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Magnetic Analogies for the Dynamics of Glass Forming Liquids

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We present a direct mapping between the dynamics of glass forming liquids and a general random field / random coupling Ising model using the replica effective potential approach. Using the overlap between two structural states of a supercooled liquid we construct a constrained overlap free energy that can be mapped directly onto that of an Ising Hamiltonian. For a Lennard-Jones glass the fluctuations and mean values of the random fields and interactions place it within the universality group of the random field Ising magnet, not the Ising spin glass. This corresponds with the explanation for a random first order transition.

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