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Interplay of superconductivity and ferromagnetism in ultra-small metallic grains SEBASTIAN SCHMIDT, YORAM ALHASSID, Center for Theoretical Physics, Sloane Laboratory, Yale University, New Haven, CT 06520, U.S.A., KRIS VAN HOUCKE, Department of Subatomic and radiation physics, Ghent University, Proeftuinstraat 86, B-9000 Ghent, Belgium — We investigate the competition between superconductivity and ferromagnetism in ultra-small metallic grains in a regime where both phases can coexist. We use an effective Hamiltonian in the mesoscopic regime that combines a BCS-like pairing term and a ferromagnetic Stoner-like spin exchange term. The presence of spin jumps in the ground-state phase diagram of the grain is a unique feature of the coexistence of pairing and ferromagnetic correlations. We show that the coexistence regime can be made accessible to experiments by tuning an external Zeeman field [1]. We also study the transport properties of the grain in the Coulomb blockade regime and identify signatures of the competition between superconductivity and ferromagnetism in the mesoscopic fluctuations of the conductance [2].

[1] S. Schmidt, Y. Alhassid and K. Van Houcke, *Europhys. Lett.* 80, 47004 (2007).

[2] S. Schmidt, Y. Alhassid, to be published (2007).

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