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Minimal model for polydomain nematic elastomers FANGFU YE, BING LU, Department of Physics and Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign, XIANGJUN XING, Department of Physics, Syracuse University, PAUL GOLDBART, Department of Physics and Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign — Nematic elastomers are materials that possess both the elastic properties of cross-linked rubber and the orientational properties of nematic liquid crystals. When cross-linked in the isotropic phase, and subsequently cooled into the nematic regime, these materials usually form polydomain structures. To understand the formation of these polydomain structures, we develop a microscopic model based on an elastic network medium formed by the random end-linking, via springs, of rigid dimers. We assume that the dimers interact with one another through a Maier-Saupe term, and that the springs impose soft constraints, not only on the separations between the dimers that they link but also on the relative orientations of these dimers. We then use vulcanization theory to investigate: (i) how these orientational constraints lead to the emergence of polydomain structures, as the temperature is decreased; and (ii) the dependence of the characteristic size of the domains on temperature and link density.

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