improving the accuracy of the local exchange approximation.

For the inelastic scattering predictions, the most important difference between these interactions is the strength of their high-q repulsion. The central interactions are compared, as functions of density and momentum transfer, in Fig. 4. The inelastic cross section predictions are similar at low q and then begin to diverge at the minimum of the central contribution. The HJ potential tends to overpredict the high-q cross section, particularly for surface transitions that are dominated by the low density limit of the effective interaction. The HJ potential correctly predicts the strong negative analyzing powers that result from the enhanced repulsion of the central interaction at high density. The Paris potential, on the other hand, is less repulsive at high-q and tends to underpredict the high-q cross section. The Paris potential analyzing power predictions do not become sufficiently negative. Therefore, we conclude that the high-q repulsion in the isoscalar spin-independent central component of the two-nucleon effective interaction based on the HJ potential is too strong while that of the Paris potential is too weak. This high-q repulsion arises from the core of the nucleon-nucleon potential.

Therefore, we conclude that the core of the nucleon-nucleon potential should be intermediate between the extreme hard core of the HJ and the soft core of the Paris potentials.

Figure 4. Modulus of the isoscalar spin-independent central interaction. For the interactions based on the Paris and HJ potentials, the long (short) dashed curves represent the low (saturation) density limits. The Love-Franey free t-matrix is shown on both sides as the solid curve.

5) H.V. von Geramb, "Table of Effective Density and Energy Dependent Interactions for Nucleons", unpublished.
7) W. Bauhoff, H.V. von Geramb, and G. Palla, to be published.

135 MeV PROTON SCATTERING FROM $^{13}$C

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The data from the $^{13}$C(p,p') reaction, reported in the 1980 Annual Report, has been supplemented in two short experiments, both of which were aimed at elucidating the structure, and its nature, at about 12 MeV in excitation. The second of these used a polarized proton beam, and it is expected that the asymmetry
measurements from this run will be of great assistance in determining the spin and parity of the states excited.

Two different DWBA analyses were used in the analysis of the inelastic scattering data. The first used an effective nucleon-nucleon t-matrix devised by Love\(^1\) to fit the phase shifts for free nucleon-nucleon scattering at 140 MeV, and a set of optical model parameters which contain a relatively large value for the depth of the imaginary potential. Such a value appears to be required by the optical model fitting of data on the elastic scattering of 155 MeV protons from light nuclei,\(^2\) including both differential cross sections and polarization. The second used a modification of a t-matrix devised for lower energy interactions, again to fit free nucleon-nucleon scattering data,\(^3\) and an averaged set of optical model parameters.\(^4\) Overall, the first of these interactions was the more successful, but that situation is not true for all of the observed final states. The two sets of optical model parameters are shown in Table I.

<table>
<thead>
<tr>
<th>Best</th>
<th>Average</th>
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<tbody>
<tr>
<td>(V_R)</td>
<td>13.477</td>
</tr>
<tr>
<td>(r_R)</td>
<td>1.395</td>
</tr>
<tr>
<td>(a_R)</td>
<td>0.565</td>
</tr>
<tr>
<td>(W_1)</td>
<td>20.855</td>
</tr>
<tr>
<td>(r_1)</td>
<td>1.002</td>
</tr>
<tr>
<td>(a_1)</td>
<td>0.693</td>
</tr>
<tr>
<td>(V_g)</td>
<td>3.336</td>
</tr>
<tr>
<td>(W_g)</td>
<td>-4.881</td>
</tr>
<tr>
<td>(r_g)</td>
<td>0.799</td>
</tr>
<tr>
<td>(a_g)</td>
<td>0.607</td>
</tr>
<tr>
<td>(r_c)</td>
<td>1.347</td>
</tr>
</tbody>
</table>

*units are MeV and fm.

Two final states, namely those at 8.86 and 11.08 MeV excitation (both 1/2\(^-\); \(I = 1/2\)), stand out in that neither analysis produces anywhere near satisfactory fits to the data (see Fig. 1). We suggest that this results from a structure that is predominantly of the form 1p\(_{1/2}\) neutron coupled to the 7.66 MeV (0\(^+\)) state of \(^{12}\)C (see Fig. 2). This latter state is not satisfactorily treated within the framework of the intermediate coupling shell model,\(^5\) and therefore one would not expect the two states built upon it to be well described within that model either.

![Figure 1](image-url)

The differential cross sections for \(^{12}\)C(p, p\(^1\)) transitions to the 1/2\(^-\)states at 8.86 and 11.08 MeV in \(^{13}\)C are compared to the DWBA calculations using interactions A (Love) and B (Wong and Wong), and the Cohen-Kurath wave function for the first excited 1/2\(^-\)state.


5) C.M. Perey and F.G. Perey, Atomic Data and Nuclear Data Tables 17, 1 (1976).

6) S. Cohen and D. Kurath, Nucl. Phy. 73, 1 (1965).

Figure 2: The measured differential cross section for the $^{12}$C(p,p$^\prime$)$^{12}$C* (7.66 MeV) reaction at 135 MeV compared with the sum of the differential cross sections for exciting the 8.86 and 11.08 MeV states of $^{13}$C.

FRAGMENTATION OF HIGH-SPIN PARTICLE-HOLE STATES IN $^{26}$Mg

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Systematic information is now being obtained on the excitation of spin-flip degrees of freedom throughout the periodic table from inelastic scattering and charge exchange reactions. An overall systematic quenching of the isovector spin-flip strength has been identified, although the quenching mechanism is not yet understood. Inelastic proton and pion scattering reactions also indicate a large quenching for isoscalar spin-flip excitations, although the systematics of this effect are less well established.2,3

Several theoretical explanations have been offered for this reduction in the spin-flip strength. These explanations include: fragmentation of the single-particle strength, mesonic renormalization of...