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Thermal Conductivity in Supercooled Water[1] JOHN BIDDLE, VINCENT HOLTEN, JAN SENGERS, MIKHAIL ANISIMOV, University of Maryland, College Park — The heat capacity of supercooled water, measured down to -37 C, shows an anomalous increase as temperature decreases. The thermal diffusivity, the ratio of thermal conductivity and the heat capacity per unit volume, shows a decrease. These anomalies may be associated with a hypothetical liquid-liquid critical point in metastable water below the line of homogeneous nucleation. The data suggest that the thermal conductivity does not show a significant critical enhancement, in contrast to what is observed near the vapor-liquid critical point. We have used mode-coupling theory to investigate the possible effect of critical fluctuations on the thermal conductivity of supercooled water, and shown that indeed this effect would be too small to be measurable at experimentally accessible temperatures. We discuss physical reasons for the striking difference between the vapor-liquid and liquid-liquid critical enhancements of thermal conductivity in water. We also discuss the discrepancy between the thermal conductivity calculated from experimental data and that obtained by computer simulations of the TIP5P water-like model.

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John Biddle
University of Maryland, College Park

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