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Lifetime measurements of the rotational quasi-continuum transitions in ^{163}Tm

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Abstract

The lifetime of the unresolved transitions forming the rotational quasi-continuum spectra has been measured in ^{163}Tm using the Doppler shift attenuation technique. Spectra associated to different values of the coincidence folds, angular anisotropies and the dynamical moment of inertia were also obtained from the present experiment. The Doppler shift has been measured for discrete transitions, for the ridge structures in $E_{\gamma 1} \times E_{\gamma 2}$ spectra and for the rotational E2 bump in one dimensional spectra. The data were compared to the theory using a simulation model which makes use of microscopically calculated levels and transition probabilities. Above 1300 keV the results indicate collectivity with lifetime faster than 10^{-14}s, while at lower E_γ the results are well described by predictions with $B(E2) = 400$ WU. © 1997 Elsevier Science B.V.

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Progress in the study of the rotational quasi-continuum for normally deformed nuclei in the rare earth region has been made in the last few years by employing two different techniques, one based on the shape analysis of the ''ridge-valley'' structure in $E_{\gamma 1} \times E_{\gamma 2}$ spectra [1], and the other on a fluctuation analysis method [2]. These techniques were used to extract information about the regular excited rotational bands forming ridges and on the damped motion characterizing the region of high level density.

A particularly interesting effect was obtained by analysing the shape of the valley in measured $E_{\gamma 1} \times E_{\gamma 2}$ spectra [1]. The valley region along the $E_{\gamma 1} = E_{\gamma 2}$ diagonal is mainly populated by γ-rays from the region of damped rotational transitions at high excitation energy. In the picture of the rotational damping one expects that the spreading of the rotational strength over many states gives rise to uncorrelated transitions for two consecutive γ-decay-steps, namely independently chosen by the nucleus from the corresponding $B(E2)$ distributions [3]. In contrast, the experimental study of the shape of the valley for ^{163}Tm gave results in disagreement with this assumption [1]. This led to the conclusion that either the rotational damping mechanism is more complex than

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