and further emphasized by the extremly large variations in the amount over Columbus as reported by Migeotte. There is a temptation to regard the presence of carbon monoxide in the air as a consequence of its nature as a product of incomplete combustion. It would be most instructive to follow the course of carbon monoxide above Columbus as a function of fuel consumption and local weather.

Amongst the minor constituents of the atmosphere, carbon monoxide must be regarded as a local manifestation, unlike nitrous oxide, for example, which was recently shown to be world wide in an essentially constant amount.[3]

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On the Excited States of Li^7

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The ground state of Li^7 has nuclear spin $I=3/2$, and the possibility[1] that the 480-kev excited state is the other state of the doublet, $^2P_{\frac{1}{2}}$, is favored[2] by the existence of a transition[3] to this state by K-capture in Be^7. However, when thermal neutrons impinge on B^{10}, which[4] has $I=3$, the transition by alpha-emission leads[5] almost entirely (93 percent) to the excited state of Li^7, and this strong preference seems to demand[6] a selection rule based on a large angular momentum associated with the excited level, considerably larger than the value $I=1/2$. In keeping with the assumption of spherically symmetric exchange interactions, which have been used[7] fairly successfully to correlate nuclear stability properties, it was suggested[6] that the excited level of Li^7 might be the two states of an unresolved ^{2}F, having $I=7/2$ and $5/2$. In the light of recent observations[8] which display the energy groups as sharp peaks and agree quite closely on the excitation energy (and barring a pervasive selection rule), this would require very small spin-orbit coupling (<10 kev).

The objection to this latter scheme[9] is that it leaves the total orbital angular momentum L too nearly a good quantum number, and the Be^7 K-capture to the excited level would be forbidden with $\Delta L=2$. Retention of L as a quantum number is perhaps an oversimplification. It is noteworthy that agreement could be obtained both with the Be^7 K-capture and the $B^{10}(n, \alpha)Li^7$ transitions to the excited state by the assumption that this excited state is single and simply has $I=5/2$. This assumption is also compatible with the observed lifetime[10] of the excited state, which may be attributed to a magnetic dipole transition moment of plausible magnitude,[10] but requires an electric quadrupole transition moment considerably larger than estimated from nuclear dimensions. It agrees as well with the observed angular distribution[11] of the reaction $Li^6(d, p)Li^7$ at low energies, wherein the spherical symmetry of the long-range protons and a term as high as $\cos^4\theta$ in the short-range protons may be explained, only if the excited state has $I\geq 5/2$, in which case the explanation involves compound states 0^+, 2^+ (both competing with alphas[12]) and 5^-. Since $I=5/2$ seems to be the only single value compatible with all the observations, the problem is to make this assumption theoretically plausible.

The shell structure apparent as "magic numbers" in nuclear stability has been correlated by Mayer[13] with the trend of nuclear spins and magnetic moments by postulating $j-j$ coupling for the individual nucleons, which requires strong spin-orbit coupling in most nuclei. There are sufficiently few exceptions to the general experimental agreement[13,14] that the scheme has a strong empirical appeal in spite of its sharp divergence from previous concepts.[7] Perhaps the most serious discrepancy is found in Li^6, where two nucleons each with $j=3/2$ would be expected[14] to combine to make $I=3$, rather than 1 as observed, but there might be exceptionally small spin-orbit coupling in this nucleus because of the exceptionally weak binding of these nucleons. Then Li^7 might also be expected to have somewhat weaker spin-orbit coupling than normal for p orbits, and a 480-kev doublet splitting would seem ample to be compatible with a splitting of 2 Mev or more in heavier nuclei as might be required to have an influence on shell structure. This would leave the excited state a $^2P_{\frac{1}{2}}$. Because this is incompatible with the $B^{10}(n, \alpha)Li^7$ and the $Li^6(d, p)Li^7$ data, we wish also to consider the possibility of stronger spin-orbit coupling in Li^7.

In extreme $j-j$ coupling, one obtains the low states by coupling three vectors $j=3/2$. Because of the exclusion principle, the two neutron vectors make $J_\nu=0$ in the ground state, and $J_\nu=2$ combining with j_π to make $I=7/2$, $5/2$, $3/2$, $1/2$ in the simplest description of the next higher states, and we may expect that some acceptable choice of nucleon interactions would make their energies ascend in this order. Enumeration of the higher states with various nucleons having $j=1/2$ rather than $3/2$ shows that there are in all two states with $7/2$, five states with $5/2$, eight with $3/2$, and six with $1/2$. In a second-order calculation departing from extreme $j-j$ coupling, one might expect very roughly that the extent of depression of the lowest state with a given I, due to the familiar second-order "repulsion" in energy, would be greatest for the value of I which characterizes the greatest number of states. By this criterion, the first-order ground state would be depressed most and remain the ground state, and $I=5/2$ would be depressed more than $I=7/2$, which does indeed make it a fairly plausible first excited state. Unfortunately, in an approach to the intermediate coupling situation from the opposite extreme of $L-S$ coupling with the ^2P assumed lowest in first order as in earlier calculations,[7] the same plausibility argument favors $I=1/2$ as the first excited state. This suggests that the interactions which one assumes to provide the $j-j$ coupling scheme may have to deviate from previous concepts so severely as to alter the order of the multiplets calculated by neglecting spin-orbit coupling. Another difficulty is that recent observations[15] fail to detect further excited states in Li^7 up to about 1.6 Mev, and this qualitative discussion unfortunately does not suffice to explain this gap.

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Meson Exchange and Spin-Orbit Coupling in Nuclei

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The single-nucleon spin-orbit coupling required by recent conjectures[1–3] concerning the prevalence of a $j-j$ coupling scheme in most nuclei is too strong a coupling to be