Comment on the Mean Field Solution and Orderings in a Field parallel to the Layers

Ryusuke Ikeda

Department of Physics, Kyoto University, Kyoto 606, Japan

Abstract

Mean field solutions and the ordering behaviors in the liquid regime in fields strictly parallel to the layers are studied in terms of the Lawrence-Doniach model and within the lowest Landau-level. It is found that, in $b \equiv 2\pi Bd^2\sqrt{,}/\Phi_0 < 1.2$, where B is the flux density, d the layer spacing, and , the mass ratio, the mean field solution is the floating solid familiar in the anisotropic GL model, except in very narrow field-windows where the commensurability effect changes the positional structure of vortices, while the mean field solution in $b > 1.5$ is the triangular solid stabilized by the layering in which all interlayer spacings include vortices. In $1.2 < b < 1.5$, however, a waving structure with a local triangular solid similar to that observed by Hu and Tachiki seems to become stable, although the energy difference from the regular triangular solid is quite small. Further, we investigated perturbatively within the same model the positional and phase orderings on cooling in the liquid regime. It is emphasized that, in any model with no magnetic screening, the positional ordering tends to occur first not across but *along* the layers because of the intrinsic anisotropy of phase ordering. This tendency becomes more remarkable with increasing b and is *opposite* to the scenario favoring a vortex smectic phase in which the full magnetic screening was assumed. It is argued based on the details of positional ordering that the freezing transition should be, strictly speaking, of first order.