Wednesday, August 21, 2002

The Fritz London Memorial Prize Lectures

Fritz W. London (1900 – 1954)

Chairperson : Moses H. W. Chan (Chair of the London Prize Committee)

9:45 – 12:30 Hall B (Phoenix Hall)

L1 **Turbulence at Low Temperatures**

Russell J. Donnelly

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Much of modern research in turbulence requires high Reynolds and Rayleigh numbers. A collaborative effort involving researchers at the University of Oregon and at Yale University has investigated the use of cryogenic gaseous helium to study thermal convection, helium I to study turbulent flow through pipes and grids, and helium II for the study of superfluid grid turbulence. We have recently constructed and commissioned the first cryogenic wind tunnel operating with helium gas at 6K. Intense turbulence generates very small eddies which need to be resolved. Progress in this direction will be described. We have also been successful in implementing Particle Image Velocimetry at low temperatures and have applied it to the study of grid turbulence in helium I. The talk will conclude with a discussion of challenges and opportunities in this field in the future.

From H_2 to cryogenic H masers, to High-Tc superconductors: an unlikely but rewarding path **L2**

Walter Hardy

Department of Physics and Astronomy, University of British Columbia, 6224 Agricultural Road, Vancouver B.C. CANADA

A selection of seemingly unrelated experiments on sold molecular hydrogen, cryogenic atomic hydrogen and high temperature superconductors are revisited, with the object of showing how one followed from the other. Along the way, the advantages (and disadvantages) of being a scientific gypsy will be pointed out.

Superconductor-Insulator Transitions in the Two-Dimensional Limit * **L3**

Allen M. Goldman

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Superconductor-insulator (SI) transitions in ultra-thin metal films, tuned by magnetic field and disorder have attracted substantial attention over the last decade because of the possibility that they are quantum phase transitions, and because in two dimensions, there is a direct competition between coherence effects associated with superconductivity and effects associated with localization. The elegant bosonic picture of superconductor-insulator transitions that was proposed some years ago and appeared to explain the data is only in qualitative agreement with measurements. Although finite-size-scaling analyses of conductivity data have been successful, suggesting the existence of quantum critical points, detailed study has revealed more complex behavior. In particular, the limiting resistance separating superconducting and insulating behavior is nonuniversal, and values of critical exponents may be quite different from theoretical expectations. There are also indications from very low temperature measurements that there is always a significant metallic regime, and that dissipation plays a role in determining low temperature behavior. A critical review of the experiments along with a survey of theoretical approaches will be presented. The prospects for resolving the outstanding issues will also be discussed.

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Supporters of the Fritz London Memorial Prize

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