(1) $\delta\langle r^2\rangle$ or $\Delta\beta/\beta$ has for the first time been established to be greater than 0.

(2) The results tend to show that $\Delta\beta/\beta$ is smaller than the value predicted by the theory of Davydov and Chaban, as treated by Diamond, Stephens, and Swiatecki.

With regard to conclusion (2), we note that the indicated discrepancy is not evidence for nonadiabatic effects or a need to depart from a purely rotational model. In the centrifugal stretching model, as originally introduced by Davydov and Chaban,[7] the authors intend γ to be associated with a rotational degree of freedom of an axially asymmetric nucleus. If this is done it might be possible to calculate a smaller value of $\Delta\beta/\beta$ using purely rotational degrees of freedom.

Another calculation for $\Delta\beta/\beta$ has been given by Faessler and Greiner.[10] According to them $\delta\langle r^2\rangle$ is very sensitive to E_β, the energy of the second 0^+ level sometimes observed in even-even nuclei. In order to bring their calculation into agreement with our result it is required that $E_\beta = \sim 6$ MeV whereas nuclear systematics and theoretical considerations suggest that $E_\beta = \sim 1$ MeV.

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POLARIZATION MEASUREMENTS NEAR ISOBARIC ANALOGS OF STATES IN $N=83$ ISOTONES*

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Measurements of the polarization of protons scattered from barium and cerium have been made to determine the total angular momenta, J, of isobaric analogs of states in ^{139}Ba and in ^{141}Ce. The second p-wave state in each case has been found to have angular momentum $\frac{1}{2}$ in contrast to previous assignments of $J=\frac{3}{2}$ to this level.

The existence of isobaric analog states in proton elastic and inelastic scattering from ^{138}Ba and ^{140}Ce has recently been established by von Brentano et al.[1] Since these targets have a closed neutron shell, analog states in the compound nuclei can provide information about the configurations consisting of one nucleon outside a closed shell. We have measured the polarization in proton elastic scattering between 9 and 12 MeV for each target in order to determine the total angular momenta of five analog states in each compound nucleus. The levels occur at energies comparable with the Coulomb barrier. Therefore the polarization away from the resonances is relatively large, and it was necessary to study the polarization between the resonances as well.[2]

Measurements were made at 80 and 110° for each target and in addition at 145° for barium. The polarization of the scattered protons was deduced from the left-right asymmetry when the polarized proton beam of the Wisconsin tandem accelerator was scattered from thin foils of the target metals. The results are shown in Figs. 1 and 2. The error bars indicate the statistical uncertainties. The curves were calculated with a scattering matrix S, defined by[3,4]

$$S_l^{\pm} = \exp[2i(\omega_l + \lambda_l^{\pm})]\left\{\exp(-2\mu_l^{\pm}) + \exp(2i\varphi_p)\left[\frac{i\Gamma_p}{E_0 - E - \frac{1}{2}i\Gamma}\right]\right\},$$

where ω_l is the Coulomb phase shift and $\lambda_l^\pm + i\mu_l^\pm$ is the off-resonance phase shift describing the elastic scattering for the lth partial wave with $J = l \pm \frac{1}{2}$. The quantities E_0, Γ, and Γ_p are, respectively, the energy, total width, and partial elastic width of the resonance, and φ_p is a parameter which shifts the phase of the resonance with respect to the background. When two levels of the same total angular momentum and parity were present, the scattering matrix was taken to be of the form[5]

$$S_l^\pm = \exp[2i(\omega_l + \lambda_l^\pm)]\left\{\exp(-2\mu_l^\pm) + \sum_{n=1}^{2} \exp(2i\varphi_p^{(n)})\left[\frac{i\Gamma_p^{(n)}}{E_0^{(n)} - E - \frac{1}{2}i\Gamma^{(n)}}\right]\right\}.$$

The off-resonance phase shifts were calculated for $E_p = 11$ MeV from the optical-model parameters of Rosen et al.[6] and were assumed to be constant between 9 and 12 MeV. The calculated curves were averaged over the target thickness (~30 keV) and the angular acceptance of the detectors (±4.5°). The natural abundance of the isotope of interest was also taken into account in the calculations. Protons scattered from the carbon and oxygen in the thin backings did not affect the results, since these protons were seen as a separate peak in the pulse-height spectra from the solid-state detectors.

The assumption of constant background phase shifts gave sufficiently good fits to the measured energy dependence of the polarization to determine the J values of all the analog resonances reported in the paper from Heidelberg.[1] For the first, second, and third cerium resonances values of $\varphi_p = -8$, 15, and 10° were found to improve slightly the calculated energy dependence of the polarization near the resonances. In all other cases φ_p was set equal to 0.

