# Investigation of a sudden increase in collectivity at $^{170,172}$W*

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The rare-earth isotopes represent one of the best-studied regions of the nuclear chart with respect to quadrupole deformation and, thus, provide a testing ground for the development of nuclear structure and collectivity. The $R_{4/2}$ value and the $B(E2; 2_1^+ \to 0_1^+)$ value serve as indicators for nuclear structure. Especially the observables for the isotopes around $N = 90$ [1, 2] undergo a rapid change between the theoretical limits for spherical and axial deformation. However, the tungsten isotopic chain offers an astonishing anomaly. The data imply a smooth evolution of the $R_{4/2}$ value with increasing neutron number, while the literature data on $B(E2; 2_1^+ \to 0_1^+)$ values suggest a sudden change in deformation around $N = 96, 98$.

We conducted an experiment to investigate the absolute yrast $E2$ transition strengths of $^{170}$W applying a lifetime measurement [3]. The $B(E2)$ values exhibit an $X(5)$-like character, which fits to its $R_{4/2}$ value of 2.95 being close to the limit representing the $X(5)$ symmetry [4] of 2.90 and having a $P$ factor of $\sim 5$. To extend our investigation to $N = 98$, we performed a lifetime measurement of yrast states of $^{172}$W at the 10 MV FN-tandem accelerator at the University of Cologne. The new Cologne CATHEDRAL (Cologne Coincidence detector Array at the Tandem accelerator for High Efficiency Doppler shift Recoil and LaBr fast-timing measurements) spectrometer was used together with the Cologne plunger device [5] to simultaneously apply the fast-timing and the recoil distance Doppler-shift (RDDS) methods to cover a wide range of lifetimes.

The lifetimes of the $2_1^+$ and $4_1^+$ states of $^{172}$W were determined with the fast-timing method. The lifetimes of higher-lying states were determined with the RDDS method. The results of $^{170}$W and $^{172}$W are compared to the confined $\beta$-soft rotor model [6].

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*This work is supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) as part of the Research Training Group 2128 Accelence and Project-ID 499256822 - GRK 2891 'Nuclear Photonics' and by the German Federal Ministry of Education and Research (BMBF) under Grant No. 05P21RDCI2.