Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Interplay of ballistic and diffusive superconductivity in the vortex core in the model two-band system MgB_2 K. TANAKA, University of Saskatchewan, M. ESCHRIG, Universitaet Karlsruhe, D. F. AGTERBERG, University of Wisconsin - Milwaukee — A revived interest in multi-band superconductivity has emerged due to the unexpected and interesting simultaneous presence of diffusive and ballistic bands in the superconductor MgB_2. Motivated by recent experimental data on the vortex state in MgB_2 obtained by scanning tunneling spectroscopy, we theoretically study the intriguing effects of superconductivity in a diffusive band ('π band') induced by superconductivity in a ballistic band ('σ band'). We apply a unique model that has been developed recently [1] for describing such a system, based on coupled Eilenberger and Usadel equations. Results are presented for the spatial variation of the order parameter, the current density, and the vortex core spectrum in the two bands. A particularly interesting result emerging from our studies is the possibility of additional bound states near the gap edge in the 'strong' σ band, which arise from hybridization with the 'weak' π band. The development of such gap-edge bound states is examined for various sets of physical parameters that are relevant for MgB_2. We will also discuss the induced Kramer-Pesch effect in the π band and magnetic-field dependence of vortex core size. [1] K. Tanaka, D. F. Agterberg, J. Kopu, M. Eschrig, Phys. Rev. B **73**, 220501(R) (2006).

Kaori Tanaka
University of Saskatchewan

Date submitted: 24 Nov 2006 Electronic form version 1.4