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p-wave Superconductor in a Mesoscopic Size Grain SUNGKIT YIP, BOR-LUEN HUANG, Institute of Physics, Academia Sinica — Motivated by the claim that Sr2RuO4 is a p-wave superconductor with broken time-reversal symmetry in the bulk, and many recent experimental studies of superconductors in mesoscopic size grains, we study theoretically a two-component p-wave superconductor in confined geometries, considering circular disks and rectangular samples, using both Ginzburg-Landau (GL) and quasiclassical (QC) Green function theories. For GL theory with parameters near the weak-coupling limit, we find that a sufficiently small circular disk remains normal. For zero field and intermediate sizes, a disk with sufficiently smooth boundary is in a time-reversal symmetric state, where the order parameter can be represented by a real vector forming a vortex-like structure. Only for larger grains and at lower temperatures can a broken time-reversal state be recovered. For intermediate sizes but with finite external magnetic field, the system can have possibly re-entrant phase transitions. For rectangular samples with sufficiently large aspect ratios, the superconductor near its transition temperature at zero fields has its order parameter vector parallel to the long side of the sample. Within a critical aspect ratio however, the order parameter vector forms a vortex-like structure, much like for the disk.

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