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Study of the ^{169}Tm(n, γ) reaction using DANCE facility at LANSCE

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The reason for studying the neutron capture reaction on the mono-isotopic element thulium is twofold. Its only stable isotope, ^{169}Tm, is often used as a neutron-flux activation monitor. The neutron capture cross-section in the relevant energy range has been measured several times \[1-4] in the past and more recently at CSNS \5. While these data show rough agreement, there are significant differences. Moreover, the uncertainties are often not quoted. These two motivate a state-of-the-art measurement and analysis of the neutron capture cross-section in the keV energy range.

The neutron capture cross-section can also be calculated via the Hauser-Feshbach approach \6, for which the key ingredients are the photon-strength-functions (PSFs) and nuclear level density (NLD). These quantities can be inferred from the γ-ray spectra of *s*-wave resonances by comparing them to the simulated spectra.

The neutron-capture reactions on the ^{169}Tm nuclei have been measured with the DANCE calorimeter \[7,8] at LANSCE \9. The background-corrected sum-energy and multi-step-cascade spectra were extracted for a number of strong isolated *s*-wave resonances. These experimental coincident γ-ray spectra are compared with their simulated counterparts using Monte-Carlo code DICEBOX \10 to obtain information about PSFs and NLD. In particular, we investigate the scissors-mode (SM) role in the *M1* PSF. Previously, SM parameters of well-deformed rare-earth nuclei were obtained by several experimental techniques, see e.g. Refs. \[11-13] and review \14. They show significant differences, especially in the strength of the mode. The shape of the low-energy tail of the giant electric-dipole resonance is uncertain too. Because of these inconsistencies, additional information on PSFs in this region is of great interest.

The neutron capture cross-section is deduced from the experimental data in the usual fashion, i.e. by subtracting backgrounds, determining the neutron flux using several flux monitors, and normalizing to the standard cross-section. The analysis steps, internal consistency of our data, preliminary results on PSFs, and neutron capture cross-sections will be presented.

\[1][R. C. Block *et al.*, Conference proceedings, "Time of Flight Methods,"Saclay, 1961.][1]
\2[J. Gibbons *et al.*, Phys. Rev. **122**, 182 (1961).]2
\3[R. L. Macklin *et al.*, Nucl. Sci. Eng. **82**, 143 (1982).]3
\[4][Y.-J. Xia *et al.*, Chinese Nucl. Phys. **11**, 75 (1989).][4]
\5[J. Ren *et al.*, Chin. Phys. C **46**, 044002 (2022).]5
\6[W. Hauser and H. Feshbach, Phys. Rev. **87**, 366 (1952).]6
\7[M. Heil *et al.*, Nucl. Instrum. Methods Phys. Res., Sect. A **459**, 229 (2001).]7
\8[R. Reifarth *et al.*, Nucl. Instrum. Methods Phys. Res., Sect. A **531**, 530 (2004).]8
\9[M. Mocko and G. Muhrer, Nucl. Instrum. Methods Phys. Res., Sect. A **704**, 27 (2013).]9
\10[F. Bečvář, Nucl. Instr. Methods A **417**, 434 (1998).]10
\11[U. Kneissl, H. H. Pitz, and A. Zilges, Prog. Part. Nucl. Phys. **37**, 349 (1996).]11
\12[I. Knapová *et al.*, Phys. Rev. C **107**, 044313 (2023).]12
\13[E. Melby *et al.*, Phys. Rev. C **63**, 044309 (2001).]13
\14[S. Goriely *et al.*, Eur. Phys. J. A **55**, 172 (2019).]14

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