CONF-800452--1

HIGH SPIN ISOMERS IN ^{153}Er

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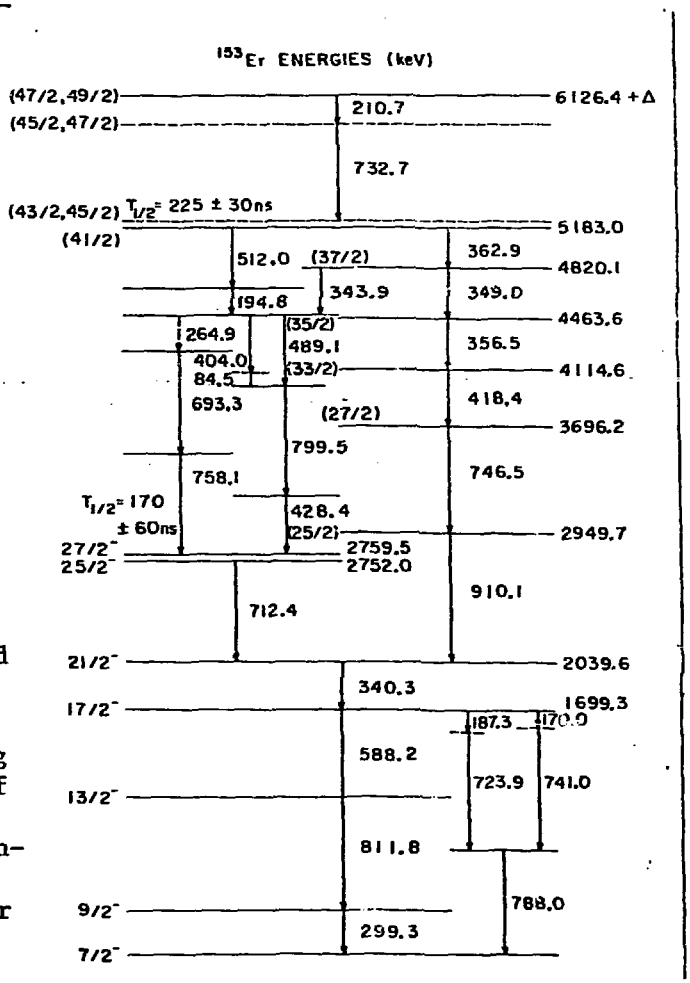
The N=85 isotones have provided striking examples of shell structure at high spins. For example, the signature of valence neutron states and their coupling to aligned proton configurations in ^{151}Dy has been discussed by Kleinheinz.[1] Such coupling frequently gives rise to isomeric states. Several survey experiments have reported evidence of high spin isomers in ^{153}Er.[2,3] Our investigation of ^{153}Er confirmed two long lived high spin isomers, and established their positions and decays.

An array of 4 NaI detectors in delayed coincidence with a Ge(Li) detector served to isolate those transitions associated with lifetimes ≥10ns. Identification of the delayed transitions was obtained from excitation functions and cross bombardments using ^{12}C+^{144}Sm, ^{11}B+^{144}Sm, and ^{32}S+^{124}Te. Measurements of angular distributions, halflives (pulsed beam), and γ-γ coincidences were all obtained using the ^{144}Sm(^{12}C,3n)^{153}Er reaction at 82 MeV.

The level ordering is based on coincidence timing, intensities at 82 MeV (A_0 from angular distribution), and relative intensities from the excitation functions. Due, in part, to the number of different reaction channels open, uncertainties remain and the level scheme shown at right should be considered tentative. The energy of the unobserved transition deexciting the $T_{1/2}$=170±60ns isomer is deduced to be 7.5 keV from crossovers which feed the isomer from the main cascade. Comparing this isomer with the analogous isomeric state in ^{151}Dy[1] yields a similar transition rate, indicating M1 character. The near-Yrast states are established up to an excitation energy of 5183.0 keV. Transitions deexciting this state show a half life of 225±30ns. Since tentative assignments do not suggest M2 or E3 character for the 362.9 keV γ-ray, the isomerism may



arise from an unobserved low-energy transition. Bjørnholm et al.[3] have reported an isomer at 5.2±0.25 MeV, but with a longer half-life than observed here.

Levels up to 2039.6 keV may be described in analogy with the other N=85 isotones as: (i) a $\nu(f_{7/2}^3)$ ground state configuration with two excited states, and (ii) a $\nu(h_{9/2}f_{7/2}^2)$ sequence with $J^\pi=9/2^-$ to $21/2^-$. The $27/2^-$ and $25/2^-$ states may be interpreted as $\pi(h_{11/2}^2) \otimes \nu(f_{7/2})^3$ with the 5/2 projection of $(f_{7/2})^3$ falling below the 7/2 projection as discussed in ref. 1. The pattern above the isomer certainly resembles that below, but further configuration assignments should await determination of level parities from our planned linear polarization measurements. The existence of a long-lived isomer of spin ≈22ħ, the complex feeding pattern, and the irregular energy spacings in this nucleus all favor the aligned single-particle picture for ^{153}Er at high spin.

