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On the origin of the peak effect in the classical superconductor Nb_3Sn: the role of critical fluctuations NICOLAS MUSOLINO, ROLF LORTZ, ALAIN JUNOD, Department of Condensed Matter Physics, University of Geneva, 24 quai E. Ansermet, CH-1211 Geneva 4, Switzerland, NAOKI TOYOTA, Physics Department, Graduate School of Science, Tohoku University, 980-8571 Sendai, Japan — We found a sharp pronounced peak effect in the magnetization and the isothermal magnetocaloric effect of a single crystal of the classical superconductor Nb_3Sn. The construction of a new type of isothermal calorimeter allowed us to study the underlying thermodynamics with an extremely high resolution. A small lambda-type anomaly could be resolved superimposed on the specific heat jump at T_c. It follows scaling laws as expected for the presence of critical fluctuations. We interpret this feature as the first clear observation of the regime of critical fluctuations in a classical superconductor. Simultaneous measurements of the specific heat and the isothermal magnetocaloric effect reveal that the peak effect occurs at the onset of fluctuations below the H_{c2} line. No indications of a thermodynamic transition as the origin of the peak effect could be found. Our investigation favours thus rather a scenario in which a vortex lattice looses its topological order more continously due to the increasing strength of thermal fluctuations upon approaching the H_{c2} line.

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