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*Processes and Holism in Physics: A Perspective for Re-Thinking Emergence*

### Abstract

Although the causal relevance of processes in biology has been increasingly recognized by philosophers as ubiquitous, it has largely been rejected, or at best, overlooked in physics. At the heart of the matter –or so I shall argue– is, on the one hand, the ‘reified’ relationship between units and their purported constituents or ‘particles’, and on the other, the causal commerce of such relationship. For it is a common view in the philosophy of biology that various biological processes nested within different time scales interact with each other to form different particles or ‘units of selection’ (genes, organisms, populations, species, ecosystems and so on). In other words, that it is from the complex interactions of process that different particles or units *emerge* is almost now a truism in biology, while still remains a highly contested view in physics.

This issue, which can be also characterized by the ontological antagonism of substance versus process, is not just empirical, but deeply metaphysical. An important reason is that the scientific developments of the sixteenth and seventeenth century yielded a ‘dualistic’, yet still, substance oriented metaphysics of mind and matter. And although several findings in twentieth century physics have strongly put in doubt the feasibility of projects built around such dualism, the latter has still carried on without sufficient scrutiny as an ontological presupposition of mainstream reductive physicalism. Moreover, physicalism has been promoted on the basis of being the only ‘healthy’ alternative *vis-à-vis* a supposed threat of ending up with mental or Cartesian metaphysics. As if there could be no *tertium quid* to choose from, this not only results in a false framework, but also a false dichotomy: for the striking similarities between these two positions, which far outweigh their differences, remain largely unacknowledged. In this manner, whilst dualism entails that at bottom all is made up or ‘reified’ by only two types of substances or entities (i.e. mental and physical), physicalism just denies the existence of those that are mental.

Consequently, the two doctrines truly end up presupposing that what exists at bottom are entities and substances. So, ultimately, the quarrel seems to turn on whether there exist two types or rather only one. However, I contend that holistic physical organization presents a strong challenge to such evidently ‘reified’ notions normally associated with physics. For so-called ‘substance-particles’ at the molecular, atomic and even the quantum level, are often not only unstable but are also differently emerging from and dissipated by the causal efficacy of their generating processes, which yield, in turn, most of the salient holistic features of organization in their corresponding ontological level.