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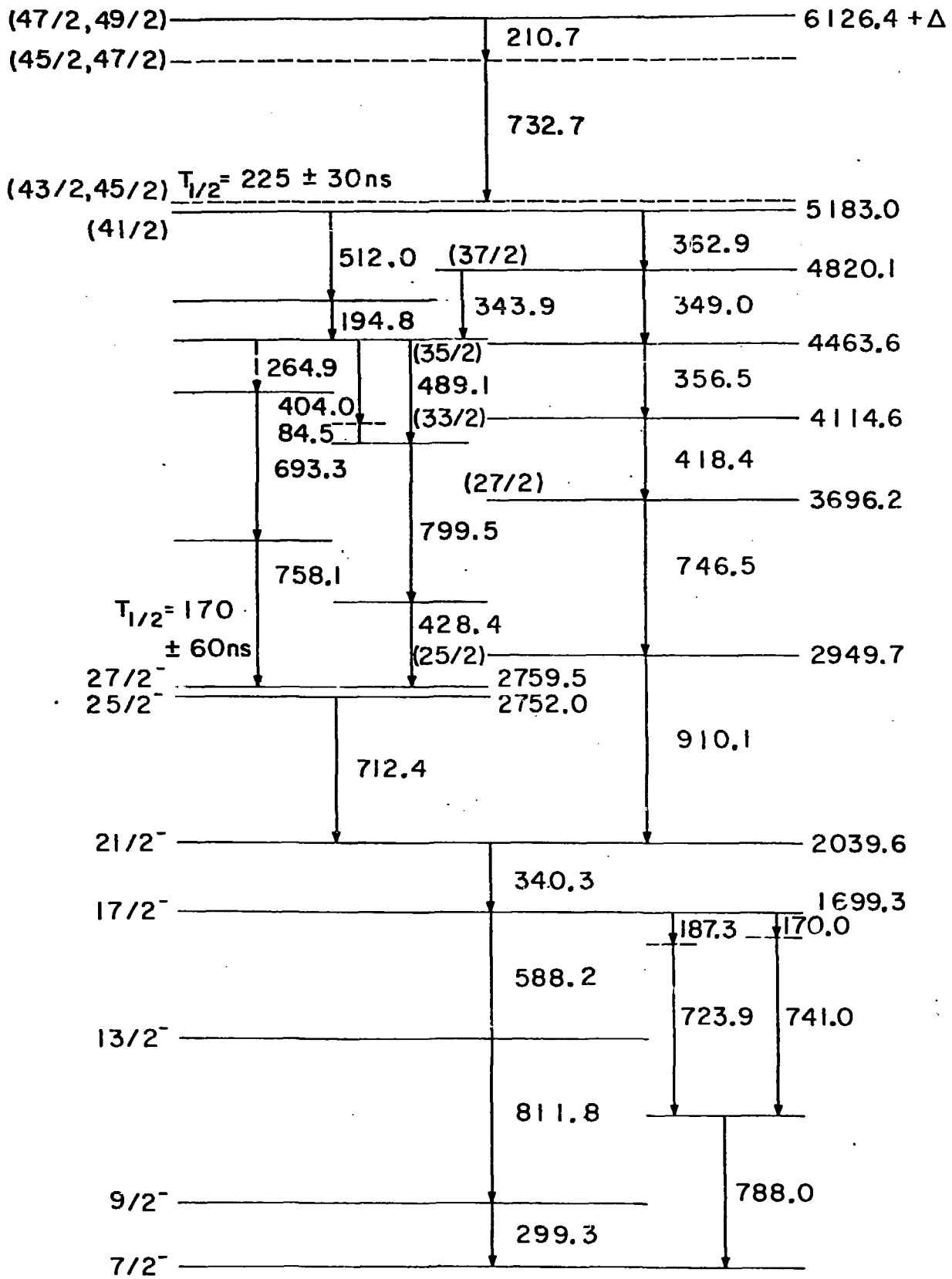
1. P. Kleinheinz, Proc. Symp. on High-Spin Phenomena in Nuclei, Argonne, Ill. (1979) 125.

2. D.J.C.M. Hageman, M.J.A. de Voight, and J.F.W. Jansen, Phys. Lett. 84B (1979) 301.

3. S. Bjørnholm, J. Borggreen, O. Christensen, A. DelZoppo, B. Herskind, J. Pedersen, and G.Sletten, Proc. Symp. on High-Spin Phenomena in Nuclei, Argonne, Ill. (1979) 421.

^{153}Er ENERGIES (keV)



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