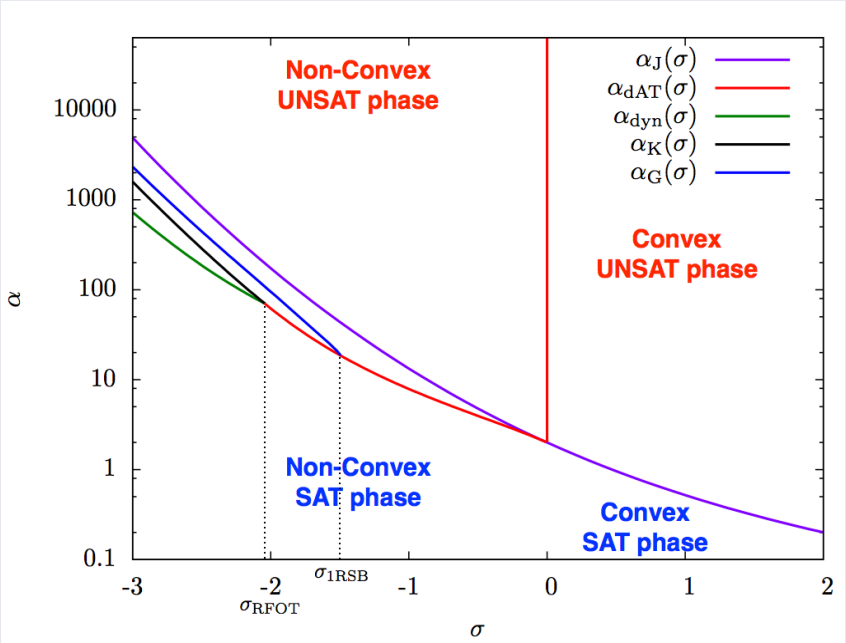
The jamming transition in non-convex continuous constraint satisfaction problems

S. Franz (LPTMS), G. Parisi (Università di Roma La Sapienza), M. Sevelev (LPTMS), P. Urbani (IPhT), F. Zamponi (LPTENS).

Hard spheres are very simple glass former. In 2012-2014, a complete theory of hard sphere glasses in high dimensions has been developed combining techniques coming from liquid theory and spin glasses. A result of this work has been the prediction of the critical exponents of the jamming transition. Remarkably, this prediction works very well to describe three dimensional amorphous jammed packings.



S. Franz and G. Parisi have then realized that the jamming transition can be thought as a satisfiability transition point for a continuous constraint satisfaction problem. Therefore they have introduced the spherical random perceptron as a simplest schematic model for jamming.

In this work we have analyzed the phase diagram of this model. We have shown that there are a set of different phase transitions that appear depending on the control parameters of the model. In particular jamming is always inside a so called Gardner (or marginal) phase. We have studied in detail the properties of the model both in the unjammed (SAT) and jammed (UNSAT) phases and we have shown how the critical behavior at the satisfiability threshold emerges. Finally we have computed the critical exponents associated to the approach to the transition from the SAT and UNSAT phases.

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