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Introductory Remarks

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Introductory Remarks

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Nearly twenty years ago, G. D. Rochester and I organized a Discussion Meeting here on the origin of the cosmic radiation. Part of that meeting was devoted to primary gamma rays, and this meeting was followed a few years later by a meeting devoted entirely to gamma ray astronomy. At that time gamma rays represented a 'new window on the Universe'. Now it is the turn of neutrinos to move into that slot, although it must be said that neutrino astronomy is not as far on as gamma ray astronomy was at that stage. Nevertheless, the subject *has* started and has already thrown up some dramatic questions, questions of interest to both astronomer and elementary particle physicist.

In the more conventional astronomies, the Sun appears to be quite well behaved, and reasonably understood, with the interests of many centring on more distant and 'dramatic' objects, such as supernovae and extragalactic sources. With neutrinos, however, supernovae seem to be well behaved – at the superficial level, at least and based on one event – but the Sun does not. The remarkable deficit in solar neutrino flux recorded by Davis and collaborators over the past decades has been confirmed and we look forward to hearing the details of these confirmations, as well as the energy dependence of the flux and its comparison with expectation.

A possible explanation of the flux deficit lies in the direction of supposing neutrino oscillations which convert electron neutrinos (the type detected in the Davis experiment) to muon- or tau-neutrinos. An associated property of the neutrino would be that it has a finite mass, a property which would delight those elementary particle physicists who dream of departures from 'the standard model'. This strong link of neutrino astronomy with particle physics is the reason for the present meeting being organized by a particle physicist (D. H. Perkins) and myself and for the inclusion of papers by particle physicists.

The interrelation of neutrino astronomy and cosmic ray physics is a strong one; indeed, one can regard neutrinos as comprising one of the components of the cosmic radiation. Certainly, the early experiments which detected 'cosmic neutrinos' were carried out by cosmic ray groups (including my own, in the Kolar Gold Fields, during the 1960s). Such neutrinos are produced by cosmic ray interactions and decays in the atmosphere.

It is a remarkable fact that there may be a discrepancy in the number of muon-neutrino induced events in comparison with expectation. Again, neutrino oscillations may be responsible.

The link of neutrino astronomy with cosmic rays is very strong, too, in the extragalactic arena. For some years, experimenters have been patiently developing techniques for detectors of the very large areas indeed which are necessary to record the very weak signals, principally at the highest energies, where considerable interest lies. This area of the subject seems poised to take off.

No contemporary conference on astronomy is complete without a cosmological

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component and this Discussion Meeting is no exception. In fact, it is not necessary to introduce it artificially, the cosmological connection is quite natural. Not only are massive neutrinos called upon, from time to time, to provide the dark matter particles responsible for the missing mass (a call that may, of course, be inappropriate) but some of the detectors currently being developed to search for dark matter particles should have sensitivity to cosmic neutrinos. It would be in the spirit of modern astrophysics if – as with the proton-decay experiments which recorded neutrinos from the supernova 1987A – detectors constructed to search for hypothetical dark matter particles should instead (or, better, as well) lead to new detections in neutrinos astronomy.

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