

Physics and metaphysics: interaction or autonomy?

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In this paper I will argue in favor of the view that if physics is to become a coherent metaphysics of nature, it needs an interpretation, namely (i) a clear formulation of its ontological/metaphysical claims and (ii) and a precise understanding of how such claims are related to the world of our experience, which is the most important reservoir of traditional, merely aprioristic metaphysical speculations.

1. AN ATTEMPT AT CLASSIFYING POSSIBLE ATTITUDES

In order to argue defend this claim, I will begin by quoting some interesting remarks of Robert DiSalle's *Understanding Spacetime*, where we find an historically grounded discussion about possible ways of characterizing the relationship between physics and metaphysics (DiSalle 2006, pp. 57-60). Some of his remarks will be very helpful not only as a starting point to survey possible ways to characterize such a relationship in contemporary philosophy of physics, but also to understand, to a certain extent, the historical development of this relationship, and also some future directions that it might take.

A *first* position that Di Salle does not discuss and that is, however, too important and widespread to be neglected claims that physics and metaphysics are to be regarded as completely *independent* of each other, so that they cannot conflict even in principle. This position amounts to a reciprocal attitude that – when it does not amount to disrespect – could

be labelled *Tolerance*. “Tolerance” means that the subject matter of the disciplines is to be regarded by their practitioners as completely non-overlapping, so that neither of the two disciplines can claim to offer a more reliable description of the fundamental structure of reality. This stance is widespread among a significant number of contemporary philosophers or metaphysicians, who pursue their work without paying any attention whatsoever to what happens in the field of science, or physics in particular. Perhaps more significantly, this attitude is also advocated by the vast majority of physicists, who – unconscious disciples of early neopositivism – are convinced that physics has nothing to do with metaphysics. Physics is, and ought to remain, immune from metaphysics: possibly, the only metaphysical hypothesis that is needed by physics is, as Dirac used to say at the beginning of his lectures, that there exists an external world.

A *second* option consists in the attempt to subordinate one discipline to the other. “Subordination”, in its turn, here might mean two different things, as argued by DiSalle (ibid. p. 57). On the hypothesis that physics and metaphysics both try to offer a description of reality and could give conflicting claims about it, one could either claim that either physics or metaphysics is *closer to the truth* than the other – either on single questions or in general – or try to derive the principles of one discipline from those of the other. Let us distinguish between these two attitudes, by naming the former *Denial* and the latter *Explanatory Imperialism*. *Denial* and *Explanatory Imperialism* have been exercised much more on the part of philosophers over physics, than in the opposite direction. This asymmetry might depend on the sociological fact that in the last two centuries science has acquired much more prestige with respect to traditional metaphysics. Consequently, while physicists often implicitly believe that they can afford to ignore what happens in the field of metaphysics since they are tracking the truth, the converse does not hold. Metaphysicians feel that they have to justify

they own approach to things even if many of their beloved concepts (space, time, matter, number, motion etc.) have become the subject matter of science.

The historical figures of Descartes and – to a lesser extent that of Leibniz – represent the first clear example of *Denial*, namely the attempt to claim that metaphysics is closer to truth than physics (see also DiSalle, p.57). The reader will recall that Galileo was accused by Descartes of lacking a systematic method in his approach to natural philosophy, and of being too absorbed by scattered and isolated empirical questions. On the other hand, Newton's physical hypotheses were attacked by Leibniz on the basis of metaphysical and theological principles (the Identity of the Indiscernibles, and the Principle of Sufficient Reason applied to God's choice). Notably, in contemporary metaphysics this attitude of Denial seems lost: even those who tamper with Special Relativity for purely metaphysical reasons (see Craig 2001), do not deny the fact **that** the scientific theory they consider has some claim to (approximate) truth; in the example at hand, they simply supplement it with an unobservable reference frame which, as such, does not contradict the theory, but only its spirit (see Dorato 2001).

