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From BCS to Vortices: A 40 Year Personal Journey through Superconductivity from Basic Research to Power Applications

PAUL M. GRANT, IBM Research Staff Member Emeritus, San Jose, CA 95120 USA

A century has passed since the discovery of superconductivity in Leiden followed 75 years later by the Great Leap Forward in Zuerich.¹ This talk will chronicle the author's trajectory through the science and technology of superconductivity first taking off with his IBM career in fundamental research on organic and layered copper oxide perovskite superconductors to a final landing at EPRI to explore applications of the latter to the electric power industry. Although many fundamental mysteries remain with respect to the copper and iron compounds, especially regarding the BCS pairing mechanism, nonetheless a significant number of successful demonstrations of cables, rotating machinery, storage and power conditioning equipment employing both low-and high- T_C superconducting materials² have been undertaken worldwide since the decade of the 1960s to the present. However, massive application to the power industry has yet to take place or be inserted into utility long-range planning cycles.³ Although there will certainly be a relatively small number of opportunistic deployments in those situations where superconductivity has a compelling advantage over conventional technology, its time will more likely await a future revolution in energy and electricity infrastructure such as a sympiosis⁴ of nuclear and hydrogen with superconductivity. Perhaps the distant future will even deliver the dream⁵ of a room temperature superconductor.

¹"20th Anniversary of the Woodstock of Physics," APS March Meeting 2007, Denver, CO.

²P. M. Grant, IEEE Trans. Appl. Supercon. **7**, 112 (1997).

³P. M. Grant, "Superconductivity in Power Applications," submitted to the ICEC-ICMC 2010 Conference Proceedings.

⁴P. M. Grant, C. Starr and T. J. Overbye, "A Power Grid for the Hydrogen Economy," Scientific American, July 2006, p.76.

⁵P. M. Grant, Physics Today, May 1998.