Absorption of Thermal Radiation in Liquid Helium

Zack Conway

Several accelerators are being proposed today which require large numbers of superconducting cavities operating at limits rarely achieved in laboratory settings today. One, immensely successful, technique to determine and study what is limiting the performance of the superconducting cavities involves using a large complicated thermometer array attached to the outside of the superconducting cavity surface. This technique has been immensely successful in determining the limits of single cell cavities and was pioneered at Cornell and other labs in the past 20 years. This immensely successful technique requires good thermal contact between the thermometers and the superconducting cavity outer surface. This is a non-trivial problem in a superfluid helium bath and becomes even more cumbersome with larger cavities, like the ones required for the International Linear Collider (ILC) and energy recover linacs (ERLs). You will investigate the infrared emission and transmission properties of niobium and superfluid helium. This will involve measuring the emissivity of niobium and the absorption of infrared in superfluid helium at temperatures approaching absolute zero. You will be exposed to many techniques and methods useful in an experimental physics career: thermodynamics, surface-physics, superfluid Helium, cryogenics, rough-vacuum systems, low-noise electronics, detectors, data acquisition, and data analysis.