Thermodynamics of the Lambda-Anomaly in Superconductivity

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At the transition temperature, T_c , of a superconductor there is a characteristic triangular line shape figure in the heat capacity versus temperature curve. This is often referred to as a lambda-anomaly. It is essentially the same for a wide range of classes and compositions of materials. This implies that the processes that contribute to, and are responsible for, the lambda-anomaly are independent of chemical composition. The anomaly is the result of the electronic fermion – boson wave function transitions that occur at, or near, the Fermi level energy, E_F. This is well known. What is not so well known, or is often overlooked, is the associated Fermi temperature, T_F. The Fermi temperature, that is ~ 10^4 K for some superconductors, is of prime importance in understanding the lambda-anomaly. By use of the concept of T_F one can understand the difference of the signs of the chemical potential, ***m***, for bosons and fermions. This also leads to estimates of the electronic enthalpy and entropy changes of some fermion – boson transitions at T_c. On the basis of the model considered the itinerant electron density in a fermion – boson transition is proportional to the height of the lambda-anomaly at T_c.