# news and views

## Cosmic gamma-ray bursts

*from K. J. Orford*

SINCE their first reported discovery 4 years ago, cosmic gamma-ray bursts have been observed at a rate of roughly one per month. These events have until now been observable only from satellites, or balloons, since the weak gamma-ray energy flux cannot penetrate the atmosphere or compete with atmospheric radiation. Their theoretical interpretation has been hindered by a lack of sufficient knowledge of their celestial positions, their distribution in size, and a lack of any correlated phenomena which could narrow the search for sources. As a consequence the number of theoretical models has exceeded, if not the number of bursts (about 50), then at least the number of well established parameters. Some recent results reported in *Nature* may help.

Manchanda and Ramsden (*Nature* **266,** 425; 1977) point out that about 90% of the bursts have sizes, or energy fluxes, within a relatively narrow range. If the assumption is made that they all originate in explosive events of similar energy output then a burst's size reveals its distance, at least relatively. The distribution in distance so obtained bears a remarkable resemblance to the distribution of supernova remnants. Supernovae are thought to be sources of both neutron stars and black holes. The disruption of a neutron star by a black hole would provide a neat explanation not only of the size distribution, but also of the gamma-ray burst's energy spectrum. Two consequences of this theory are that the bursts should have a particular distribution in celestial position and that very small and very large bursts should be relatively infrequent. The first must await the accumulation of a large number of bursts with well measured positions, easy only for the rarer large bursts which are recorded by several satellites. The second is in contrast with the situation for many random astronomical phenomena, for which the count rate is in some way inversely dependent on size, that is, smaller bursts would be expected to be more frequent. Smaller bursts are indeed observed to be less frequent, but unfortunately just at a size where current satellites have difficulty in detecting them.

To resolve this, a number of balloon-borne experiments have been carried out with very large detectors. Such detectors, some hundred times larger than those at present carried in satellites, should be capable of seeing bursts about two orders of magnitude smaller in size. Their lack of confirmed observations has enabled some upper limits to be placed on small burst rates, with consequences for burst origins (for example Carter *et al. Nature* **262,** 370; 1976). However Cline *et al.*, at the Goddard Space Flight Centre, have revealed a source of confusion for such experiments (*Nature* **266,** 694; 1977). In an attempt to detect very small bursts, and to prove that any bursts seen were of cosmic origin, two similar detectors were flown on balloons separated by at least 1,400 km. They achieved 20 h of simultaneous observations, but detected no coincident bursts of cosmic gamma rays. Slow 'bursts' were observed on each individual payload and some were associated, but separated in time by many seconds. Whatever the cause of these (suggested to be due to magnetospheric activity), they constitute a serious source of background noise for burst experiments using a single balloon or near-Earth orbit satellite. As these authors point out, much more sensitive experiments are needed to enable small bursts to be seen and their expected anisotropy to be observed.

It may be that the theoretical interpretation of bursts may be helped more immediately by the observation of some correlated phenomenon. One particular burst was observed on 16 August last year by one of the chain of Vela satellites responsible for the original discovery, by two new satellites, Solrad 11A and 11B (Laros *et al.*, this issue of *Nature*, page 131) and by a transatlantic balloon experiment. The gamma-ray results published do not by themselves mark out the burst as very special (except as a simultaneous observation by a number of different experiments, including a balloon flight). However, what may be a very significant radio observation was made by Mandolesi *et al.* (*Nature* **266,** 427; 1977) at Medicina and Trieste. They observed on 16 August 1976 a radio burst at three widely spaced frequencies at Medicina, and at a fourth frequency using a 10-m parabola at Trieste. All lasted about 30 s, the duration of the gamma-ray burst, and they rule out man-made, atmospheric and solar effects as its cause. It occurred less than one minute after the gamma-ray burst, to which coincidence they ascribe a chance probability less than $10^{-4}$. If the satellite burst position is eventually found to agree with the radio position, it will confirm the first such burst-correlated phenomenon. The separation in time would then be a consequence of the evolution of the burst source and would limit the models proposed to explain both bursts. Since this coincident radio burst was discovered only about a month after full operation of the radio array, and if the two bursts had a genuine common source, then one may hope that further coincidences will soon follow. □

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### A hundred years ago

THE WOODPECKER.—In the April session of the German Ornithological Society Prof. Alton concluded the recital of his investigations on the habits of the woodpecker. The peculiar drumming sound often caused by it was shown on various grounds to be entirely disconnected with the search for insects as hitherto supposed, and was regarded as a call to the opposite sex. Dr. Brehm defended the woodpeckers against the charge of seriously injuring the trees, and considered the slight damage resulting from them as more than compensated by the colour and animation which they gave to the otherwise sober and quiet forests.

From *Nature* **16,** 10 May, 30; 1877.