Abstract Submitted
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Threefold onset of vortex loops in superconductors with a magnetic core[1] MAURO DORIA, Instituto de Fisica, Universidade Federal do Rio de Janeiro, Brazil., MILORAD MILOSEVIC, Department of Physics, University of Antwerp, Belgium, ANTONIO ROMAGUERA, Instituto de Fisica, Universidade Federal do Rio de Janeiro, Brazil., FRANCOIS PEETERS, Department of Physics, University of Antwerp, Belgium. — Superconductivity and magnetism are known to coexist inside several compounds, such as $RuSr_2LnCu_2O$ and $ErNi_2B_2C$. Recently, artificially nano-engineered superconductors with magnetic inclusions have been realized experimentally. In mesoscopic samples, where the ratio volume to area is small, the vortex patterns vary according to the sample symmetry. On the other hand, magnetic inclusions give rise to vortex loops inside the superconductor. To capture these aspects, we consider theoretically a sub-micron superconductor (e.g. sphere) with a static magnetic moment in its center in order to observe these confined vortex states. The 3D Ginzburg-Landau theory is applied and solved in the finite difference scheme, from which we obtain the very complex 3D vortex configurations. For large samples, when the influence of the boundary diminishes, we found that vortex loops always nucleate in threes. The final superconducting state is characterized by the number of created vortex loops and the number of vortex-antivortex pairs that spring to the surface.

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