My dissertation will investigate the changes in scientific thought and practice brought about by computer simulation. It will roughly be split in two parts. The first part is a case study of how computer simulation changed the hypothesis and theory formation in certain subdiscplines of physics. It serves as a foundation for the second part, which will reflect on what these changes mean for philosophy of science in general and for a philosophy of computer simulation in particular.

The guiding questions will be: Is there a fundamental difference between science before and after computer simulation? Has this difference been reflected adequately in philosophy of science? Does it imply a need for a new epistemology? What are the specific problems a philosophy of computer simulation should be concerned with? The case study will show if there is a fundamental difference between physical theorizing before and after the advent of powerful computer simulation techniques.

The idea is to compare two prominent physical theories. One which was developed before computer simulation (e.g. quantum theory) and one which shares a co-evolution with computer simulation (e.g. lattice quantum chromodynamics). As any two physical theories differ in many aspects which are obviously not related to computer simulation, the question is: Which differences can be relevantly attributed to it? The comparison gives one example with which the answer to this question can be fleshed out. It has been claimed that aforementioned changes in the physical sciences (in a wider scope the whole of science)

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warrant fundamental changes to how philosophers conceptualize the scientific enterprise and that a philosophy of computer simulation is needed (e.g. Winsberg in Science in the Age of Computer Simulation or Humphreys in The philosophical novelty of computer simulation methods).

I think that computer simulation can be described in a more continuous fashion with scientific method. This poses a philosophical problem, which has to be tackled first. Can the same historical process (in my case the building of a physical theory) be equivalently described in a continuous and discontinuous fashion? If that is the case the whole controversy might be moot. Still the leading questions from above remain. So the main thrust of the second part of my dissertation – underpinned by the case study above – will be to answer those questions.

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