found to be in good agreement with the present classification.

Following the filling of the 7/2+ orbit in Lu^{175}, the next two protons appear to fill the 9/2− orbit pairwise. The 7/2+ orbit then occurs a second time as a ground state in Ta^{181}, and the Re isotopes have the $\Omega_p = 5/2+$ ground-state configuration. Although the 9/2− orbit thus does not occur as a ground-state configuration, its existence is verified by its occurrence as an excited configuration in Lu^{175},[12] in Lu^{177},[13] and in Re^{187}.[13] The occurrence of this small irregularity in the level sequence may be associated with the residual interactions between the nucleons.[14]

The experimental evidence concerning the spins of Hf^{177} and Hf^{179} is conflicting. Tentative hyperfine structure measurements[15] have been interpreted as suggesting a spin of $\frac{1}{2}$ or $\frac{3}{2}$. However, more recent evidence[16] from the nuclear rotational spectra seems more consistent with the high spins expected from Fig. 2.

In the discussion of the nuclear ground-state spins, we have used the experimentally measured deformation. One may, however, obtain a theoretical estimate of this quantity by considering the total nuclear energy obtained from Figs. 1 and 2 as a function of the deformation and thus obtain the equilibrium shape for each configuration.[17] It is found that the calculated equilibrium shapes have the observed prolate type of deformations for the nuclei considered in the present note. The calculated deformations for the ground-state configurations are also found to follow rather well the variation of the nuclear distortions as deduced from the observed electric quadrupole moments (see Fig. 3).

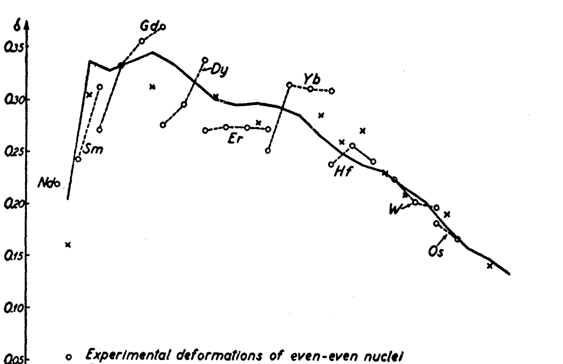

FIG. 3. The calculated ground-state equilibrium deformations are compared with those deduced from the observed intrinsic quadrupole moments.

In particular the dramatic increase in the nuclear deformation which is observed[18] in going from neutron number $N=88$ to $N=90$ follows as a consequence of the breaking up of the $h_{11/2}$ shell which occurs at this point.

During the course of the present work we have enjoyed many illuminating discussions with Dr. A. Bohr, and it is a pleasure to acknowledge the stimulation which he has provided.

* European Organization for Nuclear Research.

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Mean Lifetime of Positive K Mesons*

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MEAN lifetimes for heavy mesons from cosmic rays have been reported by various groups using cloud chambers and Čerenkov counters.[1,2] We have carried out a measurement of the mean lifetime of artificially produced K^+ mesons by making use of their decay in flight in nuclear emulsion.

"Along the track" scanning of K^+ mesons in nuclear emulsions has shown a number of interactions in flight[3]; in addition, 19 events have been found in which there is a single outgoing track of grain density less than that of the incoming K^+ meson. In each of these events the mass of the incoming particle was determined by grain counting and multiple-scattering measurements and its identity as a K^+ particle was thus established. If these events were due to interactions in flight, one would expect to find some stars with a lightly ionizing track coming out together with one or more black evaporation prongs. No such stars were observed. Also, none of the interactions in flight so far seen[3] give off a visible L meson. It therefore seems reasonable to identify all events of this type as the decay of K^+ mesons in flight. From the number of decays in flight found and the proper slowing-down time of all the K^+ mesons followed, a mean lifetime is obtained.

Stacks of stripped 600μ Ilford G.5 nuclear emulsions were exposed edge on to the focused K^+-meson beam[4] of the Bevatron. The mesons were produced from a copper target at an angle of 90° to the 6.2-Bev proton beam and travel a distance of 2.7 m from the target to the emulsion stack. Exposures were made with two different momentum-acceptance bands, positive particles of 390 to 450 Mev/c momentum and 335 to 360 Mev/c momentum. In such an exposure the protons, K mesons, and π mesons, all of the same momentum, have different ranges in the emulsion stack, increasing in that order.

The scanning technique used is as follows. In the region of the plate just beyond where the protons stop, tracks are chosen on the basis of grain density. K-particle tracks have about twice the minimum grain density, while π mesons of the same momentum are essentially at minimum. Tracks between 1.8 and 3 times minimum grain density are picked and followed through the stack. Nearly all tracks selected in this way turn out to be K particles or τ mesons, except for a contamination of about 15% caused by stray protons and π mesons scattered into the stack and prongs of stars formed in the emulsion. Excluding the track length due to τ^+ mesons, a total of 31.6 meters of K^+-meson track has been followed. The corresponding total proper slowing-down time was calculated using the tables of Barkas and Young[5] and was found to be 19.2×10^{-8} sec. The mass of the K meson was taken as equal to that of the τ meson for this calculation. Since decays in flight near the end of a track may not be readily identified, the proper time spent in the last 2 mm before a stopping has not been included. From the 19 decays in flight observed we find a mean lifetime for K^+ mesons of

$$\tau_{K^+}=1.01_{-0.21}^{+0.33}\times10^{-8}\text{ sec.}$$

The error given is the statistical standard deviation combined with a 10% uncertainty in the length of track scanned. If the decays in flight are due to K^+ mesons of two or more different mean lifetimes, the quantity that has been measured is an average of the form

$$\tau_{K^+}=\left(\sum_i \frac{\alpha_i}{\tau_i}\right)^{-1},$$

where α_i is the fraction of the K^+ mesons entering the stack that is associated with a mean lifetime of τ_i. Owing to the time of flight from the target to the emulsion stack, less than 3% of any particles of mean life 0.3×10^{-8} sec or less would arrive at the emulsion stack. Any such short-lived particles would thus be highly discriminated against in this measurement. In the course of the experiment 1.7 meters of τ^+-meson track was followed which corresponds to a total proper slowing-down time of 1.07×10^{-8} sec. No decay in flight of a τ^+ meson was observed. The results of this experiment are consistent with those of Mezzetti and Keuffel[1] and Barker *et al.*[2]

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Radiations from Long-Lived $Tc^{(98)}$*†

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A NEW beta-emitting isotope of technetium has been separated from Ru which was subjected to intense neutron irradiation in the Materials Testing Reactor ($\sim2\times10^{21}$ neutrons/cm^2). After the initial purification, made one year after the end of irradiation, the predominant activity was 90-day Tc^{97m}. The decay was followed with an end-window β-ray counter, an argon-filled x-ray counter spectrometer, and a scintillation counter with Pb absorbers of various thicknesses. Whereas the 90-day period predominated with the first two detectors, the γ radiation measured through 6 g