The level parameters E_0, Γ, and Γ_p, as well as the total angular momenta and parities used in calculating the solid curves (Figs. 1

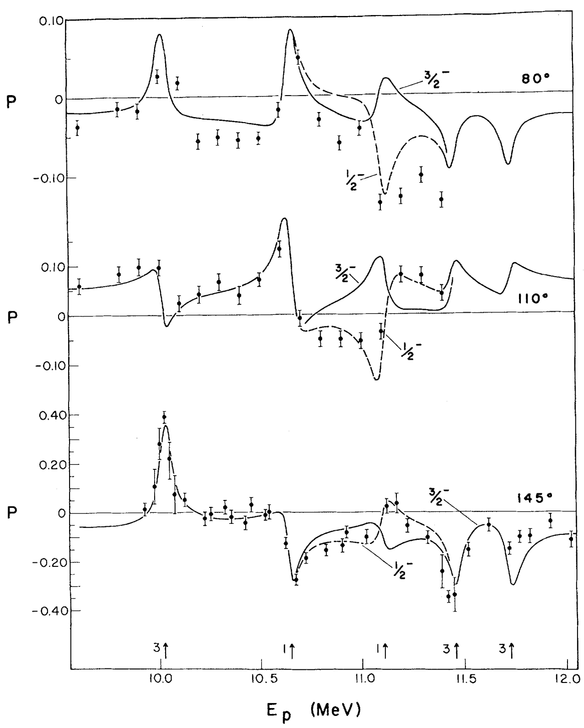

FIG. 1. Polarization data for Ba(p,p)Ba. The solid lines are theoretical curves. The resonance energies and l values for the analog states in ^{139}La from Ref. 1 are shown at the bottom. Near the third resonance, the dashed curve is for spin $\frac{1}{2}$ and the solid curve for spin $\frac{3}{2}$.

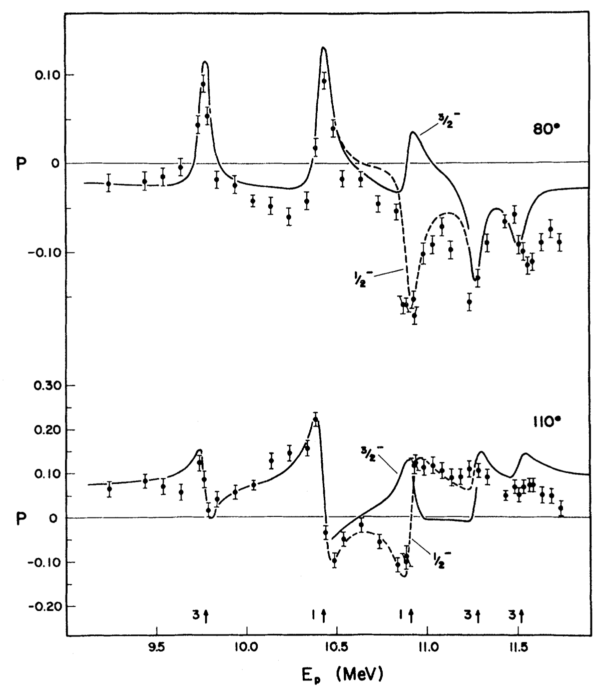

FIG. 2. Polarization data for Ce(p,p)Ce. The solid lines are theoretical curves. The resonance energies and l values for analog states in ^{141}Pr from Ref. 1 are shown at the bottom. Near the third resonance the dashed curve is for spin $\frac{1}{2}$ and the solid curve for spin $\frac{3}{2}$.

and 2) are those reported by von Brentano. The values of J and π used for the five levels in each nucleus are, respectively, $\frac{7}{2}^-$, $\frac{3}{2}^-$, $\frac{3}{2}^-$, $\frac{5}{2}^-$, and $\frac{5}{2}^-$. The dashed curve was obtained by changing the J value assumed for the third resonance shown in each figure from $\frac{3}{2}$ to $\frac{1}{2}$, while doubling the partial elastic widths in order to give approximately the same elastic-scattering cross sections.

The third resonance in each case clearly corresponds to a $\frac{1}{2}^-$ level. This assignment is in disagreement with the interpretation of this state by Holm and Martin[7] and by Fulmer, McCarthy, and Cohen[8] as a $\frac{3}{2}^-$ level arising from the coupling of the $f_{7/2}$ single-particle state with a 2^+ collective excitation of the core.

Comparison can also be made with the results of Wurm et al.[9] for protons scattered from ^{142}Nd and of Marouchian et al.[10] for scattering from ^{144}Sm. In both of these cases the third analog resonance was assigned $J^\pi = \frac{3}{2}^-$ on the basis of elastic cross-section data at many angles. However, since these two targets have the same closed neutron shell as ^{138}Ba and ^{140}Ce, our measurements suggest that these angular-momentum assignments may also be in error. The erroneous assignments in this case probably arose because the assumption was made[9] that the off-resonance spin-flip scattering amplitudes can be neglected. The presence of nonzero polarization between the resonances indicates that this is not the case.

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PECULIAR VELOCITY OF THE SUN AND THE COSMIC MICROWAVE BACKGROUND

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The sun's peculiar velocity with respect to distant galaxies is roughly estimated from the red-shift data for nearby galaxies to be ~400 km/sec toward $l_{\rm II} \sim 335°$, $b_{\rm II} \sim 7°$. Future observations on the angular distribution of the cosmic microwave background should be able to test this estimate, if the background has a cosmological origin. If the test is successful it would imply that a "local" inertial frame is nonrotating with respect to distant matter to an accuracy of 10^{-3} sec of arc per century, which would represent a 5000-fold increase of accuracy.

The remarkable measurements of Partridge and Wilkinson[1] indicate that the excess microwave background is highly isotropic along the celestial equator. They found no 24-h asymmetry with an amplitude greater than ±0.1% (of 3°K), and thereby derived an upper limit of about 300 km/sec for the equatorial component of the sun's velocity relative to the effective source of the radiation. If the radiation has a cosmological origin,[2] then this effective source would actually be the distant matter (red shift $z \gg 1$) which last scattered the radiation. In that case it should become possible to measure the "absolute" motion of the solar system, that is, its motion relative to the universe as a whole.