The third possibility, *Explanatory Imperialism*, also grants metaphysics some sort of superiority over physics, and according to DiSalle is exemplified by the great mathematician Euler and by the early Kant. By granting «the possibility that the principles of physics may be taken at face value», and need not be rejected in the name of metaphysics, such a third view still assigns metaphysics the task to understand *why* those physical principles hold (ibid.). In other words metaphysics has the task to explain the basic principle of physics, by *deriving* them from deeper aprioristic, metaphysical truths. Also this third attitude, in contemporary metaphysics seems completely lost. Both Denial and Explanatory Imperialism seem two attempts at resisting a fundamental change in ways of acquiring knowledge about reality: from aprioristic analysis to empirical inquiry supplemented by mathematical models.

Interestingly, the mature Kant realised that after Newton's *Philosophiae Naturalis Principia Mathematica* traditional metaphysics had no future. *Transcendentalism* or *Foundationalism* is the attempt to using philosophy or the theory of knowledge to inquire into the very possibility of physics (and metaphysics), namely to dig out those apriori structures of the transcendental subject that make physics (and mathematics) possible. In a nutshell, according to Kant's Critique of Pure Reason, Newtonian physics is a fact, and his theory of knowledge explains why it holds necessarily and universally, against the doubts raised by Humean scepticism with respect to the universal validity of physical laws. Contemporary neokantians give up the idea that our apriori categories grant universality and necessity to physics, but still retain the Reichenbachian view that *some* historically changing structure might be *constitutive* of important physical theories (Friedman 2001).

According to DiSalle, this kind of kantian Foundationalism is to be interpreted at the same time as an inquiry into the right that physics has to address metaphysical questions (ibid.). This is why DiSalle, certainly by making some violence to Kant, also attributes him what for us should be regarded a distinct, fifth position, amounting to the claim that: «physics is not a consequence of the metaphysics of nature. Quite simply it *is* the metaphysics of nature. The metaphysical concepts that we find in physics – body, force, motion, space, time, become to us intelligible precisely, and only, as they are constructed by physics itself; physics provide us with the only intelligible notions we have on this matter» (ibid., p. 60).

This fifth position, which we could call *Physical Autonomy*, is the claim that physics, being itself a metaphysics theory of nature, does not need any metaphysical analysis or intervention from outside. The reason why physics is a metaphysical theory of nature is given by the fact that it aspires to describe reality: as Einstein wrote to Schrödinger “the true difficulty lies in the fact that physics is a kind of metaphysics. Physics describes “reality”. But we don't know

what reality is unless we describe it with physics” (quoted from Allori, Dorato, Laudisa, Zanghì 2005, p. 13).

Let us now pass to comment those options that are nowadays still regarded as alive, in particular Tolerance and Physical Autonomy.

2 TOLERANCE, DISTORTION AND THE COMPATIBILITY TEST WITH PHYSICS

(2.1) Contemporary analytic metaphysics is replete with attempts at gaining some precise explications of notions like substance, event, persistence, object, sameness, identity, becoming, properties, disposition, causation, etc. All these investigations proceed, in many cases at least, in ways that are completely *independent* of what is taking place or has taken place within physics. For this reason, such investigations seem to belong to the kind of approach to metaphysics that I have named *Tolerance*.

Are these researches relevant for a deeper understanding of physics? The answer seems to be in the negative, whenever these inquiries do not even feel the need to confront their theories with physics. This autonomous metaphysical theorizing is certainly interesting and worth-pursuing, but also ~~containing~~ ~~contains~~ the danger of sterility and isolation. Of course, I would not be ready to deny that, say, understanding the nature of causation, is important for its own sake; what is less clear, however, and still open to philosophical debate, is whether causation has any role in the *object* language of physics, rather than being important in a purely pragmatic or explanatory sense (see the debate between Norton 2009, claiming that physics does not need causation and Frisch 2009, trying to argue for the opposite claim). Here is how Norton put it in 2003: “Mature sciences, I maintain, are adequate to account for their realms without need of supplement by causal notions and principles.” The idea here is that in

physics the notion of law replaces the notion of cause,¹ even though the latter notion has still an important role in helping us to recover old, approximate theories from newer ones (say, Newton's "cause" of free fall, invoking a force, from the contemporary geometrized theory of gravity).

In conclusion, I would like to put forward the following claim: *if it is not clear yet in what sense the notion of "property" or "cause" or "object" can affect, and play a role in physics, a confrontation with physics looks dubious or suspicious*, and this is the main reason why many metaphysical inquiries within the analytic tradition remain, and possibly ought to remain, safely within the tradition of autonomy, with all the "dangers" that such an autonomy involves.

