Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Effects of anisotropy and disorder-mediated nucleation of vortices on the superheating field of superconductors DANILO LIARTE, Cornell University, SAM POSEN, Fermi National Accelerator Laboratory, MARK TRANSTRUM, Brigham Young University, GIANLUIGI CATELANI, Peter Gruenberg Institut, MATTHIAS LIEPE, JAMES SETHNA, Cornell University — We provide a theory for the effects of disorder and materials anisotropy on the maximum parallel surface field H_{sh} that a superconductor can sustain, important for accelerating cavities in current particle accelerators. (Current niobium cavities routinely operate above H_{c1}, in a metastable regime susceptible to vortex penetration). Dirt is discussed in an 'instanton' calculation of disorder-mediated vortex nucleation. The increased susceptibility to dirt due to the smaller coherence lengths in new materials (Nb_3Sn, NbN, MgB_2) is swamped by much stronger effects of the distance from the pure H_{sh}: Nb_3Sn should be as reliable at 0.92 Tesla as Nb at typical operating fields of 0.18 Tesla, according to a crude estimate. The effects of anisotropy in layered materials is calculated within Ginzburg-Landau theory, applicable near the critical temperature. For high-κ materials like MgB_2, the anisotropy is negligible near T_c; we speculate about possible large anisotropies at lower temperatures. We briefly review current experimental development of Nb_3Sn cavities.

Danilo Liarte
Cornell University

Date submitted: 11 Nov 2016 Electronic form version 1.4