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Angular momentum blockade in nanoscale high-Tc superconducting grains[1] FRANCESCO MANCARELLA, ALEXANDER BALATSKY, Nordita, MATS WALLIN, ANDERS ROSENGREN, Royal Institute of Technology, NORDITA - CONDENSED MATTER COLLABORATION, KTH- THEORETICAL PHYSICS COLLABORATION — We discuss the angular momentum blockade in small d-wave SC grains in an external magnetic field. We find abrupt changes in angular momentum state of the condensate ("angular momentum blockade") as a result of the variation of the external field. The effect represents a direct analog of the Coulomb blockade. We use the Ginzburg-Landau theory to illustrate how the field turns a d-wave order parameter (OP) into a$(d_{x^2-y^2}+id_{xy})$-OP. We derive the volume magnetic susceptibility as a function of the field, and corresponding small jumps in magnetization at critical values of the field that should be experimentally observable in SC grains. The observation of these jumps requires a small grain, since their extent is inversely proportional to the number of Cooper pairs in the sample. The general source of instability of the pure d-wave gap is the presence of gap nodes, completely lifted by the secondary OP component. A $d+id'$-state is chiral and hence has an orbital moment carried by Cooper pairs. We consider fields $H \ll H_{c2}$, making negligible the vortex perturbations of the OP. Boundary effects will be also discussed. Recent experiments suggest that nanoscale d-wave SC can be fully gapped and this minimal gap can be modified by an external field.

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