Science report

Astronomy: Ionosphere reading of stars

Research by Indian astrophysicists suggests that X-ray stars can be detected by the disturbances they create in the Earth's ionosphere. Such disturbances could be used to alert astronomers to stellar activity that might otherwise not have been noticed, and so help significantly with the analysis of still controversial stellar object such as the X-ray star Sco X-1.

The extent to which X-rays from such stars as Sco X-1 affect the Earth's ionosphere is a vexed question mainly because it is difficult to detect the ionization produced by these X-rays against the background produced in other ways, by cosmic rays, for example.

The ionosphere, that part of the atmosphere between about 70 and 110km above the Earth's surface, is made up predominantly of ions and electrons, and it is the fluctuations in their number caused by X-ray flares that scientists try to detect. X-rays can ionize atoms and molecules by giving electrons enough energy to escape from the clutches of the atomic nucleus.

The arguments have gone on during the past few years on two levels. First, the theoreticians have disagreed about the amount of extra ionization one could expect to be caused by flares from Sco X-1 and other bright X-ray stars. Second, expermentalists, have argued about whether slight changes in the Earth's magnetic field, as measured at the surface, and minor alterations to the way in which radio waves propagate by bouncing off the ionosphere really can be attributed to the X-ray stars.

An experimental paper suggests positively that the effects of X-rays from stars has a significant and detectable influence on the ionosphere. Dr Sastri and Dr Murthy, of the Indian Institute of Astrophysics, Kodaikanal, have reexamined records of terrestrial magnetic field measurements made in the daytime on October 15, 1967, a day on which Sco X-1 flared up and died away again in the space of 30 minutes or so. Measurements of the Earth's magnetic field made at Kodaikanal at the same time show a pronounced increase which lasted about 20 minutes and came to a peak about 16 minutes after the peak of the Sco X-1 flare.

The delay before the magnetic field increases is not a difficulty because such effects almost always take some time to work through the ionosphere–magnetic field system. Rather more difficulty was presented by the occurrence 10 minutes or so before the Sco X-1 flare started of a flare of solar X-rays. But Dr Sastri and Dr Murthy argue that previous experience of this kind of flare rules it out as the cause of the magnetic field increase, which occurred too long afterwards, about 33 minutes, to be associated with the solar flare.

Other astronomers are also interested in being able to detect events in space by looking at the ionosphere. Bursts of gamma rays, which are simply very energetic X-rays, given off when catastrophic events occur in some stars may also produce a characteristic signature in the ionosphere which might profitably be used as a means of detection.

By Nature-Times News Service.

Source: *Nature*, September (257, 35, 1975)

THE TIMES, LONDON 10/9/1975