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**On a partial differential equation for determining the free energy of ternary mixtures from light scattering data** GEORGE THURSTON, CARL LUTZER, Dept Mathematics, Rochester Institute of Technology, DAVID ROSS, Kaiser Permanente — With use of an approximation appropriate for liquid mixtures, we formulate a well- established relation for light scattering from ternary mixtures as a second-order nonlinear partial differential equation, which relates the inverse Hessian of the intensive free energy to the efficiency of light scattered near the forward direction. We examine the mathematical conditions under which light scattering data can be a suitable input for solving this equation, thereby to determine the free energy in a nearly model-independent fashion. We find that within the thermodynamically stable and metastable regions of the phase diagram, composition curves that are nearly perpendicular to the gradient of the dielectric constant are also not what are termed characteristic for the light scattering partial differential equation. This criterion, in turn, implies that free energy solutions in the neighborhood of a such a composition curve can be self-consistently constructed by combining a known free energy gradient along the curve with light scattering data in the surrounding region. These considerations suggest that an experimental method comprising light scattering in the ternary composition triangle, combined with other means of finding the needed boundary conditions along a suitable curve, should in principle be capable of determining ternary mixture free energies without adopting specific free energy models in advance.

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