“Schwankungen” in Electroscopes and Microscopes. Vienna Indeterminism and its Evidences

By: Michael Stoeltzner

It is commonly assumed that philosophical debates about the principles underlying a basic theory of science and experimental investigations opening a new field of inquiry in an explorative mode are miles apart. While the former, it is said, only make sense after assuming – implicitly at least – general validity of a basic theory, the latter operate in the absence of almost any theory and are often kept together by material traditions or research schools. In my paper, I want to present a counterexample. It involves the (almost) simultaneous emergence of Egon von Schweidler’s concept of radioactive fluctuations (1905) and Marian von Smoluchowski’s explanation of Brownian motion (1906), on the one hand, and the empiricist indeterminism touted in Franz Serafin Exner’s 1908 inaugural address as rector of the University of Vienna, on the other hand.

Three epistemological lessons will be drawn from this case study. First, well-entrenched experimental traditions can turn into a liability. To overthrow what for a long time seemed evident, the velocities of particles under the microscope, requires both an open-minded descriptivist attitude and a new philosophical orientation. Second, the same combination between bottom-up empiricism and a philosophical stand within which indeterminism was a valid option, was instrumental in creating a new kind of physical quantity, to wit, fluctuations that figured in statistical laws and be set apart from the manifold measurement errors, which were to be explained away. Third, what has initially been a vague philosophical conception can become a program, if it is supported by phenomena that can be listed as evidence. Or so Exner would develop the indeterminism contemplated by the late Boltzmann into a veritable manifesto for the Viennese thought collective.