Statistical vs. direct γ-decay of ^{64,65}Ni

L. Crespo Campo[1], M. Guttormsen[1], A. C. Larsen[1], F. L. Bello Garrote[1], T. K. Erisken[2], A. Görgen[1], K. Hadynska-Klek[3], M. Klintefjord[1], T. Renstrøm[1], E. Sahin[1], S. Siem[1], A. Springer[1], T. G. Tornyi[2], G. M. Tveten[1]

[1] Dept. of Physics, University of Oslo, N-0316 Oslo, Norway

[2] Dept. of Nuclear Physics, The Australian National University, ACT 2601, Australia.

[3] Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Legnaro, 2 35020 Legnaro, Italy

Several analytical techniques in nuclear physics are based on the generalized Brink-Axel hypothesis (gBA), since it considerably simplifies calculations. In general terms, the gBA hypothesis implies that the dipole γ-strength is independent on the structure of the initial state, having no explicit dependence on the excitation energy, spin or parity, besides the selection rules for dipole transitions [1, 2]. Therefore, when the gBA hypothesis is valid, the γ-Strength Function (γSF) depends solely on the γ-ray energy for dipole radiation [3].

Given the extensive application of the gBA hypothesis, it is of great importance to determine the circumstances under which this hypothesis holds. This is often a difficult task, specially for nuclei in which strong Porter-Thomas fluctuations are observed. As shown in Ref. [5], the heavy odd-odd nucleus ^{237}Np presents a extremely high level density ($\approx 10^7$ levels/MeV). Averaging over many γ-transitions can be then performed and Porter-Thomas fluctuations are less significant. In contrast, lighter nuclei such as ^{64,65}Ni present a much lower level density ($\approx 10^3$ levels/MeV) and strong Porter-Thomas fluctuations are seen. Extracting conclusions regarding the validity of the gBA hypothesis becomes then more difficult and the role of Porter-Thomas fluctuations needs to be investigated in more detail.

In this talk, the validity of the gBA hypothesis in ^{64,65}Ni is discussed. The analysis of particle-γ coincidences on the ^{64}Ni$(p, p'\gamma)^{64}$Ni and ^{64}Ni$(d, p\gamma)^{65}$Ni reactions [6, 7] is here presented together with a further study of the γSF of ^{64,65}Ni. The dependence of the γSF with initial and final excitation energy is investigated and the role of Porter-Thomas fluctuations estimated.

[1] D. M. Brink, P.h.D. thesis, Oxford University, 1955.

[2] P. Axel, Phys. Rev. 126, 671 (1962).

[3] G. A. Bartholomew *et al.*, Advances in Nuclear Physics, edited by M. Baranger and E. Vogt (Plenum, New York, 1973), Vol. 7, p. 229.

[4] C. E. Porter and R. G. Thomas, Phys. Rev. **104**, 483 (1956).

[5] M. Guttormsen,*et al*, Phys. Rev. Lett. **116**, 012502 (2016). M. Guttormsen, *et al*, *Is the generalized Brink-Axel hypothesis valid?*, 26th International Nuclear Physics Conference, Adelaide, Australia. Submitted to Proceedings of Science (2016).

[6] L. Crespo Campo, *et al.* Phys. Rev. C **T 94**, 044321 (2016)

[7] L. Crespo Campo, *et al.*, *Investigating the γ-decay of ^{65}Ni*, to be submitted to Phys. Rev. C.