The Special Nuclear Structure of ^{131}Te ◇

T. v. Egidy, H. F. Wirth, I. Tomandl [a], J. Honzatko [a], V. Bondarenko [b], D. Bucurescu [c], Y. Eisermann, G. Graw, R. Hertenberger, and S. Raman [d]
[a] Nuclear Physics Institute, CZ-25068 Rez, Czech Republic
[b] Institute of Solid State Physics, University of Latvia, LV-1063 Riga, Latvia
[c] Horia Hulubei Institute of Physics and Nuclear Engineering, RO-76900, Bucharest, Romania
[d] Oak Ridge National Laboratory, Oak Ridge TN 37831, USA

The nuclear structure of Te isotopes deserves special interest due to the vicinity to the magic Sn nuclides with Z=50. The open questions were whether the U(5) or the O(6) symmetry of the interacting boson model or the quasiparticle phonon model reproduce better the observed structure, whether intruder states exist at low excitations and why the $11/2^-$ isomer is relatively strongly populated in (γ,γ') and (n,γ) reactions. Consequently, a large international collaboration investigates all Te isotopes which can be studied with (n,γ) and one-nucleon transfer reactions: ^{119}Te, ^{121}Te, ^{122}Te, ^{123}Te, ^{124}Te, ^{125}Te, ^{126}Te, ^{127}Te, ^{129}Te, ^{131}Te (see previous Jahresberichte).

The nucleus ^{131}Te is the heaviest in this chain and approaches the doubly magic nucleus ^{132}Sn and ^{134}Te, the most frequent fission fragment. We performed the (n,$\gamma\gamma$) reaction at Řež with two Ge detectors in coincidence. The ^{130}Te($\vec{d}$,p)^{131}Te reaction was measured with polarized deuterons at the Q3D spectrograph of the Munich Tandem Accelerator. This new very extensive experimental information together with previous results yielded a rather complete level scheme with 84 levels containing 380 lines, nearly all confirmed by coincidences (see fig. 1). In many cases spin and parity values are given. This is an excellent basis for tests of various theories.

In this short report we would like to point at three special features of the level scheme of ^{131}Te:
i) Practically all γ-lines observed in the single (n,γ) spectrum were placed. The surprising observed completeness is demonstrated by the fact that the depopulation of the capture state is 100% and the population of the ground state and isomer is also 100%. This is very unusual for heavier nuclei. ii) There is an unexpected large number of 42 primary transitions with energies between 750 keV and 2500 keV to levels above 3500 keV as shown in fig. 1.
iii) About 2.1% of the population of the capture state goes through $1/2^+ \rightarrow 3/2^- \rightarrow 7/2^- \rightarrow 11/2^-$ cascades directly to the isomer indicating strong E2 transitions to higher spins.

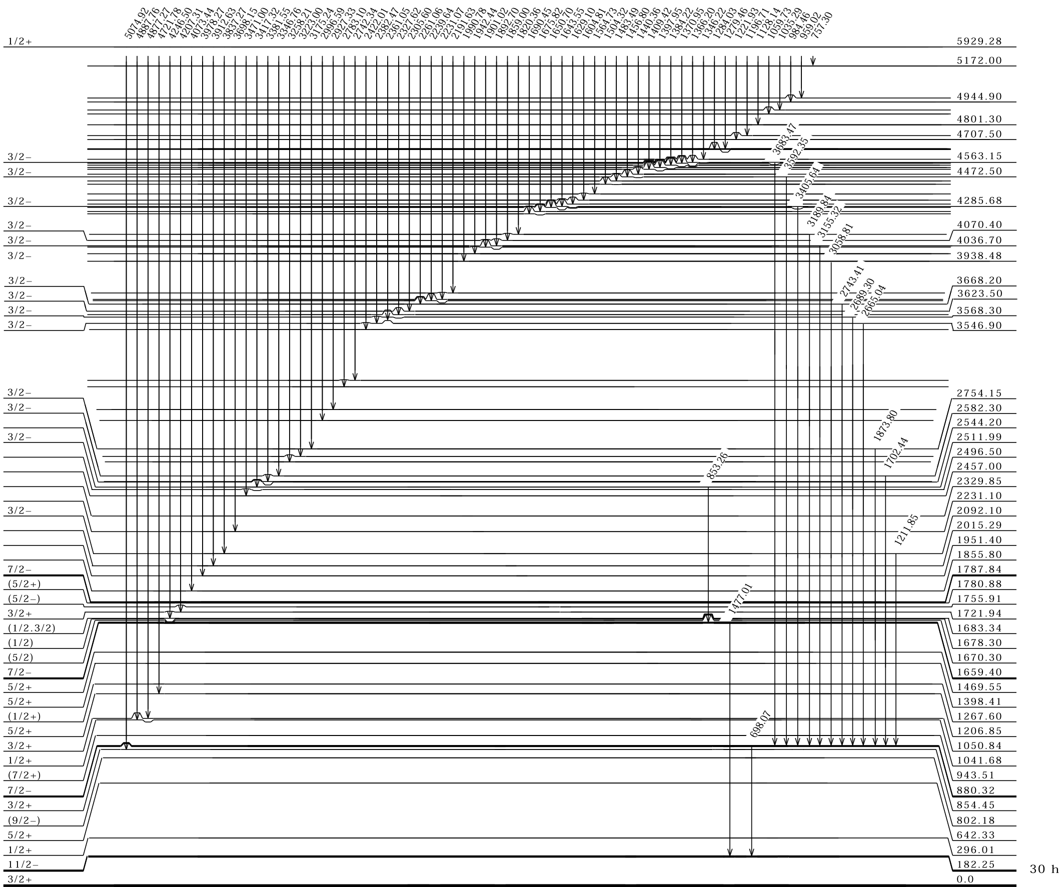

Fig. 1: The level scheme of ^{131}Te containing all primary transitions and cascades to the $11/2^-$ isomer.

◇ We wish to thank N. Pietralla, P. von Brentano, H. Machner and G. Bohlen for target material.