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Title: From dynamical chaos to logical chaos and vice-versa: Explored and unexplored paths

Abstract: One of the more exciting contributions of Tere M. Seara is the study of instability and chaos. Chaos was coined by Edward Lorenz in 1961 with the simple statement "*Chaos: When the present determines the future, but the approximate present does not approximately determine the future*". A different sort of chaos was unveiled by Cris Moore in 1990 with a 2D Turing-type dynamical systems using generalized shifts. The existence of a Turing machine associated with the dynamical system added a new intrigue to the plot: the undecidability of the halting problem (established by Alan Turing himself back in 1936) yielded the impossibility of logical predictions in the new models. Those 2D systems based on mappings on the square Cantor set, however, are not physical. In this talk, I will give 3D physical (and/or "almost" physical) constructions of logical chaos using fluids. Against all odds, the main ingredient of this construction is geometrical and relies on powerful techniques from contact topology. Many questions around such construction are pending including the connection among different levels of complexity (dynamical and logical) and the (in)existence of a hierarchy among them. I will end up my talk with some new challenges and open questions. One of them is a joint project with Tere M. Seara.

Main references:

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