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Delocalization transition in low energy excitation modes of vector spin glasses

Low energy excitations of glasses display a remarkable degree of universality. In addition to usual phonons and other extended modes, in a variety of model glassy system it has been found the presence of low energy quasi-localized excitations with density of states (DOS) roughly behaving quartically at low frequencies DQLS(ω) ∼ Aω^a with $a\approx 4$. Despite the fact that this spectrum of localized modes was first predicted by phenomenological theories, a theoretical comprehension based on microscopic models, as well as an understanding of its generality is at present lacking. It is natural to model glasses as simple disordered systems with continuous variables. I will consider in this talk the fully-connected m-components vector spin glass model in an external magnetic field for $m \geq 3$. The model has a zero temperature transition from a paramagnetic phase at high field to a spin glass phase at low field. I will discuss the low energy excitations around minima in the two phases. The spectrum is gapless both in the paramagnetic and in the spin glass phase, with a pseudo-gap behaving as λm−1 in the paramagnetic phase and as $\sqrt{\lambda}$ at criticality and in the spin glass phase. Despite the long-range nature of the model, the eigenstates close to the edge of the spectrum display quasi-localization properties. I will show that the paramagnetic to spin glass transition corresponds to delocalization of the edge eigenvectors. We solve the model by the cavity method in the thermodynamic limit. We also perform numerical minimization of the Hamiltonian for $N \leq 2048$ and compute the spectral properties, that show strong corrections to the asymptotic scaling approaching the critical point. I will show how this scenario is modified for spin glass models defined on finite connectivity Random Graph, where in both phases the low energy states are localized, but with a different geometrical organization.