cent of the local mass density is in an unseen form, subject to the assumption that the unseen mass is strongly concentrated to the disk[9]. If the unseen mass has a more nearly spherical distribution, however, its mass can be very much greater than this[10].

For many years it has been a puzzle that giant elliptical galaxies have such a high mass-to-light ratio[11]. The present considerations lead us to suggest that the majority of the mass of such galaxies is in the form of collapsars.

We thank W. D. Arnett and M. Schmidt for discussions. This research was supported in part by grants from the US National Science Foundation and the US National Aeronautics and Space Administration.

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Received February 2, 1970.

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An Oscillating State as an Alternative to Gravitational Collapse

THE possibility of an oscillating universe is often disputed on the grounds that oscillations are not possible when

giving for the gravitational mass the value

$$m = (1/3)\ (8\pi k)^{-1/2} \qquad (6)$$

and for the radius

$$R = (8\pi k)^{-1/2} \qquad (7)$$

Pressure and density become infinite at the origin, but there is a theorem[2] applicable in this case which ensures the existence of solutions with the same equation of state, and with a total mass as near as desired to that of our solution provided that the central pressure and density are high enough, though finite.

It is possible therefore to have as large a mass as desired in equilibrium provided we admit an equation of state of the form $\rho = p + k$ small enough. Oppenheimer and Volkoff's proof[3] of the existence of a critical mass of the order of that of the Sun relies on the known equation of state for cold neutron matter.

Misner and Zapolsky[4] have generalized the proof of ref. 3 for the case when matter with over nuclear density obeys an equation of state of the form $p = \rho(\gamma - 1)$ with $1 \leq \gamma \leq 2$ while for under nuclear densities the equation of state is the known equation for cold neutron matter.

Comparing my solution with that of Misner and Zapolsky, both propose the same equation of state for the core (if we take $\gamma = 2$). The essential difference is that the equation $\rho = p$ is considered by Misner and Zapolsky to be valid for over nuclear densities only, while in our case (for k very small) the equation $\rho = p$ remains approximately valid for a considerable range of under nuclear densities. When the equation $\rho = p$ can be extended to a quantity of matter sufficiently larger than that considered by Misner and Zapolsky, there may be equilibrium configurations for masses as great as desired.

The approach of Misner and Zapolsky is sound, so I do not propose my solution as a model for big masses in equilibrium. I accept therefore that there is no configuration of equilibrium for big masses of cold neutron matter. As such big masses collapse, however, most of the matter may become of over nuclear density.

The existence of restoring forces must now be studied with due regard to the equation of state prevailing in the dynamical process during which there exists a much higher ratio of matter with over nuclear density to matter an external observer who will observe the body as tending asymptotically towards the Schwarzschild radius.

I thank Professor W. Isreal for pertinent remarks.

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Received November 3, 1969.

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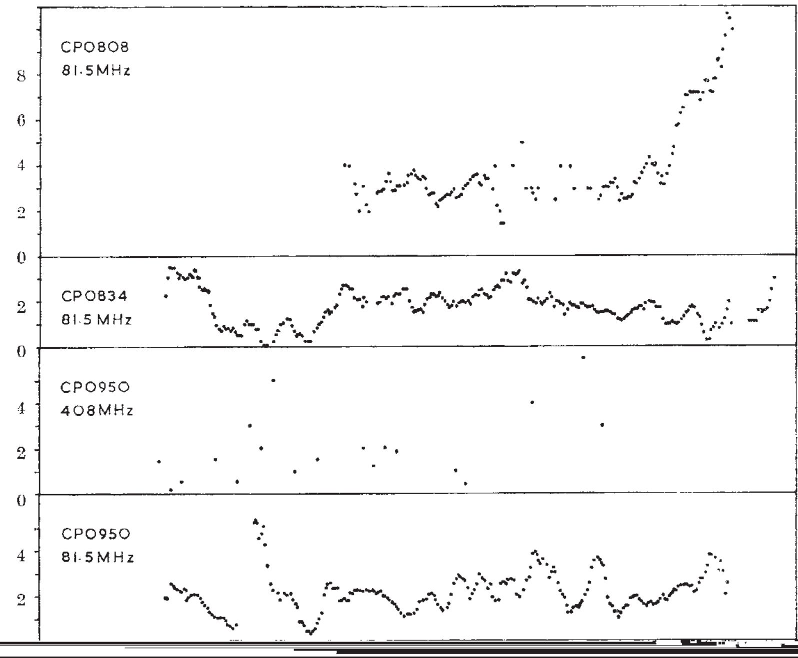
Long Term Variations of Pulsar Intensities

PULSAR intensity variations may be divided roughly into three classes. There are rapid variations on a time-scale of seconds to minutes which occur simultaneously over a wide range of frequency and must therefore be intrinsic to the source[1]. On a somewhat longer time-scale there are variations typically over a few minutes to a few hours which correlate only over limited bandwidths. There is strong evidence that they are caused by irregular diffraction in the interstellar medium[2,3]. Finally, there are variations on a time-scale of days to months[4] about which little is known because extended regular observations are required. In this report we present some new results obtained during timing observations carried out on a routine basis over 11 months.

The five pulsars CP 0808, CP 0834, CP 0950, CP 1133 and CP 1919 were observed during meridian transit with the 81·5 MHz phased array at Cambridge. A daily measure of the mean intensity was obtained by averaging the ten largest pulses to occur during the 4 min or so that the source was in the beam. Considerable day to day variations must arise from the interstellar fluctuations (extrapolating



lation of long period variations at another frequency. We thank the Nuffield Radio Astronomy Laboratories, Jodrell Bank, for these data, which were obtained from observations with the Mark I telescope usually tracking each source for about an hour. Because the medium period fluctuations are slower at 408 MHz, these points were smoothed by taking a mean over 4 days wherever possible. There is no clear correlation between the strength at the two frequencies for either source, but for CP 0950 the peaks and troughs at 81·5 MHz tend to coincide with those at 408 MHz. The correlation coefficient for the CP 0950 data (unsmoothed at 408 MHz) is 0·37, which is significant at the 5 per cent confidence level. The correlation is almost unchanged by smoothing. There is no significant correlation for the CP 1919 data. This indicates that there may be some correlation of long-term variations over this frequency range, but more extended observations are needed to settle this point.

There seems to be no possibility of accounting for long term variations of intensity by random diffraction in the interstellar medium. Irregularities in the interstellar medium produce a diffraction pattern at the Earth which appears as an intensity variation in time due to the transverse velocities of the irregularities relative to the