(2.2) Another instance of tolerance, sometimes masked under the invitation to coming to terms with "real physics", is what I could call "distortion". This occurs when the confrontation with physics is only *apparent*, since the kind of physics that is invoked is either distorted or highly simplified. This sort of uses of a "non-actual physics" on the part of the analytic metaphysicians is what Ladyman and Ross criticize in various parts of their book, when they refer, for example, to the alleged "physically-based" opposition between atomism and "gunkism" (the view that matter is infinitely divisible): "it is preposterous that in spite of the developments in the scientific understanding of matter that have occurred since [Descartes], contemporary metaphysicians continue to suppose that the dichotomy between [partless] atoms and gunk remains relevant, and that it can be addressed a priori" (Ladyman and Ross, 2007, p.20). This sort of appeal to an imagined physics really counts as an instance of Tolerance, especially if the method of inquiry continues to be wholly *a priori*.

(2.3) One way in which a confrontation between metaphysics and physics really does occur, on the contrary, is when physical theories are invoked as a sort of *experimenta crucis*

¹ For the relation between causation and law, see, among other texts, Dorato (2005) and Psillos (2002).

to decide between two or more competing metaphysical views: if one of the metaphysical theories is in conflict with physics, it ought to be abandoned. An instance of this use of physics within the community of analytic metaphysicians is given for instance by the dispute between presentism and eternalism, namely between the view that only the present exists (presentism), and the view that past, present and future events exist on a par in a block universe (eternalism).

Interestingly, there are people nowadays who claim that this dispute is not genuine (Dolev 2006, Dorato 2006, Savitt 2006). But let us assume, for the sake of the argument, that there is a genuine debate just in conceptual and metaphysical terms, and let us assume that this holds also for another debate with respect to which the special theory has been invoked as a decisive test, namely the problem between endurantists and perdurantists. I quote from an abstract of a recent article: “There are two main theories about the persistence of objects through time: endurantism and perdurantism. Endurantists hold that objects are three-dimensional, have only spatial parts, and wholly exist at each moment of their existence. Perdurantists hold that objects are four-dimensional, have temporal parts, and only partly exist at each moment of their existence. In this paper we argue that endurantism is poorly suited to describe the persistence of objects in a world governed by Special Relativity.” (Hales and Johnson 2003)).

Clearly, the meta-philosophical principle, in both of these cases, is that if a metaphysical theory is not compatible with, or is not properly suited to adapt itself to, a physical theory, we should abandon it. However, note that also in these cases, the metaphysical debate is somewhat *completely external to physics*: the solutions to the question whether the future is real or not, or to the problem how entities persist, seem quite unrelated to what physicists nowadays are really after. These metaphysical problems, in other words, are external to, and independent of, the issues that are really debated within physics. This is why also this type of

relationship between physics and metaphysics, I take it, fully belongs to the philosophical style that I referred to as *Tolerance*.

3 THE METAPHYSICS WITHIN PHYSICS AND THE NATURE OF INTERPRETATION

Taking stock from Einstein's quotation above ("physics is a type of metaphysics"), or DiSalle ("physics is the metaphysics of nature"), I would like to sketch a view of the relationship between metaphysics and physics that regards the former as being strictly dependent on the latter. If the essential task of the philosopher of physics is *interpreting* physical theories – i.e., 1) coming up with a precise and exact *ontology* to associate to the language and formulas of physical theories and 2) relating such ontology to the world of our experience – it then seems that 1) necessarily involves a metaphysical task, namely finding out how the world can be like *if* our physical theories are at least approximately true. Note that this interpretation of the "interpretation of physics" (which has variously defended by van Fraassen 1980, Giere 1988 and Lange 2002) does not require truth from our physical theories, but can be embarked upon also by instrumentalists, since the whole interpretative task rests on a conditional statement ("if the theories are at least approximately true").

