

MAR07-2006-004097

Abstract for an Invited Paper  
for the MAR07 Meeting of  
the American Physical Society

### **Understanding of Mechanisms for Design of Advanced Superconductors<sup>1</sup>**

WARREN PICKETT, University of California Davis

A recent DOE panel considered the future of research in superconducting materials and made a number of recommendations for priority research directions ([http://www.er.doe.gov/bes/reports/files/SC\\_rpt.pdf](http://www.er.doe.gov/bes/reports/files/SC_rpt.pdf)), two of which will be discussed. These items, under the rubric of *Enabling Superconductivity*, emphasize that *Finding the Mechanisms* is essential for furthering the field, and that once understood, the prospect of *Superconductors by Design* becomes a viable line of research. Establishing the mechanism in the high temperature superconducting cuprates continues to attract substantial efforts, with no consensus near. In several superconductors, including some discovered in the past decade or so, having  $T_c$  around or above 20 K [(Ba,K)BiO<sub>3</sub>; Li<sub>x</sub>HfNCl; PuCoGa<sub>5</sub>] the mechanism is in question. On the more positive side, there are several cases established in the past six years, beginning with MgB<sub>2</sub> and extending to elemental metals under pressure (Li, Y, Ca), where the familiar electron-phonon mechanism has provided unexpectedly high  $T_c$  and thereby stimulated enthusiasm and optimism into this area of superconductivity research. The clear understanding of this mechanism (at least in many respects) provides a path for improvements in superconducting materials.

<sup>1</sup>Supported by NSF Grant DMR-0421810.