Dear David Albert:

Time and Chance introduced me to the philosophical problems of thermodynamics, and I learned from your 1992 book how puzzling quantum mechanics can be. I write to you because I admire the clarity and seriousness of your discussions of how to solve them. You say in an interview by Robert Lawrence Kuhn that you hope that the problems of physics will be solved by finding a picture of the world that is as "concrete and mechanical" as possible. I believe that I have found a way to do that, and I am asking you to consider it. Though it is a radical solution, I believe that you will see its promise, and I will show how it solves three problems you discuss: the necessity of laws of physics. the probabilistic nature of quantum laws, and the arrow of time.

It is a radical solution in physics because it starts with an explanation of mathematical truth. Though as you say, Eugene Wigner was wildly off target in using consciousness to solve the measurement problem in quantum mechanics, he was not mistaken to wonder about the "unreasonable effectiveness" of mathematics in discovering laws of physics. Mathematics is usually assumed to be known independently of what perception finds in the world, and the belief that it known by a faculty of rational intuition is, I believe, what causes the problems of physics. So the first step in solving them is to explain the truth of mathematics by its correspondence to the natural world.

That is possible for naturalists because they believe that the natural world is made up of objects in space that exist independently of one another. Instead of assuming that the basic branch of science discovers mathematically formulated laws of nature, they can try basing science on the belief that the natural world is constituted by substances and infer the kinds of substances that constitute the natural world as the

best explanation of what is found in the world, starting with the "unreasonable effectiveness" of mathematics in discovering laws of physics. You should not object to this, since you say that you want to get along with as few abstract entities as possible.

By *substances*, I mean what the pre-Socratic philosophers agreed in the end about the nature of the first cause. They held that the natural world is constituted by self-subsistent entities with definite ways of existing in themselves as they endure through time, and they expected to explain everything in the world by showing how it is constituted by them. That would explain not only the kinds of *things*, but also their existence. Since *ontology* is the study of existence, it is fitting to call substances *ontological causes.* The pre-Socratics were ontological naturalists, and though they never agreed about the kinds of substances that constitute the world, contemporary ontological naturalists can agree because what they find in the natural world includes the mathematically formulated laws that physics has discovered over the past three centuries or so. They will infer that the kinds of substances constituting the natural world include space as well as matter because correspondence to them is the best ontological explanation of the truth of mathematics.

In a world constituted by substances, change is constituted by their interactions, so regularities about change can be explained by the powers that enable them to interact with one another. The kinds of regularities that can be generated by interactions of space and matter are constrained by their essential natures, and since every regularity that their interactions can generate is quantitative, that explains why mathematics corresponds to the world. Space has an intrinsic geometrical structure as it exists independently of matter, so it explains why Euclidean geometry corresponds to the natural world. Arithmetic can be explained by rules for

counting things with a distinct existence, including units of space and time, so if matter has an intrinsic quantity (measurable by units) as it exists independently of space, all the properties of what is found in the natural world would be quantitative. That is, bits of matter coinciding with parts of space would have definite quantities, and assuming that species of bits of matter are defined by the (spatio-temporal) geometrical structures of their correspondence with parts of space, all regularities about change generated by the interactions of space and matter would necessarily be quantitative.

If that is why mathematics is so "unreasonably effective" in discovering laws of nature, it is possible that space and matter have more specific powers that enable their interactions to generate the regularities described by laws of physics. Discovering those powers would not only confirm this ontological explanation of the truth of mathematics, but also solve the problems of modern physics. Since our ordinary way of understanding the natural world includes geometry and counting, there would be nothing puzzling about what corresponds to the laws of physics, and that would solve the problems of physics. And it would solve the three problems that you mentioned to Kuhn.

This would solve the problem about the *necessity of the laws of physics*. Their necessity would be explained by the reduction of physics to ontology because the ways that space and matter exist in themselves does not change as they endure through time, and the regularities generated by their interaction express their powers.

The ontological reduction of physics could trace the *probabilistic character of quantum laws* to regularities generated by interactions of space and matter to which physicists are blind. Though they can use mathematics as a language for describing regularities about change because

they are all quantitative, the way that physicists use mathematics could hide some regularities from physics. Space acts on matter by giving bits of matter spatial relations, and its role as the container of matter is represented by the use of coordinate systems to describe how they move and interact. But since space and matter *inter*-act, bits of matter can also act on space in ways that affect other ways that space acts on matter, and their omission could be what causes problems in modern physics. *Those* roles of space in helping matter generate regularities about change cannot be described by equations that use coordinate systems to describe how bits of matter move and interact. For example, some ways that space acts on bits of matter besides giving them spatial relations could be the long-suspected hidden variable that explains the probabilistic character of quantum laws as just an appearance. It could not, in principle, be described by a mathematically formulated law of physics.

