IS THE GENERALIZED BRINK-AXEL HYPOTHESIS VALID?

M. Guttormsen[1], A. C. Larsen[1], A. Görgen[1], T. Renstrøm[1], S. Siem[1], T. G. Tornyi[1,2], and G. M. Tveten[1]

[1]Department of Physics, University of Oslo, N-0316 Oslo, Norway
[2]Department of Nuclear Physics, Australian National University, Canberra, Australia

More than sixty years ago, Brink proposed in his Ph.D. thesis that the photoabsorption cross section of the giant electric dipole resonance is independent of the detailed structure of the initial state. In more general terms, the hypothesis implies that the dipole γ-decay strength has no explicit dependence on excitation energy or spin, except the obvious dipole transition selection rules.

The generalized Brink-Axel (gBA) hypothesis is used in a variety of applications as it drastically simplifies the considered problem and in some cases is a necessity in order to perform the calculations. Hence, the question of whether the hypothesis is valid or not, and under which circumstances, is of utmost importance. The gBA hypothesis has fundamental impact on nuclear structure and dynamics, and has a pivotal role in the description of γ and β decay for applied nuclear physics. In particular, the hypothesis is the basis for calculating (n, γ) cross-section needed to model the *r*-process nucleosynthesis and next-generation fast nuclear reactors.

In this work, experimental results on the ^{237}Np(d, pγ)^{238}Np reaction are presented, which verifies the gBA hypothesis for γ transitions between states in the quasi-continuum excitation region, not only for specific collective resonances but for the full dipole strength below the neutron separation energy. We discuss the validity of the gBA also for lighter systems where the concept of average γ-strength is problematic due to large Porter-Thomas fluctuations. Criteria for the validity of the gBA hypothesis are presented.