8.1 Properties of Heavy and Superheavy Nuclei

by M.Kowal, A.Parkhomenko, L.Shvedov and A.Sobiczewski **[II.4]**

Studies of the properties of the heaviest nuclei have been continued. Main attention has been given to the analysis of mass, M^{sp}, of heavy and superheavy nuclei at their saddle point. This quantity is basic for calculations of cross sections for synthesis. To get a realistic value of M^{sp}, it is essential to use a sufficiently large deformation space in the analysis. In our calculations, we used 7- to 13-dimensional spaces [1-9]. The role of non-axial deformations of the nuclei, which are quite often neglected in the literature, has been found to be important.

Two review articles [10, 11] on the properties of the heaviest nuclei and two popular ones [12,13] on the progress in their synthesis, were written.

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8.2 Electron Capture and Internal Conversion in H-like and He-like Ions

by Z.Patyk **[II.3]**

Electron capture (EC) is a nuclear process where an orbital electron is captured by a nucleus and an electron neutrino is emitted. In internal conversion (IC) the nucleus transits between two energetic levels and an orbital electron is emitted taking out the transition energy. Both processes have been investigated theoretically [1] in He- and H-like ions for nuclei with initial and final spin values I and (I±1*)*, respectively and the probability ratios for both types of decay have been calculated [1]. The ratio depends on the initial nuclear spin I and is given by the simple formula:

$$\lambda_H / \lambda_{He} = \frac{(2I+1)}{2(I \pm 1/2)+1} \qquad (1)$$

where λ_H and λ_{He} denote probability decay per unit time for H- and He-like ions, respectively.

Equation (1) applied for IC process in H- and He-like ions of ^{57}Fe for the transition between the excited state with the energy 14.4 eV ($3/2^- \rightarrow 1/2^-$) and the ground state predicts the probability ratio as 4/3. This agrees with the measured value 8.03/6.16(0.09)=1.30(0.09) [2,3].

Recently, at GSI Darmstadt the EC process in H- and He-like ions of ^{140}Pr has been experimentally studied [4] for the transition between nuclear spins and parities $1^+ \rightarrow 0^+$. The probability ratio λ_H/λ_{He}=1.49(0.06) has been measured and again perfectly agrees with the predicted (Eq. 1) value 3/2.

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