LETTERS TO NATURE

PHYSICAL SCIENCES

Are Protars Spinars?

MORRISON[1] has suggested that quasi-stellar radio sources and pulsars are basically similar phenomena, being analogues in every respect except scale. He has characterized both types of objects as centrally condensed magnetized spinning masses with a luminous lifetime which is governed by the rotational work done on charged particles by their moving magnetic fields. In the spirit of this hypothesis, Morrison has also proposed (private communication) that the name "spinar" be applied to objects such as quasi-stellar objects (QSOs), pulsars, and other highly condensed core objects which may exist in the nuclei of Seyfert galaxies and extragalactic radio sources.

I wish to point out a possible connexion between the hypothesis of Morrison and those of Harrison[2], Gunn and Ostriker[3], and myself[4], which may be of significance in the future.

Harrison[5] has argued that galaxies cannot condense out of an initially homogeneous big bang universe. The existence of galaxies requires the existence of inhomogeneities imprinted on the metric from a time[6]

$$t^* = (G\hbar/2c^5)^{\frac{1}{2}} \simeq 4 \times 10^{-44}\ \mathrm{s} \qquad (1)$$

Harrison therefore suggests[2] that, even during its earliest stages, the universe was structured with protogalactic configurations which were relatively dense and possessed spins. He argues that these "spinning cores" may have accounted for the origin of present galactic magnetic fields. They would thus fit Morrison's definition of spinars.

Gunn and Ostriker[3] have shown that such "spinars" may be capable of accelerating cosmic ray protons to energies of the order of

$$E_{\max} \sim \left[\frac{e^2}{Gm_p^2}\right]^{\frac{1}{3}} m_p \qquad (2)$$

or $\sim 10^{21}$ eV. The cosmic rays themselves would be unobservable if produced at high redshifts, but secondary γ-rays produced by interactions of these cosmic rays would be observable out to redshifts of ~ 100.

Indeed, such γ-rays, originating at a redshift ~ 70–100, may have already been observed by Vette *et al.*[7]. I have suggested that the γ-ray evidence suggests such primordial cosmic ray sources[4].

If we tentatively identify protars to be the spinars of an early epoch in the history of the universe, we arrive at a qualitative outline of a cosmology consistent with and suggestive of primordial inhomogeneities. Such a picture deserves further study.

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Atmospheric Dusts collected off the West African Coast

IN recent years several studies[1–4] have revealed that wind-transported (eolian) dusts make a significant contribution to the land-derived material in some deep-sea sediments. This contribution depends, among other factors, on the amount of dust in the marine atmospheres, which can vary considerably from one area to another (Table 1). The greatest concentrations of dust have been found in the north-east trade winds over the North Atlantic Ocean. These winds receive a readily available supply of dust from the Sahara Desert, and have been sampled at Barbados[1] and Bermuda[5]. Few collections have been made in oceanic areas adjacent to the Sahara coast, however. We

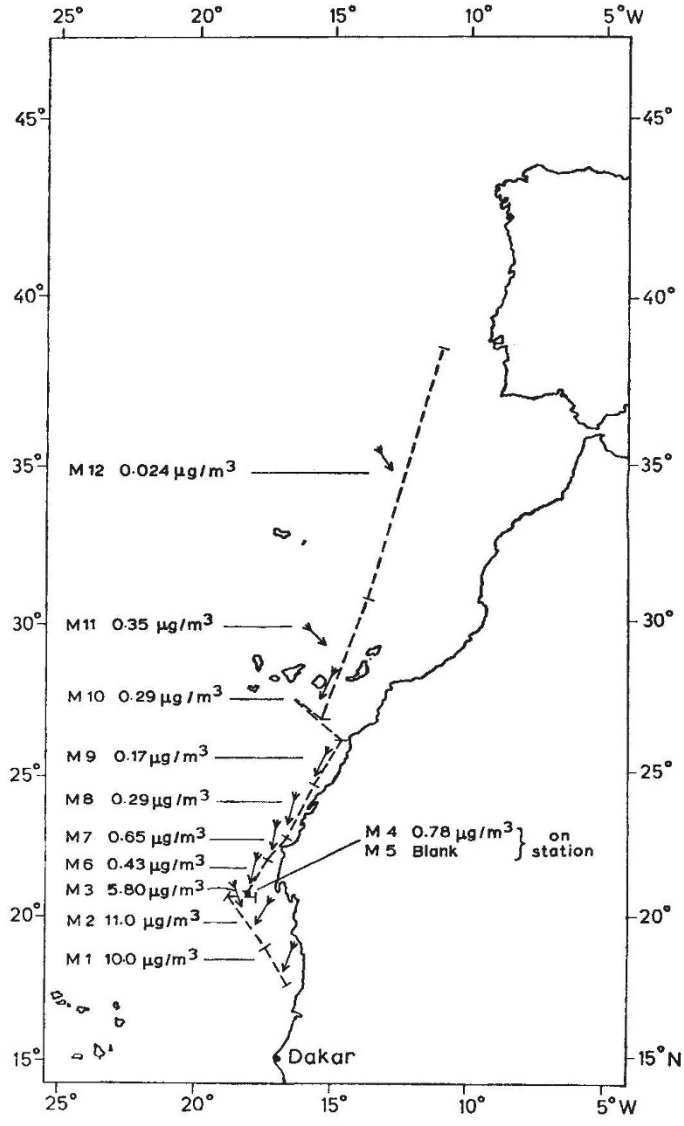

Fig. 1 Collections of atmospheric dust made on cruise 26 of RRS Discovery. The dashed line indicates the ship's track, and the arrows the relevant average wind direction. The sample reference numbers are given and the atmospheric dust load (calculated assuming a 50% mass collection efficiency).