ing, and may encourage some further thought on just how satisfactory the alternative models are. In essence, the problem Sanders has tackled is to find a mechanism for confining the ejected plasma within a narrow cone (vertex angle 12° to 25°); in earlier work with Prendergast (*Astrophys. J.*, **188,** 489–500; 1974) he has already looked at the opposite limitation, when an explosion occurring in the nucleus of a disk of gas (representing a spiral galaxy) can affect gas motions in the plane of the galaxy far from its centre, as opposed to the puzzle for double radio sources of how the emission is confined along the rotational axis.

Within the plane of such a hypothetical disk, expanding plasma produced in a central explosion meets a large mass of material which is pushed along, as Sanders graphically puts it, like a moving snowplough. In the direction of the rotation axis, above and below the plane, the explosion can soon break out into a region of lesser density, and this is obviously of interest to the confinement problem. And, happily in view of the observations, it turns out that the conditions for explosions being able to break out of the plane and for explosions affecting the plane itself over a large distance (essentially depending on the thickness of the disk) are mutually exclusive. But even so, some extra refinement is needed to confine material from explosions which do burst out within the very narrow cones observed in elliptical galaxy radio sources.

Sanders assumed first that there is a constant stellar density core in the nucleus of a giant elliptical, with the gaseous disk structure hypothesised as lying within this core. For a constant thickness disk, an explosion breaking out from the core still expands over almost the entire hemisphere, but this can be overcome by introducing non-uniform conditions, in the form of a massive central point mass. This has two effects. First, the disk is much thinner near the central mass, producing a shape which Sanders likens to a cannon barrel; second, this "barrel" shapes the blast wave from any central explosion, with a degree of focusing just in the required range of 25° and lesser vertex angles.

The implications of this study extend well beyond the "simple" study of radio astronomy, hinting at fundamental differences which may explain the division of galaxies into spirals and ellipticals. There are no Seyferts—indeed, no known spirals—with the double radio source structure typical of radio ellipticals, and on Sanders' evidence the reason may simply be that spirals do not have large point masses at their centres. One school of thought holds that elliptical galaxies could have formed in the expanding Universe on the "seeds" of just this kind of central massive object, in the form of a black hole or "retarded core", while spirals formed from collapsing gas clouds in a quite different process (see review in *Nature*, **252,** 445–450; 1974); opponents of this view may of course take the present results as indicating a fatal flaw in the rammed plasma model! But even if we now have a better understanding of the means by which an explosion at the centre of a galaxy can be collimated to produce a double radio source structure, the $64,000 question remains: what is the mechanism of the explosion itself? The energies involved hint very strongly at a gravitational process of some kind, and this again suggests the presence of massive central objects. □

Solar–geophysical exchanges discussed in the Soviet Union

from Roger H. Olson

FROM May 17 to 25, a joint US–Soviet conference was held at Kiev University and the Hydrometeorology Service in Moscow to plan for joint research and exchange of data in the fields of solar–geophysical activity prediction, in which the Crimean Astrophysical Observatory is prominent, and the effects of solar–geophysical disturbances on weather and climate. About 30 scientists and specialists attended, representing such subjects as solar physics, geomagnetism and meteorology.

There is much precedent for co-operation in the exchange of solar–geophysical forecasts and data. For years such cooperation has existed because of the need to consider solar activity in radio warning services. The need for cooperation has been emphasised more and more recently because of the need for radiation warnings to space flight operations and because of various other operational problems. In the United States daily forecasts of solar flare and proton events and of geomagnetic activity are available from the National Oceanographic and Atmospheric Administration Space Environment Forecast Center in Boulder, Colorado. In the Soviet Union, such forecasts, particularly of solar activity, are made on demand at several institutions. It was agreed that in the near future daily forecasts would be made from both sides and exchanged in real time, so that each could benefit from the thinking of the other. A common system of forecast verification, perhaps based on probability forecasting, will be devised. And efforts will be made to agree on a limited list of indices of solar and geophysical activity, to help avoid confusion.

A system of exchange has been set up between the two countries, under which scientists or technicians from each side can spend several months in the other country, working in more detail on the types of problems discussed at the conference. The first such exchange has already been concluded, with L. Svalgaard of the USA visiting the USSR, and V. Loginov visiting the USA. The next exchange will be in the spring and summer of 1977, and will involve personnel interested in solar forecasting and data exchange.

The language barrier at the conference was minimised by the presence of expert interpreters and the fact that most of the Russians were conversant with English. But they were not aware of recent results published in English language journals such as *Nature* and *Science*, and the Americans were not familiar with the Russian scientific literature, except that which has been translated into English. □

Liposomes to lysosomes

WITH regard to the article "Liposomes to lysosomes" (*News and Views*, **260,** 749; 1976) the statement that "A non-antigenic vesicle would . . . prevent the enzyme from eliciting an immunological response . . . " is not necessarily correct. Far from preventing an immunological response there are convincing demonstrations in the literature that liposomal entrapment of antigen can augment antibody production. In other words, liposomes can act as immunological adjuvants. This was first described by Allison and Gregoriadis (*Nature*, **252,** 252; 1974) using diphtheria toxoid as the antigen and again by Heath *et al.* (*Biochem. Soc. Trans.*, **4,** 129; 1976) using bovine serum albumin. While it may be possible in the future to minimise the response to a given antigen entrapped in liposomes by a suitable choice of lipid composition, charge or size range, the fact that non-antigenic vesicles can increase the immunological response to an antigen remains an incontrovertible fact.

D. CAIRD EDWARDS