It may be worth while to indicate the present status of the measurements of the moments of the gallium isotopes. From the results of Pound[5] and of Bitter[6]

$$\mu(\text{Ga}^{71})/\mu(H^1)=0.9148\pm0.0004$$

and

$$\mu(\text{Ga}^{69})/\mu(H^1)=0.7203\pm0.0006,$$

where the moments are uncorrected for diamagnetic effects.

Becker and Kusch have calculated the moments of the gallium isotopes on the basis of the assumption that $g_J(^2P_{\frac{1}{2}})=\frac{2}{3}$. Since this assumption is subject to correction because of the anomalous spin moment of the electron, and since an arithmetical error exists in the previously published values, the data have been recalculated. With the help of the known auxiliary ratios $g_J(^2P_{\frac{1}{2}}, \text{Ga})/g_J(^2S_{\frac{1}{2}}, \text{Na})$ and $g_I(H^1)/g_J(^2S_{\frac{1}{2}}, \text{Na})$:

$$\mu(\text{Ga}^{71})/\mu(H^1)=0.9078\pm0.0015$$

and

$$\mu(\text{Ga}^{69})/\mu(H^1)=0.7146\pm0.0015.$$

In each case the discrepancy between the nuclear resonance values and the h.f.s. values is about three times the sum of the stated uncertainties. The discrepancy appears to be real, especially in view of the excellent agreement between the ratio of the moments of the two isotopes of gallium.

In the experiments on the determination of the magnetic moment of the electron,[7] a large volume of data on the frequencies of lines in the h.f.s. spectrum of Ga was obtained. Nine sets of data exist from which it is possible to determine the ratio g_I/g_J for Ga^{69}. It is then found that $\mu(\text{Ga}^{69})/\mu(H^1)=0.7143\pm0.0015$. The agreement with the ratio previously obtained from h.f.s. data is excellent and points to the reality of the discrepancy of about 0.7 percent between the ratio obtained from the nuclear resonance method and h.f.s.

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Cosmic Radiation and Radio Stars

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THE normal radio wave emission from the sun amounts to 10^{-17} of the heat radiation, and increases during bursts[1] to as much as 10^{-13}. If a radio star, e.g., the source in Cygnus, is situated at a distance of 100 light years, its radio emission is of the order of 10^{-4} of the heat radiation of our sun. It is very unlikely that the atmosphere of any star could be so different from the sun's atmosphere as to allow a radio emission which is 10^9 to 10^{13} times greater, and it seems therefore to be excluded that the source could be as small as a star. The recent discovery[2] that the intensity variations of radio stars is a "twinkling" makes it possible to assume larger dimensions.

Ryle has suggested that there should be a connection between radio stars and cosmic radiation.[3]

According to a recent development of Teller and Richtmyer's theory of cosmic radiation, the sun should be surrounded by a "trapping field" of the order 10^{-6} to 10^{-5} gauss, which confines the cosmic rays to a region with dimensions of about 10^{17} cm (0.1 light year).[4] It is likely that almost every star has a cosmic radiation of its own, trapped in a region of similar size. We suggest that the radio star emission is produced by cosmic-ray electrons in the trapping field of a star.

Electrons with an energy $W\gg m_0c^2$ moving in a magnetic field H radiate at a rate

$$-dW/dt=(2e^2/3c)\omega_0^2\alpha^2, \tag{1}$$

where[5] $\omega_0=eH/m_0c$ is the gyro-frequency corresponding to the rest mass m_0, and $\alpha=W/m_0c^2$. Most of the energy is emitted with a frequency of the order

$$\nu=\omega_0\alpha^2/2\pi=2.8\times10^6H\alpha^2\text{ sec.}^{-1}. \tag{2}$$

As soon as the energy is much higher than the rest energy the emitted frequency becomes much higher than the gyro-frequency, a phenomenon which is observed in large synchrotrons, where the electron beam emits visual light.[6]

According to (2) an emission of radio waves of 100 Mc/sec. requires

$$H\alpha^2=36\text{ gauss}. \tag{3}$$

The acceleration process of cosmic radiation should accelerate electrons as well as positive particles. In the solar environment the electron component is eliminated by Compton collisions with solar light quanta as discussed by Feenberg and Primakoff.[7] In the neighborhood of a star which does not emit much light, the electrons would be accelerated until their energy is so high that they radiate. The wave-length falls in the meter band if, for example, $\alpha=300$ ($W=1.5\times10^8$ ev) and $H=3\times10^{-4}$ gauss. This field is about 100 times the estimated strength of the sun's trapping field. As the strength is determined by the "interstellar wind," a radio star should be situated in an interstellar cloud moving rather rapidly relative to the star.

In order to account for the total energy emitted by a radio star we must suppose either that the radio emission is a transitory phenomenon, lasting a time which is short compared to the lifetime of cosmic rays in the trapping field (10^8 years), or that the cosmic-ray acceleration close to the star is supplemented by a Fermi process[8] further out in the trapping field.

According to the views presented here, a radio star must not emit very much light, and should be situated in an interstellar cloud. This would explain why it is so difficult to find astronomical objects associable with the radio stars.

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The Doublets of N^{15} and O^{16}

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THE nuclear energy-level spectra[1,2] of N^{15} and O^{16} are each characterized by two or more doublets having splittings of 30 to 200 kev and separated by about 1 Mev or more, in the region of excitation 5 to 8 Mev. The lack of structure[1] in the ground state of N^{15} and the importance of spin-orbit coupling in the heavier nuclei[3] suggest that the spin-orbit coupling energy is probably too large for these to be spin-orbit doublets. It is noteworthy that these nuclei at the end of the p-shell in the usual shell model[4] have a much wider gap from the ground level to the first known excited state than have other light nuclei, and the first excitation energy, 5 or 6 Mev, seems to be the energy required to excite a nucleon from the p-shell to the next shell. The nuclear spin and magnetic moment of F^{19}, being similar to a proton's, indicate that the next nucleon state is an s-state. In O^{16}, such an excited s-nucleon, if loosely coupled to the remaining $^2P_{\frac{1}{2}}$ hole of the p-shell (similar to N^{15} or O^{15}) would give rise to adjacent states having $I=0$ and 1, a sort of doublet which might be called an "intershell j-j coupling doublet" or simply a "j-j doublet." Calculations neglecting tensor forces show that for most types of central attractive forces between nucleons the