The superfluid phases of quark matter: Ginzburg-Landau theory and color neutrality

Kei Iida [a,b] Gordon Baym [a]

[a] *Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, IL 61801*

[b] *Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo 113-0033, Japan*

Presented by: Kei Iida

Abstract

Applying Ginzburg-Landau theory to a strongly-coupled ultrarelativistic quark matter superfluid, we elucidate the possible phase diagrams near the critical temperature. The phases include a color-flavor-locked phase and, as we discover, *two* phases in the isoscalar, color-antitriplet channel. We complement the general Ginzburg-Landau approach by deriving the high-density asymptotic form of the Ginzburg-Landau free energy from the weak-coupling gap equation involving color magnetic interactions. Incorporating the color neutrality constraint into the general Ginzburg-Landau theory by introducing differences in the chemical potential between colors, we find that the gap is suppressed by this constraint in the presence of anisotropy of the order parameters in color space.

Preprint submitted to Elsevier Preprint *20 December 2000*