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Quasiparticle scattering from a double vortex scatterer in d-wave superconductors SRIRAM GANESHAN, SUNY Stony Brook, MANAS KULKARNI, Stony Brook and Brookhaven, ADAM C. DURST, SUNY Stony Brook — The low energy quasiparticle excitations of a d-wave superconductor are massless Dirac fermions. In the presence of a magnetic field, the scattering of quasiparticles from vortices receives both a superflow contribution, due to interaction with the superflow circulating about each vortex, as well as a Berry phase contribution, due to the Berry phase acquired upon circling a vortex. Calculating the cross section for quasiparticle scattering from a double vortex provides a clean way of isolating and studying the two effects. We do so by making use of elliptical coordinates, a natural setting for studying this two-center problem. With proper gauge choice, the Berry phase contribution takes the form of a branch cut between vortex centers, providing a boundary condition for the spinor wave function across the line segment joining the foci of the elliptical coordinate system. We solve the quantum scattering of Dirac quasiparticles in elliptical coordinates. Our approach is to separate the free Dirac equation in elliptical coordinates. The separated angular and radial functions turn out to be the solutions of angular and modified Whittaker-Hill's equations. We summarize the technique to expand incident plane wave spinor in terms of Whittaker-Hill functions. We also present the asymptotic form of the separated solutions in order to setup an analytical formula for differential cross section.

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