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Tuning the disorder in superglasses

We study the interplay of superfluidity, glassy and magnetic orders in the XXZ model with random Ising interactions on a three dimensional cubic lattice. In the classical limit, this model reduces to a *+-J* Edwards-Anderson Ising model with concentration p of ferromagnetic bonds, which hosts a glassy-ferromagnetic transition at a critical concentration $p_c^{cl} \sim 0.77$. Our quantum Monte Carlo simulation results show that quantum fluctuations stabilize the coexistence of superfluidity and glassy order ("superglass"), and shift the (super)glassy-ferromagnetic transition to $p_c > p_c^{cl}$. In contrast, antiferromagnetic order coexists with superfluidity to form a supersolid, and the transition to the glassy phase occurs at a higher p.