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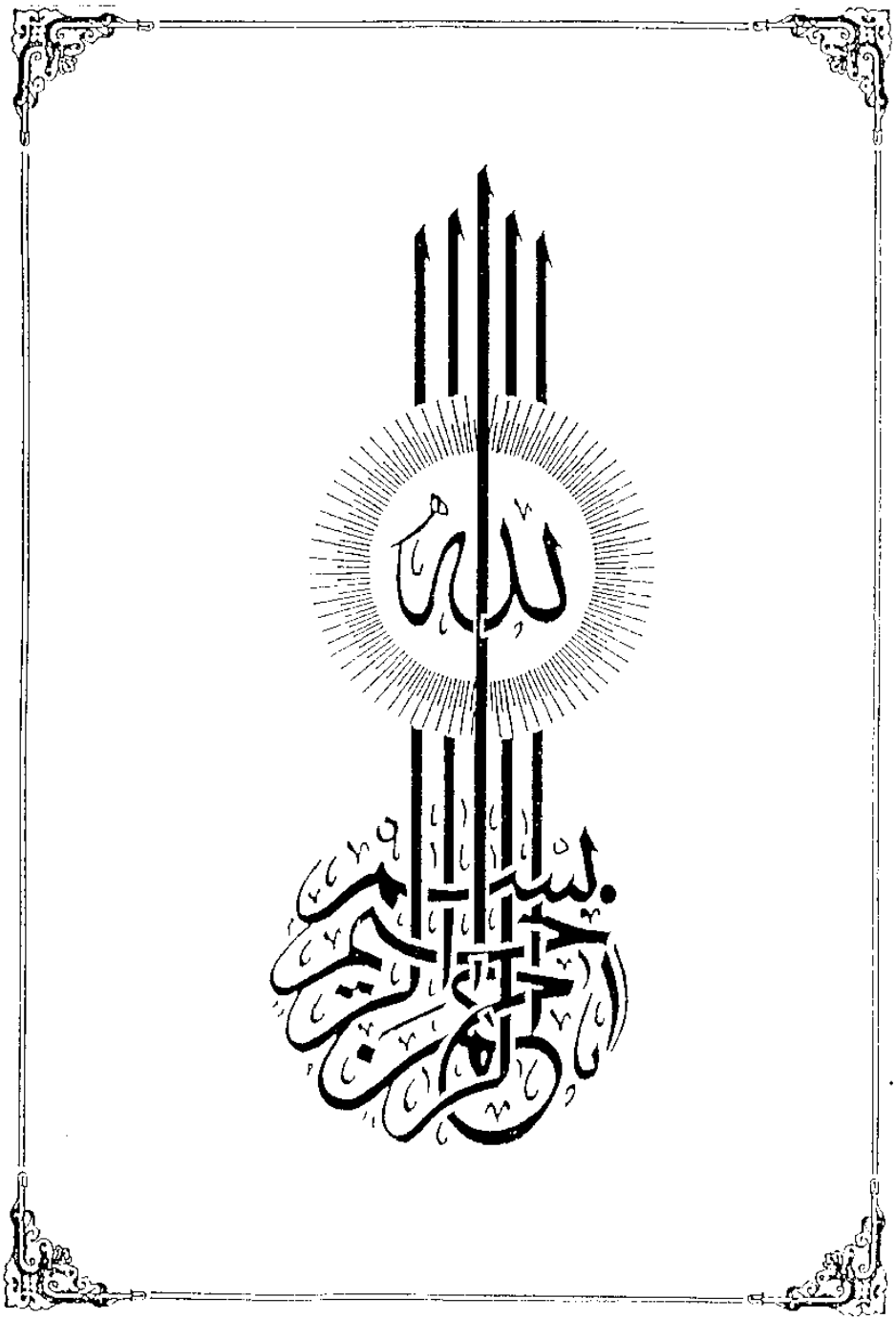

Ain Shams University
College for Girls, Arts,
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STUDY OF SOME NUCLEAR PROPERTIES OF ^{169}Tm

THESIS
Submitted to College for Girls
Ain Shams University
For the degree of
DOCTOR OF PHILOSOPHY
(Physics)

Presented by
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1997

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TO MY HUSBAND

WHO LET ME IN REST

AND HELPED ME IN

THIS WORK

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I kneel humbly to **GOD** thanking HIM for showing me the right path, with out HIS help my efforts would have gone astray.

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3. **Dr. Magda Abdel Wahab**
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CONTENTS

ABSTRACT

The decay of ^{169}Yb by electron capture to ^{169}Tm was studied using two hyper pure Germanium detectors in singles and fast-slow coincidence spectrometers, together with a HP Ge-NaI (Tl) coincidence spectrometer.

From the present singles and coincidence results fifty six gamma transitions have been attributed to the decay of ^{169}Yb to ^{169}Tm, four of which at energies 96.99, 191.37, 211.59 and 216.50 keV were observed for the first time and confirmed in the γ-γ coincidence measurements to follow the decay of ^{169}Yb.

A new position was proposed to the 336.33 keV transition proposed by previous authors. Five of the seven gamma transitions proposed by ref.(3) were confirmed, five of the eight transitions proposed by ref. (49) and latter in the data of ref.(42) were confirmed in the present work and eleven of the twenty two transitions present only in ref.(42) were confirmed according to the present singles and/or coincidence results.

The gamma ray energies, relative intensities and total intensities were determined. The electron capture branching ratios were obtained based on the present gamma ray intensities, the internal conversion corrections for the gamma ray transition intensities were obtained using either the internal conversion coefficients reported previously(42) or calculated using the theoretical values of ref.(29), the log (ft) values were deduced as well.

Theoretical calculations for energy states of ^{169}Tm has been given using two methods : strong coupling method in terms of angular momentum expansion and for the first time particle-core coupling method assuming γ-deformation effect in addition to the β-deformation effect.

In the present work, the strong coupling method neglecting coriolis effect is used to study the level structure of the positive parity bands $1/2^+$ [411], $3/2^+$ [411] and $7/2^+$ [404] and the negative parity

bands $1/2^-$ [541] and $7/2^-$ [523]. A good agreement with experimental results is obtained.

The γ-deformation effect on energy states is studied. The value of γ - is calculated from the states 2^+_1 (0.0798 MeV) and 2^+_2 (0.8211 MeV) and 3^+_1 (0.8957 MeV) in the core ^{168}Er and is found to be 11.50. Assuming that

$$^{169}Tm = {}^{168}Er + P.$$

The positive and negative parity bands in the nucleus ^{169}Tm are studied for the first time assuming γ-dependent effect of moment of inertia on the excited energy states of the required bands. These theoretical calculations are done using the FORTRAN Program AR02. The calculation of positive parity bands $1/2^+$ [411] and $7/2^+$ [404] build on the $2d_{3/2}$ and $1g_{7/2}$ single particle states, the results of variation of energy states with λ for the ground state band indicate that λ is positive in order to obtain the experimental spin sequence of that band.

The negative parity bands $1/2^-$ [541] and $7/2^-$ [523] are also calculated using the AR02 program. The results are in good agreement with experimental results. Calculations indicate that λ is negative and the γ-values are relatively small varied from that of positive parity states which indicates that the nucleus ^{169}Tm is not statistically stable against γ-deformation.