

THE ARRIVAL OF SOLAR NEUTRONS FROM A LARGE ZENITH ANGLE

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A clear solar neutron signal was detected by the solar neutron telescope located at Yangbajing at an altitude of 4250 m in Tibet, China in association with a large solar flare which took place at 0536 UT on 28 November 1998. The flare, which was located at S21E32, was also observed in hard x-rays with a magnitude X3.3 by the GOES satellite.

The solar zenith angle in Tibet at the time of the flare was large ($\theta = 53^\circ$), corresponding to an atmospheric depth of about 1000 gm, which is too great to allow solar neutrons to arrive directly at the detector. Nevertheless an enhancement was observed the solar direction but not in the anti-solar direction. We have performed a Monte Carlo calculation and have found that it is possible for solar neutrons to be detected at high altitudes, even if the solar zenith angle is large, provided scattering is taken into account (i.e. the minimum path effect, first pointed out by Smart et al.).

The data are consistent with the protons being accelerated impulsively, together with electrons, at 0536 UT. Since BATSE and YOKOH data are also available, as well as data from the magnetographs at Mitaka and NAO, it should be possible to obtain a clear picture of particle acceleration on the sun for this event.