

Seminar

Department of Physics, Temple University
**A Possible Paradigm Shift in the Search
for Higher T_c**

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In the last 30 years, great progress has been made in all areas of high temperature superconductivity (HTS) research and development from raising the transition temperature T_c , discovering new HTS compounds, developing theoretical models of HTS, to fabricating HTS prototype devices. For example, the T_c has been increased to 134 K in the stable cuprate $\text{HgBa}_2\text{Ca}_2\text{Cu}_3\text{O}_x$ at ambient by the ETH group and 164 K at 30 GPa achieved by the Houston group in 1993 and to 203 K in the unstable H_3S above 200 GPa by the Mainz group in 2015; more than 200 cuprate compounds stable at ambient and four superconducting hydrides under ultrahigh pressures have been found; numerous theoretical models have been developed; and many HTS prototype devices have been tested to display superior performance to that of their non-superconducting counterparts. However, several questions concerning the occurrence of HTS remain, for example: 1) Why do all T_c s above 77 K occur in cuprates until very recently? 2) Are the strong electron correlation and the two-dimensional feature characteristic of HTS cuprates necessary and sufficient for high T_c as previously suggested by many? 3) What is the role of interfaces in the enhancement of T_c ? 4) Will there be a paradigm-shift needed for our understanding of high temperature superconductivity and for the search of higher T_c , especially in view of the recently reported T_c of 203 K? A brief review of recent experimental results on cuprates, pnictides and hydrides relevant to the above questions will be presented and discussed.

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SERC, Room 408