Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Origins and stability of the polydomain regime in isotropic-genesis nematic elastomers BING LU, FANGFU YE, University of Illinois, XIANGJUN XING, Shanghai Jiao Tong University, PAUL GOLDBART, University of Illinois — We address the physical properties of nematic elastomers that have been randomly crosslinked in the high-temperature isotropic state. We do this by constructing a replica Landau theory in terms of a coupled pair of order-parameter fields: one for vulcanization, the other for nematic order. We focus on the correlations of the trapped-in nematic fluctuations as a diagnostic of the structure of the elastomer, determining them for a range of temperatures and disorder strengths. Our analysis shows that, in fewer than four spatial dimensions, the quenched randomness associated with the crosslinking prevents the emergence of long-range order, either of the mondomain nematic or of the spatially modulated type. It also shows that, for sufficiently strong disorder and low enough temperatures, the system exhibits unusual short-range oscillatory structure in the local nematic alignment.

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Date submitted: 19 Nov 2010 Electronic form version 1.4