This ontological reduction of physics would explain the *arrow of time* as the endurance of substances through time. Substances explain change because that is how they exist. Change is properties going out of existence or coming into existence, and if that is how substances exist at present, they constitute the passage of time. So, the past does not exist because it has already happened, and the future does not exist because it has yet to happen. The passage of time gives the temporal dimension a direction, so instead of explaining the arrow of time by the second law of thermodynamics, a science based on ontology would explain entropy increase by the collective effect of physical forces as time passes: causing particles to disperse in space and evening out the distribution of kinetic energy among them as much as possible.

More generally, I predict that the discovery that space is a substance that interacts with matter will solve all the problems modern physics, and I defend that prediction in some quantitative detail in the first volume of a trilogy called *Naturalistic Reason* that I am self-publishing as I send you this message. It describes interactions of space and matter, called *ontological mechanisms*, that generate all the regularities described by laws of physics. I leave some quantitative details to be filled in, and they may need to be corrected in minor ways. Besides reducing quantum laws to ontology, the first volume describes ontological mechanisms that generate the regularities described by Einstein's special and theories of relativity. They show how the use of transformation equations to describe the undetectability of absolute motion and gravitation indirectly, and omission of the role that space plays in generating those regularities is what causes the belief in spacetime and curved spacetime. Since space is a single substance that interacts with all the bits of matter in the universe at the same time, non-locality of the entanglement of particles entailed by quantum laws will not be a problem. Indeed, the most pressing problem of modern physics, the mathematical disparity between quantum and gravitational physics, will be solved ontologically because the regularities described by laws of both quantum and gravitational physics are generated by the interaction of the same substances everywhere. That is why the first volume of *Naturalistic Reason* is named the *Unification of Physics*. It implies, by the way, that there is a way of measuring absolute velocity.

I should mention that *Naturalistic Reason* includes much more. The second volume, the *Unification of Science*, shows how the reduction of physics to spatio-materialism reveals a kind of efficient cause, not recognized by physics, called *geometrical causes*, and shows how specialized sciences use it to explain the regularities they study completely enough to

discover that evolution brings beings like us into existence on suitable planets throughout the universe. The third volume, the *Unification of Science and Philosophy*, shows how consciousness can be part of a world constituted by matter and space, and it shows how ontological scientists will use an illusion inherent in consciousness to trace the origin of ontological science to an exchange of metaphysical arguments in Western civilization that causes a distinct stage in the evolution of life and turn science into naturalistic reason.

All these predictions are justified in enough detail to cause the scientific revolution that they predict. But they all depend on the reduction of physics to ontology, and since you will naturally be skeptical about space and matter having powers that enable their interactions to generate all these regularities, you will wonder about anyone who asks you to consider an argument that describes them, let me say something about myself and its origin. I have been working on this argument, pretty much on my own, for over 45 years, while teaching philosophy at American University for 30 years and since retiring from teaching over 20 years ago. As a philosopher, I have written this argument with a care that justifies expecting it to stand up under such scrutiny, and I am prepared to defend it on all fronts. There may be incomplete or mistaken arguments in it. But I am confident that the discovery that space is a substance that interacts with matter will eventually cause the scientific revolution I predict, and I am prepared to defend it on all fronts. My reason for writing you and a few others is to make what I have discovered public. I am about to turn 83, and I believe that it is my duty to tell others about my discoveries because my society has given me the leisure and privilege to enjoy a life spent in such an exceedingly meaningful way.

But even those who take arguments seriously will find the prospect of reading a detailed all-inclusive explanation of the natural world in three volumes daunting. So, I am offering an easier way of learning more about it. An executive summary of the entire argument is presented in a short (150 page) book titled *Sapere Aude* that I am also self-publishing now. It has three parts, and since the first chapter of each part is about physics, you will find what you need in it. I am including a free Amazon link to an eBook version of it. (See below.) And there is more information about this argument at natReason.com, including an introduction to the trilogy, a Table of Contents for it, a bookstore, and more information about me. I would be happy to answer any questions you may have and very grateful to learn about any problems that you think may cast doubt on it. You can reach me personally at philliphscribner@yahoo.com.