to the core, to make up for this loss.

This would also imply the existence around us of a large flux of high-energy neutrinos (about 10^{11} neutrinos/cm^2 sec at the earth, with a mean energy near 10 Mev). Any measurements competent to detect the solar neutrino flux such as those carried on at the present time by Raymond Davis[2] at Savannah River would detect these neutrinos easily. The Li^4 neutrinos would produce in the detector a counting rate at least a hundred times larger than that expected from the normal p-p cycle (mainly from the decay of B^8).

The absence of such a flux would constitute a strong case against the existence of Li^4

I want to thank Professor Philip Morrison for many enlightening discussions.

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POSSIBLE EFFECTS OF NUCLEAR SHELL CLOSURES ON NEUTRON STRENGTH FUNCTIONS

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Figure 1 shows a plot against mass number A of observed strength functions from low-energy (s-wave) neutron studies. The curves are theoretical ones obtained from complex potential models. For curve 3 the potential has been taken to be nonspherical to a degree indicated by $E2$ data on individual nuclei. For curves 2 and 3 the potential is diffuse-edged, and the real and imaginary parts, V and W, have the same spatial distribution and their magnitudes are independent of N or Z, the neutron and proton numbers.

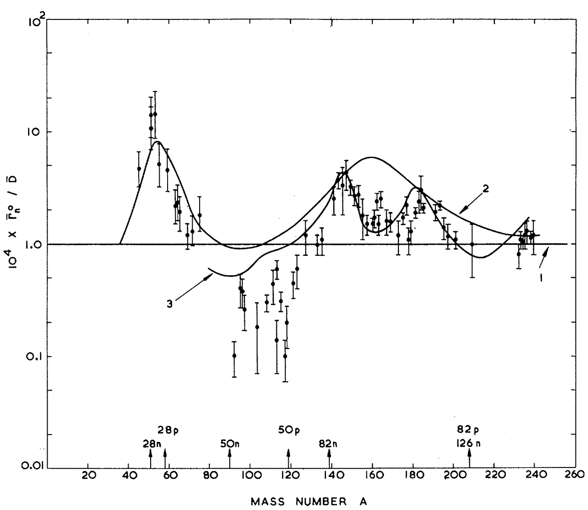

FIG. 1. The figure shows a collection of the most recently available data on neutron strength functions. It includes data plotted by Hughes, Zimmerman, and Chrien [Phys. Rev. Lett. 1, 461 (1958)] as well as additional data from Coté, Bollinger, and LeBlanc [Phys. Rev. 111, 288 (1958)] and Firk, Lynn, and Moxon (to be published). Curve 1 is the prediction of the strong-coupling model; curve 2 is that of an optical potential of Saxon-Woods shape [Feshbach, Porter, and Campbell (unpublished) quoted by V. F. Weisskopf, Physica 18, 952 (1956)]; curve 3 is that of an optical potential deformed in accordance with $E2$ data on individual nuclei [Chase, Wilets, and Edmonds, Phys. Rev. 110, 1080 (1958)].

The theoretical curve fits the observed values fairly well for most A, but there is pronounced disagreement in the region $90 < A < 130$ where the curve is too high by up to an order of magnitude. The purpose of this Letter is to point out that the disagreement may be due to fluctuations in both the shape and size of W when N and Z are near the magic number 50.

It seems to be established[1] that the real potential V contains a term proportional to $(N-Z)/A$. W is expected to have not only this smooth dependence on N and Z, but also a sharp dependence on N and Z near magic numbers. One can appreciate this by considering the hypothetical case of a doubly magic nucleus in which the energy gap in the single-particle spectrum is greater than half the nucleon binding energy. Suppose that an extra nucleon is present in an orbit of zero energy. All other states of the system allowed by the Pauli principle occur at higher total energies. This means that all energy-exchanging collisions of the extra nucleon with the closed shell nucleons are forbidden, so there is no absorption. This extreme case (which is almost realized in O^{16}, Ca^{40}, and Pb^{208}) suggests that the absorption potential W should have anomalously small values near closed shells. For a quantitative treatment of the effect, one may use the following formula for W that has been derived by several authors[2]:

$$W_{El}(r) = \pi[\langle \varphi_0 | V | \varphi_c u_p(r) \rangle^2]_{\text{Av}} \rho_{El}.$$

