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Absolute electromagnetic transition rates in semi-magic N = 50 and 126 isotones as a test for $(\pi_{9/2})^n$ single particle calculations.

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Assuming the presence of one- and two-body interactions, single-j calculations for $(j)^n$ configurations with n = 1,...,2j+1 can be performed using a semi-empirical approach, provided that the energies and absolute electromagnetic transition rates are known for the two-particle (hole) nucleus. Using those and the coefficients of fractional parentage, all needed matrix elements for the $(j)^n$ configurations can be predicted.

At the Cologne Tandem Accelerator of the Institute for Nuclear Physics we have tested these relations by measuring lifetimes of excited states in the $(\pi_{9/2})^n$ isotones with N = 50 and N = 126 over the last years. We started the studies in the two-proton nucleus ²¹⁰Po where the abnormal B(E2:2⁺₁ \rightarrow 0⁺₁) value was remeasured, providing important input for the other configurations [1]. Then lifetimes of excited states in ²¹¹At were measured using the electronic γ - γ fast timing technique, the Recoil Distance Doppler Shift (RDDS) method, and the Doppler Shift Attenuation (DSA) method~[2,3]. Very good agreement with the analytical single-j calculation is obtained. We will also shortly report on our study of ²¹³Fr.

For N=50 isotones, we recently started by remeasuring the previously unknown B(E2:4⁺₁ \rightarrow 2⁺₁) value needed for the prediction of other N=50 isotones with Z= 41-50 [4]. We will also report on experiments on ⁹³Tc, ⁹⁴Ru and ⁹⁶Pd, as well on ⁹⁴Ru and ⁹⁵Rh at FAIR Phase-0 [5].\\

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[2] V. Karayonchev, A. Blazhev, A. Esmaylzadeh, J. Jolie, M. Dannhoff, F. Diel, F. Dunkel, C. Fransen, L. M. Gerhard, R.-B. Gerst, L. Knafla, L. Kornwebel, C. Müller-Gatermann, J.-M. Régis, N. Warr, K. O. Zell, M. Stoyanova, and P. Van Isacker, Phys. Rev. C 99 (2019) 024326

[3] V. Karayonchev, A. Blazhev, J. Jolie, A. Dewald, A. Esmaylzadeh, C. Fransen, G. Häfner, L. Knafla, C. Müller-Gatermann, G. Rainovski, J. -M. Régis, K. Schomacker, and P. Van Isacker, Phys. Rev. C 106, (2022) 044321.
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[5] B. Das et al., Phys. Rev. C 105 (2022) L031304 and submitted.

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