Hyperdeformed rotational bands observed in the actinide region

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The identification of hiperdeformed nuclear states at high spins is one of the long-standing challenges in nuclear structure physics. However, hyperdeformation has been observed at low spin in the actinide region. The fission probability has been measured with high energy resolution as a function of the excitation energy using (d,pf) reactions. The observed fission resonances were described as members of rotational bands. Information on the J values of the states and the K values of the bands has been obtained from fission fragment angular distribution measurements. The rotational parameters deduced from fitting 24 and 22 rotational bands in ^{234}U and in ^{236}U are $\hbar^2/2\theta$ = 2.1±0.2 keV [1,2] and 2.3 ± 0.4 keV [1,3], respectively. They are in a good agreement with the ones deduced earlier for hyperdeformed bands in the actinide region. The level density of the rotational bands has been compared with the prediction of the back-shifted Fermi-gas formula and the energy of the ground state in the third minimum has been deduced to be E_{III} = 3.1 ± 0.4 MeV [2] and E_{III} = 2.7 ± 0.4 MeV [3], for ^{234}U and for ^{236}U, respectively. The excitation energy of the lowest hyperdeformed transmission resonance in ^{236}U, and the energy dependence of the fission isomer population probability enabled the determination of the height of the inner fission barrier E_A = 5.15±0.20 MeV [3] and its curvature parameter $\hbar\omega_A$=1.2 MeV [3]. Using this new method the long-standing uncertainties in determining the height of the inner potential barrier in uranium isotopes could be resolved.

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