The 140 MANA Seminar E



Vortex induced dissipation in narrow current-biased thin-film superconducting strips Chair: Dr. Xiao Hu (MANA Principal Investigator)

Dr. Lev Bulaevskii (Los Alamos National Laboratory, USA)

NAMIKI

Site

We consider a vortex crossing the strip from one edge to the other, perpendicular to the bias current, as the dominant mechanism of dissipation in thin current carryng superconducting films of thickness *d* on the order of the coherence length ξ , and of a width ω much narrower than the Pearl length, $\Lambda \gg \omega \gg \xi$, The vortex crossings result in detectable voltage pulses. We derive the rate of vortex crossings and thus the rate of pulses using the general theory of transition rates between metastable states. In mean-field theory, the saddle point solution corresponds to the vortex position at the strip, where the kinetic energy of supercurrents is maximum. This position determines the energy barrier for vortex crossings. The crossing rate derived in such an approach is renormalized by superconducting fluctuations which accompany the vortex crossings and their consequences for IV characteristics, when heating due to vortex crossings is negligible. We find ohmic behavior at low bias currents, power law behavior at intermediate currents and exponential IV's at currents close to the critical. We argue that pulse rate measurements may be done avoiding heating and thus may provide information on thermal and quantum dynamics of vortices and of superconducting order parameter.

Venue: Seminar Room #431, MANA Bldg. Date: <u>Apr 23th Friday</u> Time: <u>15:30-16:15</u>

Contact: International Center for Materials Nanoarchitectonics (MANA), Nakata (ex. 8806)