

Superconductivity – from Exotic Forms of Matter to Commercial Coated Conductors

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INVITED PRESENTATION

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The phenomenon of superconductivity presently impacts on a wide range of activities from fundamental physics to advanced technology. First discovered in 1911 in elemental Hg, the more recent discovery of high temperature superconductivity in entire families of cuprate materials led to an enormous burst of activity and expectations of a rapid development of cheap machinery, transformers, power lines, etc. While these developments have proved to be much more difficult than first envisioned, the progress has been steady and perhaps accelerating.

More fundamentally, superconductors interact strongly with magnetic fields and electrical currents. The presence of a magnetic field, generated either externally or by currents flowing in the material, raises its energy. Consequently most superconductors (so-called Type II materials) permit the field to enter as discrete, quantized units of magnetic flux called vortices. In this colloquium, I will describe some basic features of this curious state of matter and show that proper “doping” of the superconductor can dramatically improve its properties. Finally, I will briefly introduce some of the creative solutions being devised to fabricate superconductive wires and tapes that conduct high density currents with very low loss.

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