Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

A cavity approach to the heterogeneity of the random solid state XIAOMING MAO, PAUL GOLDBART, University of Illinois at Urbana-Champaign, MARC MEZARD, LPTMS, Universite Paris-Sud, Orsay, JEAN-PHILIPPE BOUCHAUD, SPEC, Centre d'etudes de Saclay, Gif-sur-Yvette —
Replica statistical mechanics has been invoked to explore a wide collection of properties of the random solid state of matter, as formed, e.g., by vulcanized macromolecular systems. Even at the mean-field level, this approach yields a rich and illuminating description of the state in terms of a fraction of localized particles and the statistical distribution of their localization lengths. An application of the cavity method – successfully used to analyze a wide range of spin glass models and other statistical-mechanical systems with quenched disorder – allows replica-based results for random solids to be recovered in a way that sheds light both on their physical origin and their limitations. An extension of this cavity approach, involving an assembly of Ornstein-Uhlenbeck processes, points towards a strategy for addressing certain aspects of the dynamics of the random solid state, at least at the mean-field level.

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Date submitted: 30 Nov 2004 Electronic form version 1.4