

# T<sub>C</sub>SUH Special Seminar

Texas Center for Superconductivity at the University of Houston



## Dr. George Crabtree

Senior Scientist and Director  
Materials Science Division  
Argonne National Laboratory

## Superconductivity: Challenges and Opportunities

**Monday, October 2, 2006**

Room 102, University of Houston Science Center

4:00 p.m. – 5:00 p.m.

Refreshments Following Talk

### Abstract

Electricity is the mainstay of our energy distribution system, providing instant power for light, refrigeration, transportation, industry, communication, and digital electronics at the flip of a switch. Demand for electricity will grow by 50% in the US and 100% in the world by 2030. Yet the electricity delivery system is threatened by increasingly inadequate capacity, reliability, and power quality, especially in urban areas where power density and demand growth are highest. Superconductivity can transform urban electricity delivery through (i) cables with five times the power capacity of copper wires; (ii) smart, self-healing fault current limiters and reactive power regulators that instantaneously control current, voltage, and phase angle variations; and (iii) small, robust transformers that use no contaminating or flammable oil and are safe for urban areas. Transforming the power grid with these superconducting technologies requires aggressive research to improve the current carrying performance of present-generation superconducting wires, and high risk, high payoff basic research on next-generation materials, their electromagnetic behavior mediated by superconducting vortices, and the pairing mechanisms responsible for high temperature superconductivity. The electricity challenges facing the power grid, the breakthroughs in basic research needed to overcome them, and the grand challenges facing superconductivity will be presented.

### Bio

George Crabtree is a Senior Scientist at Argonne National Laboratory and Director of its Materials Science Division. He holds a B.S. in Engineering from Northwestern University and a Ph.D. in Condensed Matter Physics from the University of Illinois at Chicago, specializing in the electronic properties of metals. He has won numerous awards, most recently the Kammerlingh Onnes Prize for his work on the properties of vortices in high temperature superconductors. This prestigious prize is awarded only once every three years; Dr. Crabtree is its second recipient. He has won the University of Chicago Award for Distinguished Performance at Argonne twice, and the U.S. Department of Energy's Award for Outstanding Scientific Accomplishment in Solid State Physics four times, a notable accomplishment. He has an R&D 100 Award for his pioneering development of Magnetic Flux Imaging Systems, is a Fellow of the American Physical Society, and is a charter member of ISI's compilation of Highly Cited Researchers in Physics.

Dr. Crabtree has served as Chairman of the Division of Condensed Matter of the American Physical Society, as a Founding Editor of the scientific journal *Physica C*, as a Divisional Associate Editor of *Physical Review Letters*, as Chair of the Advisory Committee for the National Magnet Laboratory in Tallahassee, Florida, and as Editor of several review issues of *Physica C* devoted to superconductivity. He has published more than 400 papers in leading scientific journals, and given approximately 100 invited talks at national and international scientific conferences. His research interests include materials science, nanoscale superconductors and magnets, vortex matter in superconductors, and highly correlated electrons in metals. Most recently he has served on the organizing committees of the Basic Energy Sciences Workshops on Basic Research Needs for Hydrogen, Solar Energy, and Superconductivity.

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