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**Vortex phase diagram for films of type-I Ginzburg-Landau superconductors** MARK SWEENEY, MARTIN GELFAND, Colorado State University — It has been known since the work of Tinkham, Maki, and Pearl in the early 1960's that a thin film of type-I material in a perpendicular field supports a triangular vortex lattice below the upper critical field $H_{c2}$. What happens as film thickness is increased? This was addressed in the vicinity of $H_{c2}$ using linearized Ginzburg-Landau theory, first by Lasher and more completely by Callaway. The vortex phase diagram is remarkably rich. We have made progress on this question within the full G-L theory, following an approach widely applied by Brandt (iteratively solving the G-L equations in a space of trial functions). We find that Brandt's proposed form for the magnetic field in thin-film geometry leads to some unphysical results and have devised an alternative. Our calculations precisely locate phase boundaries between triangular, square, and rectangular vortex arrays as a function of film thickness and magnetic field. They are consistent with a simple picture of vortices which repel near the film surfaces but attract away from them.

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