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Complexity and critical mathematical economics

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The aim of my talk is to present elements and discuss the potential of a research program in the intersection between mathematics and heterodox economics, which we call Critical Mathematical Economics (CME). We identify two key parts of CME, which leads to a natural structure of the talk: The first focusses on an analysis and critique of mathematical models used in mainstream economics, like e.g. the Dynamic Stochastic General Equilibrium (DSGE) in Macroeconomics. We will focus on the latter, including a discussion of the so-called "Sonnenschein-Mantel-Debreu"-Theorems that deal with the aggregation of the Micro- to the Macro-Level in economics and point to some mathematical difficulties in DSGE models. The aim of the second part of CME is to improve and extend heterodox models using ingredients from modern mathematics and computer science, a method with strong relation to Complexity Economics. We will exemplify this idea by describing how methods from Non-Linear Dynamics have been used what could be called "The Dynamical Systems approach to Post-Keynesian Macroeconomics", and also discuss possible Micro- and Mesofoundations. We conclude by giving an outlook in which areas a collaboration between mathematicians and heterodox economists could be most promising. This includes the mathematical and model-theoretic foundations of controversies in economic policy.