Abstracts

B3. Metaphysical Issues in the Philosophy of Science

What gives Direction to Time?
Loewer Barry
Rutgers University, USA

The world is full of macroscopic phenomena – so called “arrows of time”-that evolve in one temporal direction but not the reverse direction. For examples, an ice cube in warm water melts but an ice cube never spontaneously forms out of warm water and more generally the entropy of the universe (and isolated subsystems) increases but never decreases, there are records of the past but not the future, we have some influence over the future but not the past, causes precede their effects, we experience time as flowing from past to future. This gives rise to a puzzle since the fundamental dynamical laws of classical and quantum mechanics are temporally symmetric in that for any sequence of configurations of particle positions that is compatible with the laws the temporally reverse sequence is also compatible with the laws. It follows that the dynamical laws by themselves do not explain the temporal asymmetries. So what accounts for the arrows of time? One approach is to attribute them to the metaphysical nature of time itself. This is the path taken by presentists, growing block advocates and those who attribute an intrinsic direction to time itself. While these accounts provide vivid metaphysical pictures I will argue that they fail to provide explanations of the temporal asymmetries in the behavior of the material contents of space-time. In contrast are accounts that attempt to account for time’s arrows in terms of a scientific explanation of the second law of thermodynamics. The best account of the second law involves hypothesizing that at one temporal boundary of the universe – the macro state of the universe cosmologists identify as the Big Bang- the entropy is very small and positing a probability distribution over micro states that are compatible with this low entropy macro state. It will then follow that from this macro state it is very likely that the entropy of the universe would increase from the big bang until the equilibrium is attained. I will provide some reasons to believe that this approach can explain the various arrows of time in addition to the second law and discuss some problems that must be overcome if it is to provide a fully adequate account of why “time is a one way street”.

On the Prospects of an Effective Metaphysics
McKenzie Kerry
UC San Diego, USA
Two trends can arguably be discerned in contemporary metaphysics of physics, most notably (though not exclusively) in Ladyman and Ross’s *Every Thing Must Go*. On the one hand, there is an explicit embrace of non-fundamental physical ontology *qua* ‘effective’ ontology: that is, of non-fundamental entities conceived of roughly as they are in non-fundamental theories, and thus independently of more fundamental physical descriptions. On the other hand, there is an explicit disavowal of much contemporary analytic metaphysics, largely on the grounds that its models and assumptions are altogether too classical in character. But since among the effective ontology of physics one finds classical ontology, and since presumably it is classical metaphysics that is appropriate to such ontology, it is not obvious, to me at least, that this is a consistent set of views. It would be consistent if those embracing both these views further committed to the idea that metaphysics should concern itself exclusively with the fundamental. But while the idea that metaphysics is, by definition, the investigation of fundamental structure is one increasingly promoted by analytic metaphysicians, it is unclear to me why we should think that this should be the case. For if one trend in philosophy of physics is to reify non-fundamental entities, and given that such entities have properties, identities, and evolve in accordance with laws of nature, is it not natural to think that there should be a corresponding *non-fundamental metaphysics* corresponding to this ontology, at least if we are sympathetic to metaphysics at all?

In this paper, I will consider whether the embrace of effective ontology in physics suggests a corresponding embrace of ‘effective metaphysics’: that is, of a metaphysics of non-fundamental reality conceived of independently of the metaphysics of more fundamental regimes. While it strikes me as natural to think that should be so, my case will be a negative one. At the core of my argument is the observation that metaphysical theories typically cannot in any meaningful sense be said to ‘approximate’ one another. But since it is the existence of relations of approximation that underwrites the embrace of effective physical ontology in the first place, there is nothing in the latter that brings in its train an embrace of effective metaphysics. As such, it seems that the only metaphysics we should countenance is indeed one concerned exclusively with the fundamental.

Of course, since contemporary fundamental physics presents huge challenges to anyone attempting to develop a metaphysical interpretation of it, this is in many ways a disappointing and dispiriting conclusion to many metaphysicians of science. But I will close by arguing that these observations also help us gain a better purchase on the distinction between physics and metaphysics, which should at least bring some conceptual clarification to what naturalistic metaphysics is in the first place.