

## Independent evidence for $M1$ scissors resonances built on the levels in the quasicontinuum of $^{163}\text{Dy}$

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Recently, it has been found from the data on two-step cascades (TSCs) following the capture of thermal neutrons in deformed  $^{162}\text{Dy}$  that the  $M1$  scissors mode, which is systematically observed in the nuclear resonance-fluorescence experiments, is exhibited not only by a 3 MeV resonance-like gross structure in the photoexcitation cross section, but – in line with the Brink hypothesis – also by analogous “scissors resonances” built on each level in  $^{163}\text{Dy}$ , including the levels in the quasicontinuum. This finding is of fundamental importance for understanding the deexcitation mechanism of deformed nuclei. Its confirmation from other independent experiments is highly desired. For this purpose the data on multi-step  $\gamma$ -cascades following the neutron capture at unresolved  $s$ - and  $p$ -wave neutron resonances with energies of 20-100 keV have been analyzed. These data were obtained from the measurements undertaken with the  $4\pi$  BaF<sub>2</sub> detector system installed at the Karlsruhe Van de Graaff facility. It is concluded that with entire absence of scissors resonances or with their presence only at  $^{163}\text{Dy}$  levels with excitation energy below 2.5 MeV the shapes of the expected  $\gamma$ -ray spectra of the multi-step cascades are in sharp disagreement with the observed spectra, in particular with the spectra for  $\gamma$  multiplicities 2-4. On the other hand, the assumption that scissors resonances are built on *all*  $^{163}\text{Dy}$  levels, including levels in the quasicontinuum, leads to almost ideal accordance between the predicted and measured multi-step  $\gamma$ -ray spectra, which fully corroborates the earlier finding from our thermal capture TSC data.

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