Program

Tuesday 20 Sept.

14.15 Coffee, tea. Welcome

14.30 - 15.40 Chris Smeenk (Univ. of Western Ontario):

Fuzzy Modularity and Crucial Simulations

Joint work with Marie Gueguen (Rennes)

How can we assess the reliability of the extremely complex simulations that play a central role in diverse areas of scientific research? Philosophers have recently debated whether simulation science can respond effectively to a novel form of holism: it is challenging to isolate the contributions of distinct modules or components making up simulations. They are "epistemically opaque": we cannot easily trace through the impact of changing a parameter, tweaking a part of code, or altering some aspect of the physical model. Lack of insight into how different modules work together, which Lenhard and Winsberg call "fuzzy modularity," makes it difficult to determine overall reliability, even if each component is independently well understood. We argue that, while the fuzzy modularity of complex simulations does indeed undermine the use of verification and validation to ensure the trustworthiness of simulations, the spectrum of methodologies available to test the reliability of simulations is broader. Other procedures, that have not been recognized and studied by philosophers but have nonetheless been used by scientists, make it possible to assess reliability even when it is extremely difficult to pursue a divide and conquer strategy (that is, to break down a computer simulation into local components and evaluate each of them independently). Our main aim below is to explicate in detail one such methodology, that we call "crucial simulations," drawing on examples of its use in astrophysics. We will analyze the features of this methodology that make it possible to respond effectively to the holistic challenges posed by fuzzy modularity.

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15.50 - 17.00 Nic Fillion (Simon Fraser Univ.):

The argument view of computer simulations done right

What are computer simulations, and how can they generate new scientific knowledge about the world? The two main views in the literature are the experiment view and the argument view, according to which the nature and contributions of computer simulations are best understood if we think of them as experiments or as arguments, respectively. The argument view, however, seems to have found fewer proponents; I contend that it is to a significant extent due to the fact that prior accounts of the argument view (most notably Beisbart's) are in important ways defective. The objective of this talk is to rectify the situation and to give a satisfactory account of the argument view of computer simulations. I will further suggest that this account reveals valuable insights into what makes an argument good (for the purpose of scientific inquiry) and that, as a result, other questions in philosophy of science can benefit from a proper understanding of the argument view of computer simulations.

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17.10 - 18.20 Ana-Maria Cretu (Bristol Univ.):

Human Computers as Instruments

Before the advent of digital computers, it was 'human computers' and 'scanners' who performed calculations or analysed data in large-scale scientific projects. Employed as 'unskilled' workers to 'mindlessly' analyse the data, they were regarded as 'ideal' candidates for making discovery 'more objective'. But were these 'hidden figures' merely 'mindless objectifying machines'? This paper explores the similarities and the contrasts between the work and achievements of the human computers at the Harvard Observatory 1880-1920 and the scanners within the Bristol Nuclear Research Group 1935-1955, in order to understand the nature of their 'objectifying' epistemic work.

Dinner

Wednesday 21 Sept.

9.45 Coffee, tea

10.00 -11.10 Elay Shech (Auburn Univ.):

Are Mesoscale Structures Natural Kinds? Reconsidering Batterman's Middle Way

Robert W. Batterman's recent book, A Middle Way: A Non-Fundamental Approach to Many-Body Physics, presents a methodology for studying many-body systems in contexts such as physics, materials science and engineering, and biological modelling. The book's main thesis consists of claims to the effect that said methodology (i) is superior to alternatives, (ii) solves an important autonomy-robustness problem, and, consequently, (iii) implies that certain mesoscale structures ought to be considered natural kinds: "…there are theoretical, scientific reasons for treating the mesoscale [structures] as, in a rather strong sense, among those that should be considered natural kinds" (25). My goal is to assess the plausibility of, and understand exactly what is meant by, claim (iii) about natural kinds. I will consider and evaluated various interpretations including (what I call) the novel prediction (NP) interpretation, the enhanced indispensability argument (EIA) interpretation, the fundamentality interpretation, and the autonomy interpretation. I argue that the feasibility of the NP and EIA interpretation ultimately depends on the viability of rejecting reductionistic in-principle derivations, and there is a disconnect between the NP and EIA interpretations Batterman's understanding of natural kinds as "carving nature at its joints." Thus, I suggest that the fundamentality interpretation is most attainable. Arguably, the autonomy interpretation is most suggested by A Middle Way but I argue that the autonomy interpretation fails to imply (iii).

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11.25-12.35 Vincent Ardourel (IHPST Paris):

The reduction of hydrodynamics and singular limits

How are the equations of fluid mechanics connected to the equations of motion of particles? In this talk, I analyze an applied mathematics research program, which aims to derive the Navier-Stokes rigorously from the Newton equation of particles by using two mathematical limits (e.g. Gallagher 2019). Although there are major achievements in this derivation of the Navier-Stokes equations, I argue that the fluid dynamics fails to be reduced in the limit to classical mechanics because of the use of singular limits.Ref: Gallagher, I. (2019). "From Newton to Navier-Stokes, or How to Connect Fluid mechanics Equations from Microscopic to Macroscopic Scales", Bull. Amer. Math. Soc. 56, 65-85.

Lunch

13.45-14.55 Siska de Baerdemaeker (Stockholm Univ.):

Into the Unknown: Exploring Dark Matter with Stellar Streams

The dark matter problem is a central challenge to contemporary physics. It has sparked a broad observational and experimental program, both in astrophysics and in high-energy physics. This talk will provide a first stab at a systematic investigation of the epistemic underpinnings of dark matter research. I first argue that there are broadly two dark matter concepts present in the scientific literature, roughly, astrophysical and fundamental. I then use stellar stream research to focus on the former. I argue that, in stellar stream research, a limited set of observations is constraining multiple worldly targets at once, and that this feature is connected to the reliance of the stellar streams research on eliminative reasoning.

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15.10-16.20 Alex Franklin (King's College London):

Incoherent? No, Just Decoherent: How Quantum Many Worlds Emerge

The modern Everett interpretation of quantum mechanics describes an emergent multiverse. The goal of this talk is to provide a perspicuous characterisation of how the multiverse emerges making use of a recent account of (weak) ontological emergence. This will be cashed out with a case study that identifies decoherence as the mechanism for emergence. The greater metaphysical clarity enables the rebuttal of critiques from Maudlin (2010), Monton (2013), and Dawid and Thébault (2015) that cast the emergent multiverse ontology as incoherent or empirically ungrounded.

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