Disordered systems beyond the permutation symmetry paradigm

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In this talk I will review some results obtained for the mean-field spin-glass models when the disorder is not permutation invariant or, more generally, non identically distributed. Cases include the convex and non-convex multi-species, with emphasis on the deep Boltzmann machines in the Nishimori line, and the multy-bath SK model that have some relevance in high-dimensional inference and deep learning.