For instance, can the non-local correlations presupposed by entangled states be interpreted as referring to some sort of causal correlations? And if the answer is in the positive, which model of causation do they allow? When we ask such questions, it is of the utmost importance to remark that we can never exclude that one of the novelties of the whole worldview suggested by EPR-Bohm correlations lies just in the fact that no causal explanation is really fit to explain/interpret them, because these correlations are to be regarded as fundamental, or

natural in Aristotle's sense, and *as such they need no causal explanation whatsoever* (Fine 1989). In other words, without taking stance in this complicated problem, here we simply want to suggest that sometimes the old, metaphysical notions (causation, property, dispositions) may be unfit to give an account of the new ontology suggested by a physical theory. In our example, this sort of possibility makes all attempts of looking for a causal interpretation of the correlations in question look outdated.

The same could be true for the dispute between substantivalism and relationism, a metaphysical debate that might have been appropriate for the times of Leibniz and Newton, but simply inappropriate after General Relativity, which is a theory that overcomes the distinction between empty spacetime and matter by identifying spacetime with a gravitational field (Rynasiewicz 1996, Dorato 2008). In other words, the interpretative task must always be opened to the possibility that no current or traditional metaphysical category is really appropriate for the new physical theory, so that, one more time, the confrontation between metaphysics and physics is one between concepts and categories that are imposed onto the latter from the outside.

As another example, consider the question: can the timelike-separation of events in classical spacetime theories be interpreted as giving rise to a tenseless form of *local becoming*? Philosophers who have recently defended this minimalist interpretation (Savitt 2002, Dieks 2006 Dorato 2006b) are well aware that the question remains whether such a metaphysical reading of relativity is capable of connecting with, or explaining, the sense of passage of time typical of our experience. If this second explanatory task is not fulfilled by postulating a becoming of events defined as their timelike succession in the partial order defined by special relativity, the first ontological interpretation must be abandoned or at least corrected. This is why the ontological question posed by 1) – is relativity theory (special and

general) interpretable as a theory that metaphysically admits of becoming? – can never be divorced from the questions raised by 2), namely the connection with our experience.

In conclusion, I would like to stress that it is the connection of the metaphysical interpretation of a physical theory with our experience that gives us the final test for the plausibility of a proposed metaphysical interpretation. This is particularly evident in some interpretations of quantum mechanics, in particular in the no-collapse views linked to Everett's interpretation. In a nutshell, Everett's interpretation solves the measurement problem by denying the reality of the reduction process: the metaphysical interpretation here consists in claiming that the fundamental equation governing the temporal evolution of a quantum system is always linear and deterministic. Obviously, in this case one must solve two correlated problems, both involving an agreement with what we see, and therefore the relationship of the relevant metaphysical posit with our experience. The first problem is why we never perceive macroscopic superpositions. The second problem consists in trying to explain the origin of the notion of probability, namely the *impression* that the probabilities involved by the Born-rule play a fundamental role in quantum theory. The first problem is attacked with the theory of decoherence, which explains why we never perceive interferences (from within the same "world") of Schrödinger's infamous dead cat with its alive counterpart, even though all possible measurement outcomes do realize. This means that there is a world in which the cat is dead and looks dead, and a world in which the cat is alive, and looks alive, but in any of these two worlds macroscopic interferences are never observed, due to decoherence processes. In other words, the final state is still a macroscopic superposition of different "worlds", even though this state cannot be accessible to our experience. Whether this interpretation is satisfactory is of course dependent also on how the second difficulty is tackled, a difficulty that recently has involved attempts at explaining the notion of probability

in a *physical* theory with decision theoretic strategies of *agents* (Deutsch 1999, Wallace 2007).

The appropriateness of this interpretation of quantum mechanics of course cannot be judged in this context. Here it has been presented simply in order to show the reader how complicated the interpretation of a physical theory really is, and how far more promising a philosophical activity it is if compared with “external” metaphysical theorizing. The question of interpretation is in fact not external to physics at all, at least to the extent that in the past also physicists have asked themselves whether atoms or the ether existed or not; in any case the need to link the physical picture of reality with the world of our experience remains one of the main tasks of philosophy of physics (Sellars 1963).²

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² Of course, I admit that the criteria of what is “internal” and what is “external” to physics cannot be left just to the judgments of physicists. Here this difficult question of the normativity of philosophy can simply be mentioned.

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