



Contribution ID : 99

Type : Oral

Detection of High-Energy Solar Neutrons and Protons by Ground Level Detectors on April 15, 2001

Wednesday, 4 July 2007 10:30 (0:12)

Abstract content

In association with the large solar flare of April 15th 2001, the Chacaltaya neutron monitor observed an 8.2 sigma enhancement of the counting rate between 13:51 and 14:24 UT. Since the enhancement was observed from 11 minutes before the GLE, solar neutrons must be involved in this enhancement. Comparing with the Yohkoh Soft X-ray Telescope images with the observed particle time profiles, we can draw a picture on the particle acceleration mechanism as follows. By the loop-loop collisions, high speed plasma wind is generated. When the high speed plasma hits at another magnetic loop, particles inside the loop may be accelerated by the collision process within a few minutes. This may be an origin of solar cosmic rays.

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Summary

On April 15, 2001, a large solar flare was observed near the west limb of the Sun (the 'Easter flare'). In association with this flare solar neutrons were observed by the Chacaltaya neutron monitor. They were produced contemporaneously with the gamma-ray lines at 13:45-13:51UT. We conclude that protons were accelerated during this period. Soft X-ray images of the flare by the Yohkoh satellite indicate that proton acceleration probably occurred when the foot of a magnetic loop collided with the other magnetic loop. Plasma particles inside the loop may be accelerated by a shock acceleration process, in which plasma particles attain high energies in a few minutes by interacting with high-speed wind.

Reference

Proceedings of the 30th International Cosmic Ray Conference; Rogelio Caballero, Juan Carlos D'Olivo, Gustavo Medina-Tanco, Lukas Nellen, Federico A. Sánchez, José F. Valdés-Galicia (eds.); Universidad Nacional Autónoma de México, Mexico City, Mexico, 2008; Vol. 1 (SH), pages 29-32

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Session Classification : SH 1.3, SH 1.4

Track Classification : SH.1.3