant's Neo-Aristotelian Natural Power Grid is not only an exciting, radically original, independently defensible, and arguably true *contemporary Kantian theory of causal natural laws*, but also it's well-supported and arguably true as an interpretation of *Kant's own theory of causal natural laws* by the thirteen excellent essays in *Kant and the Laws of Nature*, although each of them in somewhat different and sometimes locally incompatible ways.

4. CONCLUSION

In this essay, I've been arguing for the thesis I call *physics for humans*: for Kant and for contemporary Kantians, natural science or physics is not only an objectively true a priori science, but also an irreducibly human or moral science. In my opinion, for the reasons I've provided, the physics for humans thesis is true. If the physics for humans thesis is indeed true, then, riffing on Goldman's evocative "science wars" trope in a Kantian key, *we've successfully negotiated a philosophical treaty for perpetual peace in science* (cf. *TPP*).