Thermodynamic properties of atomic nuclei with $T < 1$ MeV *

M. Guttormsen[1], A.C. Larsen[1], J. Rekstad[1], A. Schiller[2], S. Siem[1], N.U.H. Syed[1] and A. Voinov[2]

[1] Department of Physics, University of Oslo, Box 1048 Blindern, N-0316 Oslo, Norway
[2] Department of Physics and Astronomy, Ohio University, Athens, OH, 45701, USA

The Oslo nuclear physics group has developed a method [1-4] to extract nuclear level density and γ-ray strength function simultaneously from particle-γ coincidences. The experiments are performed with light-particle inelastic or transfer reactions. The charged ejectile is used to tag γ-ray spectra with excitation energies from the ground state up to the neutron (or proton) binding energy. The particle-γ coincidences are measured with the highly efficient CACTUS detector set-up at the Oslo Cyclotron Laboratory.

The method will be explained to some detail and blind tests of the predictability of the method is demonstrated. Furthermore, we focus in this talk on experimentally extracted entropies as function of excitation energy for nuclei in various mass regions.

The thermal motion of single particles represents the largest contribution to nuclear entropy and is essential for the description of thermodynamic properties [5]. The concept of thermal single-quasiparticle entropy will be presented. It will be shown that this quantity is approximately extensive (additive) for mid-shell nuclei. Various applications of thermodynamics in heated nuclei will be discussed.

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[1] L. Henden *et al.*, Nucl. Phys. **A589**, 249 (1995).
[2] A. Schiller *et al.*, Nucl. Instr. Methods Phys. Res. **A 447**, 498 (2000).
[3] M. Guttormsen *et al.*, Nucl. Instr. Methods Phys. Res. **A 374**, 371 (1996).
[4] M. Guttormsen *et al.*, Nucl. Instr. Methods Phys. Res. **A 255**, 518 (1987).
[5] M. Guttormsen *et al.*, Phys. Rev. **C63**, 044301 (2001).