

# Non-integer Flux Quanta for a Spherical Superconductor

Joonhyun Yeo

*Kon-kuk University, Seoul 143-701 Korea*

M. A. Moore

*University of Manchester, Manchester M13 9PL U. K.*

## Abstract

A thin film superconductor shaped into a spherical shell at whose center lies the end of long thin solenoid in which there is an integer flux  $N\Phi_0$  has been previously extensively studied numerically as a model of a two-dimensional superconductor. The emergent flux from the solenoid produces a radial  $B$ -field at the superconducting shell and  $N$  vortices in the superconducting film. We study here the effects of including a second solenoid (carrying a flux  $f$ ) which is inserted inside the first solenoid but passing right across the sphere. This Aharonov-Bohm (AB) flux does not have to be quantized to make the order parameter single valued. The Ginzburg-Landau (GL) free energy is minimized at fixed  $N$  as a function of  $f$  and it is found that the minimum is usually achieved when the AB flux  $f$  is half a flux quantum, but depending on  $N$  the minimum may be at  $f = 0$  or values which are not obvious rational fractions.