AGPhil 3: Philosophy of Physics

Time: Tuesday 17:30–19:00 Location: JAN/0027

AGPhil 3.1 Tue 17:30 JAN/0027

Realism Going Local: Stabilizing Quarks — •Nurida Lena Boddenberg — University of Bonn, Bonn, Germany

The aim of this talk is to present and defend a local realist position about stable phenomena and the traces leading towards them, called signatures, by acknowledging scientific practice and bottom-up data to phenomena inferences. For this endeavor, I will propose and justify a fourfold distinction into (raw) data, signatures, phenomena, and theories, utilizing a case study concerned with quarks.

I will show that jet events, or the scaling behavior of the structure functions in deep inelastic scattering, are signatures, and that their existence is independent of individual data sets and translatable across different experiments. Further, these signatures are also stabilized by their reliable reproducibility based on the different kinds of data. Nevertheless, they are not explicitly containing the entity, the quark, described in the theory of quantum chromodynamics. However, the (experimental) signatures can be traced back to a common origin, to a phenomenon. Referring to recent work on perspectival realism (Massimi 2022), I proceed to show that the more (experimental) signatures infer to one phenomenon, the more the latter is stabilized. Finally, I shall argue high-level theories or models can latch onto stabilized phenomena and provide further information, but the phenomena themselves can still exist independently.

AGPhil 3.2 Tue 18:00 JAN/0027

Feynman Diagrams providing understanding as Toy Models — •Karla Weingarten — Munich Center for Mathematical Philosophy, LMU Munich

Both in high school and undergraduate university courses, Feynman Diagrams are used to teach students about the mode of operation of elementary particle interactions. This is not for their mathematical rigor or theoretical beauty but for the accessibility and clarity of the pictorial representation. This decoupling of lower-order diagrams from the theoretical framework of perturbation theory is common practice in pedagogical settings, although they do not factually represent the underlying physical mechanisms. This raises the question of whether Feynman Diagrams, taken as literal graphical diagrams, can facilitate some form of understanding, which in most accounts requires the explanatory assumptions and models to be (at least approximately) true. This criterion can be weakened to design a concept of understanding that accommodates so-called toy models, highly idealised and simplified models intended to provide easier access to complex issues. I argue that the use of Feynman Diagrams as pictorial representations can be considered as a case of such a toy model. Although Feynman diagrams cannot (realistically) be considered to present how-actually understanding, I show that as toy models, they can indeed facilitate how-possibly understanding, emphasising their great use in learning particle physics.

AGPhil 3.3 Tue 18:30 JAN/0027

Suzanne Bachelard's Conceptualization of Mathematical Physics — •Ties van Gemert — Tilburg University, Tilburg, Netherlands

Suzanne Bachelard (1919-2007) was a French philosopher and historian of physics and mathematics. Although she was a longtime director of the prestigious l'Institut d'histoire des sciences et des techniques in Paris, she never acquired the same standing as many of her peers and her philosophy has received little to no attention. In this presentation, I will reconstruct her phenomenological epistemology through close-readings of her book The Consciousness of Rationality: A Phenomenological Study of Mathematical Physics (1958). First, I will give a general overview of her conceptualization of mathematical physics. After that, I will elucidate this overview by setting out her account of the history of three critical concepts in mathematical physics: (1) fluid objects, (2) potentiality, and (3) the principle of least action. In conclusion, I will reflect on what Bachelard's philosophy of physics can still teach us today.