

Abstract Submitted  
for the MAR12 Meeting of  
The American Physical Society

**Thermal Conductivity Data Near  $T_c$  as a Probe of Unconventional Superconductivity** BRIAN SALES, Oak Ridge National Laboratory — In classical phonon-mediated superconductors, the thermal conductivity,  $\kappa$ , just below  $T_c$  decreases since electrons in the superfluid state carry no heat. A decrease in  $\kappa$  occurs just below  $T_c$  even for BCS superconductors with relatively high transition temperatures such as  $\text{Nb}_3\text{Sn}$  and  $\text{MgB}_2$ . By contrast, in all of the unconventional superconductors, of which the author is aware, the thermal conductivity always increases just below  $T_c$ . It is hypothesized in these unconventional superconductors that magnetic or some other type of fluctuation that scatters phonons above  $T_c$  are frozen out below  $T_c$ , resulting in a larger  $\kappa$ . This suggests that a relatively simple thermal conductivity measurement may be a way of identifying superconductors with an unusual pairing mechanism. Although this phenomenology does not help identify new superconductors, it may help determine which materials have the potential for a much higher  $T_c$ . Several related examples of the effects of magnetic fluctuations or excitations on thermal transport also will be presented. This research was supported by the Materials Sciences and Engineering Division, Office of Science, U. S. Department of Energy.

Brian Sales  
Oak Ridge National Laboratory

Date submitted: 26 Nov 2011

Electronic form version 1.4