

## **Quantifying complexity of a spatially extended stochastic dynamical system**

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**Objective:** Find and test a suitable quantification of the complexity of a spatially extended stochastic dynamical system.

**Background:** There are many notions and quantifications of complexity, e.g. Feldman & Crutchfield, "A survey of complexity measures" (1998). But a distinction needs making between the complexity of the system and the complexity of its behaviour. Here we concentrate on the former and in particular address it in the spatially extended dynamical context. I suggest to explore the potential for using the spectral radius of Dobrushin's "dependency matrix" as a quantification of the complexity of probabilistic cellular automata (PCA). The dependency matrix is defined in Definition 5 of my paper "Robustness of Markov processes on large networks" (shortly to appear in J Diff Eq Appl or see my website). Perhaps there could be some relation with Afraimovich & Bunimovich, Nonlinearity 20 (2007) 1761.

**Deliverables:** a literature survey on the question, an assessment of the spectral radius of the dependency matrix as a quantification of complexity of a PCA

**Beneficiaries:** Apart from seeking to satisfy intellectuals, the proposed research could be useful to practitioners who wish to say in what sense one system is more complex than another.

**PhD prospects:** I've applied for study leave for 10/11 with the intention to go abroad so it would not make sense for me to take on a new PhD student. But the project could be a good initiation for PhD projects in spatially extended stochastic dynamics for example (perhaps with Grosskinsky or Kolokoltsov).