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Complexity of Spin Glasses and Random Matrices

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I will present an unexpected relation between the theory of random matrices (GOE) and the Morse theory of smooth high dimensional Gaussian Fields. This relation is based on the very classical Kac-Rice formula (updated by Adler-Taylor). It enables us to estimate in great detail the complexity of spherical p -Spin Glasses, i.e to count the number of critical points of Spin Glass Hamiltonians, of given index and given energy. It also gives a sharp bound on the Ground State of these Spin Glasses. This complexity is close to but different from the usual TAP complexity computed in the physics literature.

This work is joint with A. Auffinger (Courant) and J. Cerny (ETHZ).