DETECTION OF A MOVING MAGNETIC MONOPOLE

Price et al (*Physical Review Letters*, **35**, 487, 1975) have presented evidence for detection of an energetic magnatic monopole. Dirac proposed as far back as 1931 that such monopoles can exist, because there is no law forbidding their existence. Their existence will make Maxwell's equations symmetrical—looking for electric and magnetic charges and fields. He found that the quantum strength of electric charge e (e.s.u.) and the pole strength of magnetic monpole g (e.m.u) satisfy the equation $eg = \frac{1}{2}\hbar c$. (Here $\hbar$ is the Planck's constant divided by 2π and c is velocity of light). Of course, monopoles with strength in multiples of g can exist. This equation gives g about 68.5 the electric charge in appropriate units. The mass of the monopole is expected to be large. Writing $(e/mc^2) \sim (g/Mc^2)$, where m and M are masses of electron and monopole respectively, gives M=2.8 the proton mass.

Price et al observed the track of a particle passing through a stack consisting of one sheet of photographic nuclear emulsion, about 32 sheets of plastic called Lexan and a sheet of X-ray film with a radiator above. The stack was exposed to cosmic radiation at high altitude for about $2\frac{1}{2}$ days. The X-ray film acts as Cerenkov detector and in this case showed no trace in the path of the track indicating that the particle had a velocity less than about 0.6c. Price et al deduced the charge of the particle from the nuclear emulsion to be about 80 if it is an ordinary nucleus or a monopole with g=137e and with a velocity about 0.5c. In the plastic stack which is below the emulsion sheet, it showed a constant ionization (within errors) corresponding to a charge 137e. If it were a nucleus of charge 80 and velocity 0.5c it would have changed its ionization drastically in the plastic stack. Since it did not, Price et al claim that they have found the track of a magnetic monopole. If this is true, it can be said that it is one of the major discoveries in recent times.

An alternative interpretation (given by others and unpublished yet) is to assume that the identification given by the nuclear emulsion sheet in the stack is correct, while subsequently in the plastic stack the nuclues could lose a few charges in a nuclear interaction every third or fourth of the way, the decrease in charge off-setting the increase in ionization due to loss of energy. The loss of a few charges by way of protons and helium nuclei will not be recorded in the plastic detector. The probability for this phenomenon of loss of charge several times in the stack is estimated between 10^{-3} and 10^{-4}. The probability is low, but then only one such event is seen so far.

Monopoles in cosmic rays have been discussed in the past. It has been shown that monopoles can be accelerated to energies of 10^{20} MeV, in the galactic magnetic fields. The effect of the geomagnetic field on the energetic monopoles has been examined by the author to find that unless the monopole has a mass larger than 10^4 proton masses it will be deflected away Also since the galactic magnetic field in the arms is believed to be nearly parallel to it, an energetic monopole of any energy can only arrive at small angles to the arm. The distribution of energetic monopoles, if they exist in cosmic radiation should be highly anisotropic.

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EVOLUTION OF VISCOUS DISCS

The evolution of discs under the action of viscosity has been studied by Lynden-Bell and Pringle (*Monthly Notices*, **168**, 603, 1974) who have shown that whatever the dissipation mechanism may be, the basic form of evolution is such t at th outermost parts of the disc expand so that the angular momentum is steadily concentrated on to a small fraction of the mass which orbits at greater and greater distances from the centre, while the mass towards the centre goes on increasing. This result is used to study the properties of nebular variables. Assuming that some of the angular momentum excess of the protostellar material is stored in a massive disc which is left orbiting the star, it is shown that the viscous dissipation in the disc will cause the disc to shine with a sizeable fraction of the total light of the system. It is found that the smaller the mass of the star, the longer is the time durin which the luminosity of the disc dominates the luminosity output of the system.

T Tauri stars are very young stars of solar mass or below presumably in the process of gravitation contraction from the diffuse material in which they formed. They have large infrared and rapidly variable ultraviolet excesses. The theory predicts a slowly variable infrared spectrum from the disc and a rapidly variable blue continuum with emission peaking in the ultraviolet from the boundary layer where the material in the disc grazes and enters the surface of the star.

While T Tauri stars occur in clusters of up to 10^6 year age range, the older clusters have flare stars of progressively later spectral types. Flares in flare stars are interpreted by Lynden-Bell and Pringle as the result of agglomeration of matter in the old discs entering the stellar atmosphere. On this hypothesis, flaring activity could be observed in M stars even until the stars are of age 5×10^8 years. Kunkel had noted from the observed data for dMe stars in the solar neighbourhood that the average flare decay rate varies as the inverse first power of the stellar surface gravity. A noteworthy feature of Lynden-Bell and Pringle's theory is that this empirical relation may be deduced from the theory.

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