Abstract Submitted
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Magnetic-field dependence of energy levels of superconducting nano-scale mettalic grains with strong spin-orbit scattering[1] KONSTANTIN NESTEROV, YORAM ALHASSID, Center for Theoretical Physics, Sloane Physics Laboratory, Yale University, New Haven, CT 06520, USA — We study the Zeeman splitting of discrete energy levels of superconducting nano-scale metallic grains whose single-electron dynamics is chaotic [1]. In the absence of spin-orbit scattering the Zeeman splitting of a single-electron level is trivial; it is the same for all levels and linear in magnetic field. Spin-orbit coupling suppresses this splitting, induces level-to-level fluctuations and non-linear corrections to the energies. We investigate the combined effect of pairing correlations, which lead to superconductivity in the bulk limit, and spin-orbit scattering on the many-electron energy levels in a weak magnetic field. In particular, we focus our studies on the linear (g-factor) and quadratic (zero-field level curvature) corrections and their mesoscopic fluctuations. The single-electron part of the Hamiltonian follows the statistics of the Gaussian symplectic ensemble of random matrix theory, which is applicable in the limit of strong spin-orbit scattering and a large dimensionless Thouless conductance. The interaction is given by a BCS-like pairing term and the magnetic field coupling is described by a Zeeman term. [1] K. Nesterov and Y. Alhassid, to be published.

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