Poster-2-8

Superinsulators a new topological state of matter

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Superinsulators are dual superconductors [1]. They are correspondingly characterized by an infinite resistance, even at finite temperatures and by an electric Meissner effect. They arise in materials in which the effective electromagnetic interaction contains magnetic monopoles and have been detected [2] near the superconductor-to-insulator transition (SIT) in TiN, NbTiN, InO and NbSi films. Magnetic monopoles squeeze the electromagnetic interaction into thin electric flux tubes that cause a linear confining potential between charges so that only neutral states survive asymptotically, the same mechanism that permanently confines quarks inside hadrons. 3D superinsulators may be realized as the mysterious pseudogap state in high-T_c superconductors [3].

[1] For a review see: Invited contribution to the "Encyclopaedia of Condensed Matter Physics, II Edition", M.C. Diamantini, C.A. Trugenberger and V. Vinokur; to appear.
[2] M.C. Diamantini, C.A. Trugenberger and V. Vinokur; "Confinement and Asymptotic Freedom with Cooper pairs", Nature Comm. Phys. 1:77 (2018).
[3] M.C. Diamantini, C.A. Trugenberger and V. Vinokur; "Topological Nature of High Temperature Superconductivity", Advanced Quantum Technologies 2000135 (2021).