Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

High-temperature surface superconductivity in rhombohedral graphite[1] TERO HEIKKILÄ, NIKOLAI KOPNIN, Low Temperature Laboratory, Aalto University, MARI IJÄS, ARI HARJU, Department of Applied Physics, Aalto University, GRIGORI VOLOVIK, Low Temperature Laboratory, Aalto University — We show that rhombohedral graphite may support surface superconductivity with an unusual relation between the BCS coupling constant and the order parameter. This feature results from the properties of the states localized on the graphite surfaces. In a description including only the nearest neighbour coupling of the graphene layers, the surface states are topologically protected and have a flat band dispersion. We show that including higher order couplings destroys this flat band character and leads to a particle-hole symmetry breaking quadratic dispersion with a large effective mass. Employing this dispersion, we then show its effect on superconductivity and find two regimes of parameters, depending on the relation between the strength of the coupling constant and the details of the quadratic dispersion. For low coupling strengths, superconductivity is localized on the surfaces, but the order parameter is exponentially suppressed as in a conventional BCS superconductor, whereas for large coupling strengths we obtain surface superconductivity with a linear relation between the order parameter and the coupling constant. Our results offer an explanation for the recent findings of graphite superconductivity with an unusually high trans

[1]This work is supported in part by the Academy of Finland through its Centre of Excellence Program (projects no. 250280 and 251748) and by the European Research Council (Grant No. 240362-Heattronics)

Tero Heikkila
Aalto University

Date submitted: 09 Nov 2012 Electronic form version 1.4