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Maier-Saupe-type theory of ferroelectric nanoparticles in nematic liquid crystals[1] JONATHAN SELINGER, LENA LOPATINA, Liquid Crystal Institute, Kent State University — Several experiments have reported that ferroelectric nanoparticles have drastic effects on nematic liquid crystals–increasing the isotropic-nematic transition temperature by about 5 K, and greatly increasing the sensitivity to applied electric fields. In a recent paper [1], we modeled these effects through a Landau theory, based on coupled orientational order parameters for the liquid crystal and the nanoparticles. This model has one important limitation: Like all Landau theories, it involves an expansion of the free energy in powers of the order parameters, and hence it overestimates the order parameters that occur in the low-temperature phase. For that reason, we now develop a new Maier-Saupe-type model, which explicitly shows the low-temperature saturation of the order parameters. This model reduces to the Landau theory in the limit of high temperature or weak coupling, but shows different behavior in the opposite limit. We compare these calculations with experimental results on ferroelectric nanoparticles in liquid crystals.

[1] L. M. Lopatina and J. V. Selinger, Phys. Rev. Lett. 102, 197802 (2009).

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Jonathan Selinger
Liquid Crystal Institute, Kent State University

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