

ACCELERATOR SEMINAR

“Flux Trapping in Superconducting Accelerating Cavities during Cooling Down with a Spatial Temperature Gradient”

Takayuki Kubo

KEK, High Energy Accelerator Research Organization

During the cool-down of a superconducting accelerating cavity, a magnetic flux is trapped as quantized vortices, which yield additional dissipation and contribute to the residual resistance. Recently, cooling down with a large spatial temperature gradient attracts much attention for successful reductions of trapped vortices. The purpose of the present seminar is to introduce a model to explain the observed efficient flux expulsions and the role of spatial temperature gradient during the cool-down of cavity. In the vicinity of a region with a temperature close to the critical temperature T_c , the critical fields are strongly suppressed and can be smaller than the ambient magnetic field. A region with a lower critical field smaller than the ambient field is in the vortex state. As a material is cooled down, a region with a temperature close T_c associating the vortex state domain sweeps and passes through the material. In this process, vortices contained in the vortex state domain are trapped by pinning centers that randomly distribute in the material. A number of trapped vortices can be naively estimated by using the analogy with the beam-target collision event. Based on this result, the residual resistance is evaluated. We find that a number of trapped vortices and the residual resistance are proportional to the strength of the ambient magnetic field and the inverse of the temperature gradient and that the proportionality constant depends on material properties such as a number of relevant pinning centers. The obtained residual resistance agrees well with experimental results. A material property dependence of a number of trapped vortices is also discussed.

Thursday, January 21, 2016

3:00 p.m.

CEBAF Center, Room F224-225

Coffee before seminar beginning at 2:45 p.m.