Brief Communications

NEW DATA ON THE EXCITED LEVELS OF W^{182}

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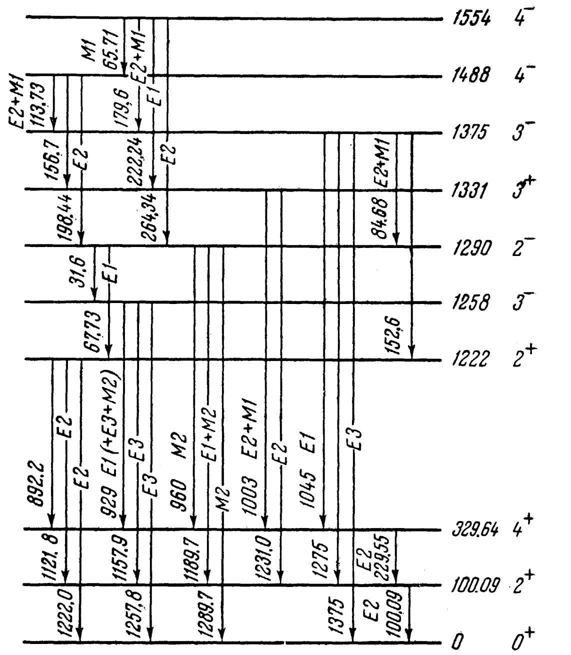
IN the toroidal-field, iron-free double β-spectrometer [1] at the Institute of Theoretical and Experimental Physics, we have investigated the conversion electron and photoelectron spectra of W^{182}. A diagram of the excited levels of W^{182} constructed from our data is shown below; the experimentally determined multipole orders are indicated.



The multipole orders of the low energy transitions were determined from the ratios of internal conversion coefficients in the different subshells. The multipole orders of the high energy transitions were determined from the intensities in the internal conversion electron and photoelectron spectra.

We have observed for the first time a transition with an energy of 892.2 keV between the levels 1222 and 329.6 keV. Vitman et al [2] were previously unable to observe this transition because of its anomalously low intensity (0.24 ± 0.05% of the intensity of the 1121.8 keV transition). It should be noted that according to existing theories [3-5] the intensity of the 892.2 keV transition should be roughly an order of magnitude greater.

If in one of the levels (1222 or 329.6 keV) there is a mixture of states with different K-quantum numbers (projections of angular momentum on the nuclear symmetry axis), then the low intensity of the 892.2 keV transition can be explained by the existence of destructive interference between the radiations proceeding from (or to) the states with different K.

The assumption that the 329.6 keV (4^+) level is not pure is supported by the existence of type E1 transitions to it from the 3^- levels (1258 and 1375 keV).

On the basis of the transition multipole orders we determined spins and parities of a number of excited levels of W^{182}. Our results agree with those published in the literature for all the levels studied by us except the 1258 keV level. For this level we obtained a spin and parity of 3^-, while other authors give for it, on the basis of indirect experiments, 2^+ [6,7] or 1^- [8].

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MEAN ENERGY OF THE β-SPECTRUM OF Pr^{142}

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THE beta spectrum of Pr^{142} is complex and consists of a hard component with an end-point energy of 2165 keV [1] corresponding to a unique first-forbidden transition to the ground state of the product nucleus, and a soft component with $E_{max} \sim 590$ keV and an intensity of 3.7% [2]. This component corresponds to a transition to the first and, apparently, the single excited level of Nd^{142} at an energy of 1572 keV [1,3].

No specific experimental determinations of the mean β-spectrum energy $\bar{E}_\beta$ for Pr^{142} have been made. The values computed by us from the distribution curves given by Pohm et al [1] and Jensen et al [4] are 805 and 870 keV, respectively. The error in these values is at least 5–10%. More exact values of $\bar{E}_\beta$ can be obtained from the calorimetric method, which is not affected by factors such as electron scattering in the source and in the apparatus, diffusion of radioactive atoms into the substrate material, electrical charging of the latter, etc. We give below the results of calorimetric measurements of $\bar{E}_\beta$ for Pr^{142}, performed with the technique previously described by us [5]. Two series of measurements were made with different samples. For the mean energy of the combined β-spectra of Pr^{142} we obtained the value 701 ± 16 keV, and for the main hard component of the spectrum, 814 ± 16 keV. The latter value was compared with theoretical values of $\bar{E}_\beta$ computed using the following form factors:

1) $S = 1$ (allowed spectrum);
2) $S = \alpha = (w^2 - 1) + (w_0 - w)^2$;
3) $S_1{}^2 = (w_0 - w)^2 L_0 + 9 L_1$ [6];
4) $S_\lambda = (w^2 - 1) + \lambda (w_0 - w)^2$ [7]

and equal respectively to 831.7, 847.3, 821.3, and 820.1 keV. It is evident from the values listed that the mean energy of the Pr^{142} β-spectrum depends only slightly on the choice of form factor and is close to the value for an allowed spectrum. Nevertheless we can draw the conclusion that even for hard β-spectra with end-point energies exceeding 2 MeV, and Z ~ 60, use in the spectrum analysis of the form factor α, which does not take into account the influence of the Coulomb field of the nucleus, is too crude an approximation. The experimental value of $\bar{E}_\beta$ obtained by us is also closest to the values obtained with the form factors S_1^2 and S_λ, and the difference between it and the value computed with the form factor α exceeds the experimental error.

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