III-2-21. MIT Air Shower Project (I)

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The contents of this article are similar to III-2-5 and the separate manuscript was not provided.

Discussion

Peters, B.: Dr. Linsley attributed to the largest observed shower an energy of 6×10^{19} ev, with the possibility that the primary particle may have been as heavy as iron. In that case the radius of curvature would be 2000 pscs in a magnetic field of 10^{-6} gauss and 200 pscs in a field of 10^{-5} gauss. I would like to ask the astrophysicists whether a field of 10^{-5} gauss in the galactic disc and/or the halo is acceptable. If it is, it seems that while the evidence for intergalactic origin may be strong, it is still perhaps not quite compelling.

Linsley, J.: I assumed a field strength of 1/3 of a gamma, which is only three times less than the figure you suggest. In putting the question to astrophysicists we should make it clear that we are inquiring about only that part of the total field that can be uniform over regions of diameter about a kiloparsec.

Burbidge, G.: Some astrophysicists would feel that a coherent field of order 10^{-5} gauss in the disc is reasonable. However the arguments for such a field are indirect, and any field in the halo could be considerably weaker.

Greisen, K.: I wish to suggest that the question of a possible factor 3 in strength of the magnetic field is not very crucial. Firstly, one recovers a factor of 2 by considering that the diameter, not just the radius of the trajectory, must be contained within the field. Secondly, one should note that extremely uniform fields of special design cannot be reasonably supposed in order to solve the problem of containment of high energy particles. Thirdly, in the Mexico Conference the largest showers reported had a few times 10^8 particles. In Moscow we heard of showers with a few times 10^9 particles. Now in Kyoto both MIT and Cornell have told of showers with a few times 10^{10} secondary particles, and the end of this story is not yet in sight. The spectrum shows no sign of approaching a cutoff, and there is absolutely no reason to believe that showers several times larger in size do not exist. So increasing the magnetic field by a small factor will not save the situation for those who wish to contain all the cosmic rays in the Galaxy.

McCusker, C.B.A.: About the statistical treatment of a very small sample of events, which have been used to suggest the sidereal variation: that is, if one subdivides the showers into arbitrary classes of energy, aren't you rather likely to pick the place where the variation is clear?

Linsley: I don't know how this kind of question can be avoided. We know that any anisotropy at low energies must be small. There are physical reasons why there may be anisotropy at higher energies. In looking for such an effect, we must make some cut. If existence of anisotropy is eventually proved, it will be proved in the sort of procedure we use.