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Quantum depinning of the magnetic vortex core in micron-size permalloy disks RICARDO ZARZUELA, SAÜL VÉLEZ, JOAN MANEL HERNANDEZ, JAVIER TEJADA, Departament de Física Fonamental, Universitat de Barcelona, VALENTYN NOVOSAD, Materials Sciences Division, Argonne National Laboratory, GRUP DE MAGNETISME TEAM, MATERIALS SCIENCES DIVISION TEAM — The vortex state being characterised by an in-plane closed flux domain structure and an out-of-plane magnetization at its centre (known as the vortex core) is one of the magnetic equilibria of thin soft ferromagnetic micron-size dots. The vortex core is a mesoscopic object and so it is a suitable candidate to observe quantum tunneling of its magnetic moment between classically stable magnetic configurations. For the first time, we report experimental evidence of quantum dynamics of the vortex core of micron-size Permalloy ($Fe_{19}Ni_{81}$) disks induced by the application of an in-plane magnetic field. It is attributed to the quantum tunneling of the vortex core through pinning barriers, which are associated to structural defects in the dots, towards its equilibrium position. The crossover temperature from the thermal to the quantum regime is obtained within the framework given by the Caldeira-Leggett theory. Comparison between experiments and theory points to tunneling of the vortex core by steps of the order of 0.3 nm and gives estimates to the parameters characterising the pinning barriers.

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