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Fluctuations of the superconducting order parameter as the origin of the Nernst effect

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An observation of a strong Nernst signal well above the critical temperature of the superconducting transition (T_c) made this phenomenon an area of high theoretical interest [1]. The Nernst effect is a transverse thermo-magnetic phenomenon in which the voltage difference is induced by a temperature gradient in the presence of a magnetic field. The Nernst effect measured in the high-Tc superconductors [2, 3] has been attributed to the motion of vortices [6, 5, 4] existing outside the region of superconductivity (vortex-liquid regime). Recent measurements of the Nernst signal in conventional amorphous superconducting films far above Tc [7, 8] can not be explained by the vortex-like fluctuations. An alterative explanation suggests that the effect is caused by fluctuations of the superconducting order parameter [9, 10]. Surprisingly, a comprehensive theory of the Nernst effect outside the superconducting state in the conventional superconductors has not been developed so far. In this study we present such a calculation for a wide range of temperatures and magnetic fields. We demonstrate a quantitative agreement between our theoretical expressions and the experiment [8].

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