

Rare-Earth Nuclei Are Not Smooth; Have Bumps, Hollows

The usual picture of a deformed nucleus is that it has a shape like a quadrupole, resembling either a door-knob or a cigar. Recently a Berkeley group (David Hendrie, Norman Glendenning, Bernard G. Harvey, O. N. Jarvis, H. H. Duhm, J. Saudinos and Jeannette Mahoney) found that the rare earths from samarium to hafnium, which were thought to be the best examples of simple deformed nuclei, actually have all sorts of hollows and bumps.

A cross section of the nucleus along the symmetry axis does not have just an elliptical shape, which would have two cycles of variation in radius as one traces around 360 deg, but has superimposed on this 4- and 6-cycle components.

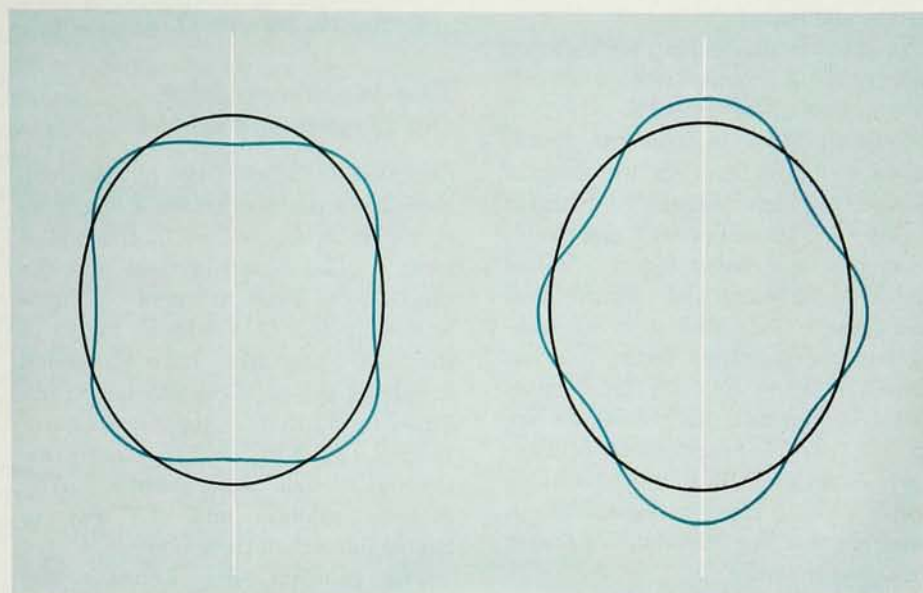
The group measured (at the 88-inch cyclotron) cross sections for inelastic alpha scattering to excited states to determine the shape of the nuclear potential. Comparison of a multipolar potential expansion with experimental values for excitation to various levels shows that the higher order terms are required. Results are reported in *Physics Letters* **26B**, 131 and 127, 1968.

Russian Six-Meter Telescope: Completion Date Uncertain

Construction of the new 6-meter telescope in the Russian Caucasus is under way, but it is not yet known when it will be ready for use. This instrument will be the world's largest optical telescope when it is finished; the big telescope at Mount Palomar has an aperture of about 5 meters.

Aleksandr Mikhailov, director of the observatory at Leningrad, has told *PHYSICS TODAY* that he cannot forecast the time of the telescope's completion owing to uncertainty in the time required to figure the parabolic mirror.

An American astronomer visiting eastern Europe writes us that the dome at Zelenchuk, 2000 meters high in the Caucasus mountains, is finished and that the mounting has been completed and assembled at the factory. It is rumored that the first of the 3-ton



SHAPES OF RARE-EARTH NUCLEI are bumpier (color) than the usual elliptical picture (black), according to recent inelastic alpha-scattering measurements.

mirror blanks that were cast broke but that another is being figured after cooling for one and a half years.

Astronomers will be able to observe either at the prime focus or through a Nasmyth optical system. Altazimuth mounting has been chosen instead of equatorial because it is better mechanically. This type of mount has a more complicated drive to follow sidereal motion, but with modern computer-assisted control this is not thought to be a problem.

Do Nucleons and Electrons Have Electric Dipole Moments?

Searches for an electric dipole moment of the neutron, proton and electron are under way at several laboratories. T. D. Lee and Lev Landau first pointed out that if such a moment exists, it would be direct evidence for violation of time-reversal invariance.

(For spin- $\frac{1}{2}$ particles at rest, since the only direction defined is that of the spin vector, an electric dipole moment would have to point in the same direction. When one reverses time, the spin would change sign, but the electric dipole moment would not; this would be inconsistent if time-reversal invariance holds; so the moment is assumed to be zero.) Although T violation can be inferred from CP viola-

tion in K_2^0 decay, no direct observation has yet been made.

Theoretical predictions of nucleon electric dipole moment range from $\mu/e = 10^{-19}$ to 10^{-26} cm. Most theories predict that the electron moment should be much smaller.

The first experimental search for an electric dipole moment in a free particle to test specifically for a breakdown of T invariance was started at Brandeis University early in 1963 by P. G. H. Sandars of Oxford and Edgar Lipworth of Brandeis,¹ who figured out a scheme for doing atomic-beam experiments on free atoms and extracting from these measurements limits on the electric dipole moment of both the free atom and the electron.

In these experiments, using alkali atoms, one looks for a shift of the Zeeman resonance that is linear in the electric field when one applies a uniform field in the resonance region. A Brandeis group² recently reported the present best upper limit on the electron moment of μ_e/e of 2×10^{-23} cm.

The main experimental difficulty arises from effects owing to the motional magnetic field $\mathbf{v} \times \mathbf{E}$; this produces signals that look like true electric-dipole signals. At Oxford, Sandars and his collaborators are about to start running an experiment with