Level Density and gamma-Strength Functions in Sm Isotopes *

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The Oslo group has developed a technique to measure with high precission the level density from the ground state up to the neutron binding energy. The method provides simultaneously the level density and gamma-ray strength function in one and the same experiment. After establishing the level density as a function of excitation energy, the entropy is known and we can explore various thermodynamical parameters of the nucleus. The temperature, derived within the framework of the micro-canonical ensemble, shows structures, which we associate with the break up of nucleon pairs (see Figure 1 below). And the nuclear heat capacity deduced within the framework of the canonical ensemble exhibits an S-shape as function of temperature, indicating a phase transition. Nuclear level densities and gamma strength functions are input parameters in large network calculations of stellar evolution, and in the simulation of accelerator-driven transmutation of nuclear waste. I will discuss the evolution of the level density and radiative strength function as one moves from the well deformed Dy, Er and Yb nuclei to the close to spherical Sm nuclei. A pygmy resonance at around 3 MeV has been observed in several deformed rare earth nuclei and vanishes for the spherical nuclei. This is as expected for a scissors mode pygmy resonance. Results from Oslo combined with a thermal neutron capture experiment analysing two-step cascades finally establish the M1 multipolarity of this pygmy resonance. Preliminary result for ^{143,144,146,147}Sm will also be shown and a discussion of what happens to the level density and the radiative strength function of samarium isotopes as one approaches and crosses the N=82 closed shell.

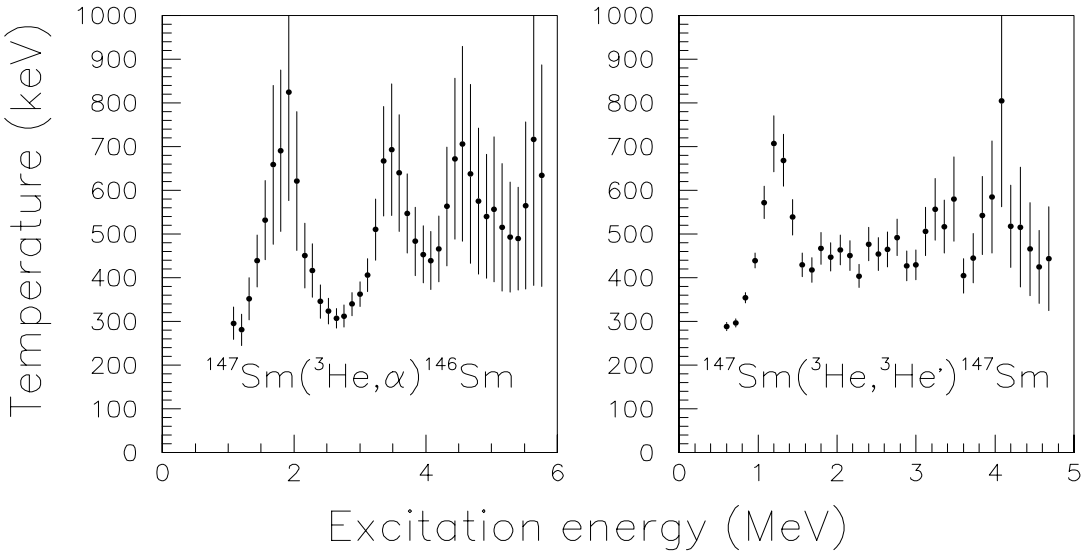

Figure 1: The microcanonical temperature as a function of excitation energy for ^{146,147}Sm.

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