beam after a single scattering. It is apparent that the effect on the angular distribution is slight when $f(r)\approx 2$ Mev. The polarization curves show fairly low percentage polarization for small angles, but the structure indicates a greater average positive polarization for larger mass numbers. It is interesting that this polarization is positive for small angles rather than negative as it is at higher energies ($\sim$300 Mev).[10] Figure 18 shows the effect of varying $f(r)$ from 1 to 4 Mev and Fig. 19 shows the corresponding effect on the angular distribution. The most significant effect on the angular distribution seems to be the damping of the diffraction oscillations with increasing $f(r)$.

Further scattering calculations are being made for different energies, for incident neutrons and protons, both with and without the spin-orbit term. A new UNIVAC calculation providing for potential of arbitrary shape is now in use. The results of these calculations will be made available as soon as feasible.

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Low-Lying Levels of P^{30}

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New states in P^{30} are identified by determination of γ-ray energies from the reaction $Si^{29}(p,\gamma)P^{30}$. The angular distributions of transitions to the ground and first excited states have been determined and spins and parities assigned on the basis of these measurements. The first excited state is thus identified as the first $T=1$ state of P^{30}.

The lowest lying states of isotopic spin $T=0$ and $T=1$ in $A=4n+2$ nuclei have been surveyed by Moskowski and Peaslee.[1] The first $T=1$ state of the nucleus P^{30}, which is one of this series, has not previously been identified with certainty. Using a reasonable value of the nuclear radius, Moskowski and Peaslee predict that this state should be at approximately 500 kev above the ground state.

Endt, Kluyver, and Van der Leun[2] have observed γ-ray transitions involving a state at 0.688±0.007 Mev in the reaction $Si^{29}(p,\gamma)P^{30}$. They studied this reaction at resonances occurring at proton energies of 414 kev and 326 kev, but were unable to determine the spin and parity of the 0.688-Mev state with certainty and so establish the isotopic spin of this state.

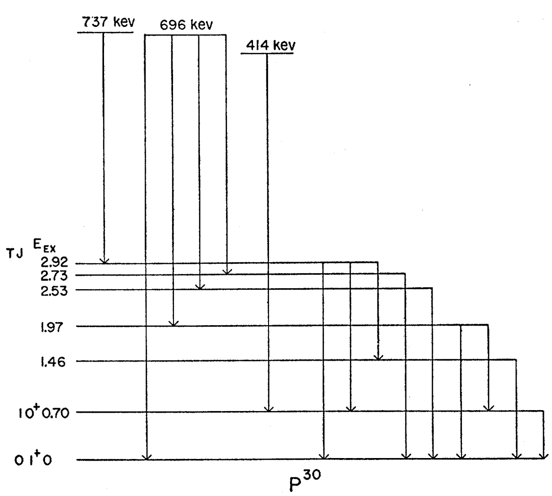

Fig. 1.

Using NaI scintillation spectrometer techniques, which have been described in a previous paper,[3] we have studied the γ radiation from the $Si^{29}(p,\gamma)P^{30}$ reaction at three resonances occurring at proton energies 737 kev, 696 kev, and 414 kev. The γ-ray energies observed fitted into the decay scheme shown in Fig. 1. This decay scheme was checked at each resonance by intensity and coincidence measurements. New states in P^{30} are observed at 1.46, 1.97, 2.53, 2.73, and 2.92 Mev.

At the 414-kev resonance, the angular distribution of 5.33-Mev γ ray and the 690±10 kev γ ray involved in the cascade, resonance level→690-kev state→ground state, have been observed. The 690-kev γ ray is isotropic. This could be due to (a) the resonance being formed by s-wave protons or (b) the formation of a $J=0^+$ resonant state by s- or p-wave protons or (c) the 690-kev state itself being $J=0^+$. The first two possibilities are ruled out by the observation that the 5.33-Mev γ ray which feeds the 690-kev state from the resonance level is not isotropic but has a strong angular distribution of the form $1-0.3\cos^2\theta$. These results can only be explained if the 690-kev state has spin and parity 0^+ and can therefore be identified with certainty as the first $T=1$ state of P^{30}.

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[2] Endt, Kluyver, and Van der Leun, Phys. Rev. **95**, 580 (1954).
[3] Green, Singh, and Willmott, Phil. Mag. (to be published).