THE DECAY OF $^{131m}$Te AND $^{131g}$Te TO $^{131}$I LEVELS

By

Z. MILIGY, D. A. E. DARWISH and S. A. EID

PHYSICS DEPARTMENT, FACULTY OF SCIENCE, AIN SHAMS UNIVERSITY
CAIRO, EGYPT

(Received in revised form 18. XII. 1974)

The gamma rays emitted in the decay of $^{131m}$Te and $^{131g}$Te to levels in $^{131}$I were investigated by means of a Ge(Li) spectrometer. The energies and intensities of 78 gamma-rays were determined from the gamma-ray singles spectra. Of these, 21 gamma-transitions reported for the first time in the present work, are identified to $^{131}$I. A new level not reported before has been proposed at 1854 keV excitation energy.

Two-parameter gamma-gamma coincidence experiments with Ge(Li) and NaI(Tl) detectors have been performed. The resolving time of the fast coincidence circuit was 50 nsec. A level scheme has been constructed for $^{131}$I on the basis of energy, intensity and coincidence measurements. The most probable spins and parities, values of mixing parameters and multipolarities of gamma rays were determined from gamma-gamma directional angular correlation measurements and log ft values. The results of spin assignment to some levels in $^{131}$I from the present work are summarised in the following, where the level energy is in keV followed by the spin and parity as $[J^P]$:

$590 (3/2^+), 603 (5/2^+), 773.7 (9/2^+), 877 (1/2^+), 1065 (9/2^+), 1188 (1/2^+), 1315 (9/2^+), 1556.4 (9/2^+), 1596.5 (11/2^+), 1646 (9/2^-), 1797 (11/2^-, 13/2^-), 1804 (9/2^-, 11/2^-, 13/2^-), 1888 (9/2^-, 11/2^-), 1899 (9/2^-), 1980 (11/2^-), 2001 (9/2^-), 2118 (9/2^-, 11/2^-, 13/2^-), 2231 (13/2^-), 2240 (9/2^-, 11/2^-) and 2330 (9/2^-, 11/2^-).

Introduction

The decay of $^{131m}$Te, $^{131g}$Te to $^{131}$I was investigated previously by many authors using beta- and gamma-ray spectrometers [1—12]. Most of the extant experimental information on $^{131}$Te decay has been summarized in the compilation of LEUERER et al. [13]. E. HOBB [1] studied the decay of $^{131}$Te and determined the end point energies of some beta-groups. The ratio $K/L^+M$ for the isomeric transition has been given to be 2.4 corresponding to $M^4$ transition. FERGUSON et al. [2] measured the gamma-ray spectrum from $^{131m}$Te and constructed a decay scheme for $^{131}$I. DEVARE et al. [3] studying this decay reported more levels in $^{131}$I. In a later paper [4] they investigated the decay of $^{131m}$Te and $^{131g}$Te and suggested the presence of 18 levels in $^{131}$I in the excitation energy range from 150 keV to 2330 keV. WALTERS et al. [5] observed 20 gamma-rays in the decay of $^{131}$Te applying a Ge(Li) detector.

Recent studies by KELLY et al. [6—10] on odd mass antimony and iodine isotopes showed that the level schemes of such isotopes were more complex than previously reported. BEYER et al. [11] investigating the disintegration
scheme of the 30 hrs $^{131m}$Te, determined the energies of 45 gamma-rays and suggested the presence of 17 levels in $^{131}$I of excitation energies between 149.7 keV and 2270 keV. From data on internal conversion, Beyer et al. [12] determined the characters and mixing ratios of 8 gamma-ray transitions.

It has been found advisable to reinvestigate the decay of $^{131g}$Te and $^{131m}$Te in order to remove the present discrepancies and to achieve a more reliable scheme for the decay of $^{131}$Te to $^{131}$I. The sources were made by irradiation of tellurium metal enriched to 95% in mass 130. Irradiation took place by a thermal neutron flux of $\sim 10^{12}$ n. cm$^{-2}$ sec$^{-1}$ in the A.R.E. Reactor for a period of 5 hours. Measurements usually started within 2--4 hours after the end of the irradiation period.

**Gamma-ray energy and intensity measurements**

The gamma-ray singles spectra were measured applying a 10 cm$^3$ Ge(Li) detector (4 keV FWHM at 1333 keV line of $^{60}$Co) coupled to a Tennelec TC 135 preamplifier, a TC 20 BLR linear amplifier, a TC 252 biased amplifier and a

![Graph of gamma-ray energy and intensity measurements](image)

*Fig. 1a. Singles gamma-ray spectrum of $^{131g}$Te and $^{131m}$Te*