Winter 2027

Empiricism and the Philosophy of Physics

AREA
Science

COURSE DESCRIPTION
How should we characterize the structure and content of physical theories? How do theories represent the world and connect to it through experiments and observations? Many philosophers of science have analyzed scientific theories using mathematical logic, following the logical positivists. This seminar considers recent work in philosophy of physics that takes a different starting point: how theories are actually applied, and the mathematical tools (approximation methods, perturbative techniques, scaling arguments, iterative refinement) used in those applications. This shift in focus, from formal logical structure to the practices of approximation, measurement, and scale-dependent modeling, reveals aspects of theory struc- ture that earlier accounts ignored. First we will consider an account of the content of theories that takes theory-mediated measurement as a guiding idea, in place of other conceptions (such as coordinative definitions a la Reichenbach). This raises a threat of circularity: the measurement of theoretical quantities presupposes the very theory that measurement is meant to test. How can measurements provide evidence for a theory if they already assume its correctness? This apparent circularity can be resolved through an iterative, eliminative methodology, exemplified in historical cases. In the second half of the seminar, we consider how this picture of theory structure and content relates to the framework of effective field theories (EFTs), which has transformed how physicists understand the scope and validity of physical theories. The EFT perspective suggests that theories are valid within limited domains, rather than providing complete descriptions of possible worlds. We will explore the implications of the EFT view for understanding measurement, the realism debate, and the structure of physical knowledge. The seminar will not presume extensive background in physics.