φ_c are states of the target particles i, φ_0 is the ground state, u_p are states of the extra nucleon, V is the nucleon-nucleus interaction $\sum_i v(\vec{r} - \vec{r}_i)$, the integration is over target particles, $[\ ]_{\text{Av}}$ denotes average over product states $\varphi_c u_p$ of angular momentum l near energy E, and ρ_{El} is the density of such states. For N near 50 and Z nonmagic, and an extra neutron, one expects ρ_{El} to have less than half the normal value. Provided that the matrix elements do not vary in a reciprocal fashion (and there is no reason to expect such perverse behavior), W will be less in proportion. Since the neutron orbit completing $N = 50$ is a g-orbit, $W(r)$ is expected to be somewhat peaked at the nuclear surface. For Z near 50, and N nonmagic, ρ_{El} should have about half the usual value. There will also be surface peaking especially if neutrons have begun to fill the h-orbit.

To discuss the effect of such changes in W on the strength function, s, one may use[3]

$$s \sim \int W(r) |u(r)|^2 dr,$$

where $u(r)$ is the nucleon wave-function in the complex potential. Between single-particle levels (i.e., near $A \sim 100$ for s-waves), not only is s decreased by the reduction in W, but it is further decreased if W is surface-peaked since $u(r)$ has a surface node. These two facts may thus explain the discrepancy in the observed values of s near $N, Z = 50$. Near the center of a single-particle level, $|u(r)|^2 \sim W^{-2}$ and $s \sim W^{-1}$, so s is increased by a reduction in W. This leads one to expect an especially large p-wave strength function near $A \sim 90$ and may help to explain why the capture cross section at 50 kev is so large in Nb.[4] One also expects a large s-wave strength function near $A \sim 50$ caused by a reduction in W due to magic number 28, and there is some weak evidence for this. Furthermore the observed[5] diminution in the width of the photonuclear peak near closed shells may be associated with a reduction in W.

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POSSIBLE RESONANT STATE IN PION-HYPERON SCATTERING*

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With charge independence, it is convenient to describe the s-wave scattering processes of low-energy K^--proton collisions by two complex scattering lengths A_0 and A_1, one each for the $I = 0$ and $I = 1$ channels, related to the complex phase shifts δ_I by

$$k \cot \delta_I = 1/A_I(k), \qquad (1)$$

where k denotes the center-of-mass momentum of the $K^- - p$ system. Since the $K^- - p$ interaction is expected to have short range ($\sim \hbar/m_K c$), Jackson et al.[1] have suggested that it is reasonable to neglect[2] the energy dependence of these amplitudes for c.m. energies below ~50 Mev. On this basis, an analysis[3] of the $K^- - p$ interaction data available from bubble-chamber investigations at low energies[4] has led to the following four solutions[5] for these amplitudes A_0 and A_1:

$$A_0 = (0.20 + 0.78i) \text{ f}, \ A_1 = (1.62 + 0.39i) \text{ f}, \qquad \text{(a+)}$$

$$A_0 = (1.88 + 0.82i) \text{ f}, \ A_1 = (0.40 + 0.41i) \text{ f}, \qquad \text{(b+)}$$

and the sets (a-), (b-) obtained from (a+), (b+) by reversing the signs of the real parts of both A_0 and A_1. As Jackson and Wyld[6] have recently pointed out, the "repulsive" interactions, that is amplitudes of the type (a-) and (b-), predict the lower elastic scattering cross sections at very low energies, owing to their destructive interference with the Coulomb scattering, and are in accord with the trend found for the cross sections at the lowest energies in emulsion studies.[7] It