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Elastic heterogeneity of soft random solids XIAOMING MAO, PAUL M. GOLDBART, University of Illinois at Urbana-Champaign, XIANGJUN XING, Syracuse University, ANNETTE ZIPPELIUS, University of Goettingen — The spatial heterogeneity of amorphous solids, which records the randomness present at the solidification transition, confers heterogeneity on elastic properties. Especially for soft random solids, which have exceptionally small shear modulus due to the large thermal fluctuations in the positions of the particles, this elastic heterogeneity exhibits interesting long-range correlations. We examine elastic heterogeneity in soft random solids via a two-pronged approach [1]. First, we examine a phenomenological elastic free energy, featuring a quenched random kernel, which induces randomness in the residual stress and Lame coefficients. Second, we explore a semi-microscopic model network using replica statistical mechanics. This model has a vulcanization transition, and the associated Goldstone fluctuations characterize shear deformations and can reproduce the phenomenological model. Via this correspondence we infer the statistical properties of the elastic heterogeneity, finding that correlations involving the residual stress are long-ranged and governed by a universal parameter that also gives the mean shear modulus. This statistical characterization allows the construction of the statistics of non-affine deformations in soft random solids. [1] Xiaoming Mao, Paul M. Goldbart, Xiangjun Xing and Annette Zippelius, cond-mat/0610407.

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