Observation of Solar Neutrons by the Very Sensitive Cosmic Ray Detector

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Motivation

Solar Neutrons are very useful to investigate ion acceleration mechanism in a solar flare. We are preparing a new Solar Neutron detector for the Solar cycle 24. I will introduce this new experiment and show how I am involved.

Introduction

Solar neutrons are produced by the interactions of accelerated ions with the solar atmosphere. Some of them come to Earth directly, because they are not deflected by magnetic fields, so they carry the original energy. It is required that neutron detectors have the capability to measure neutron energy.

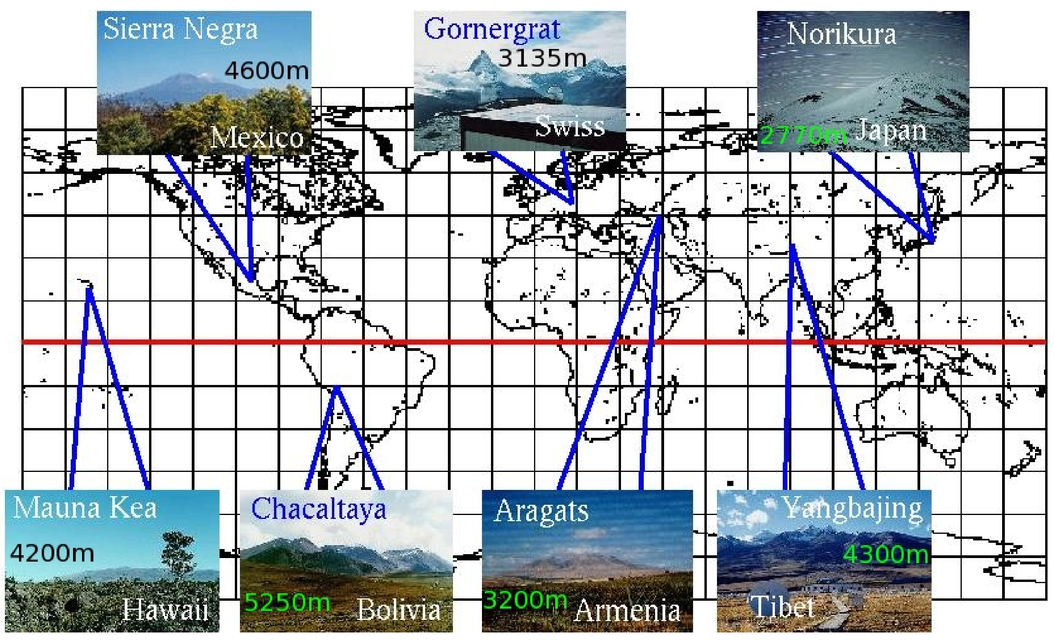

Figure 1: Current world wide network of Solar Neutron Telescopes in complete operation.

New Experiment

STELab is preparing a new type of solar neutron telescope with 10 times more sensitivity than the current ones.

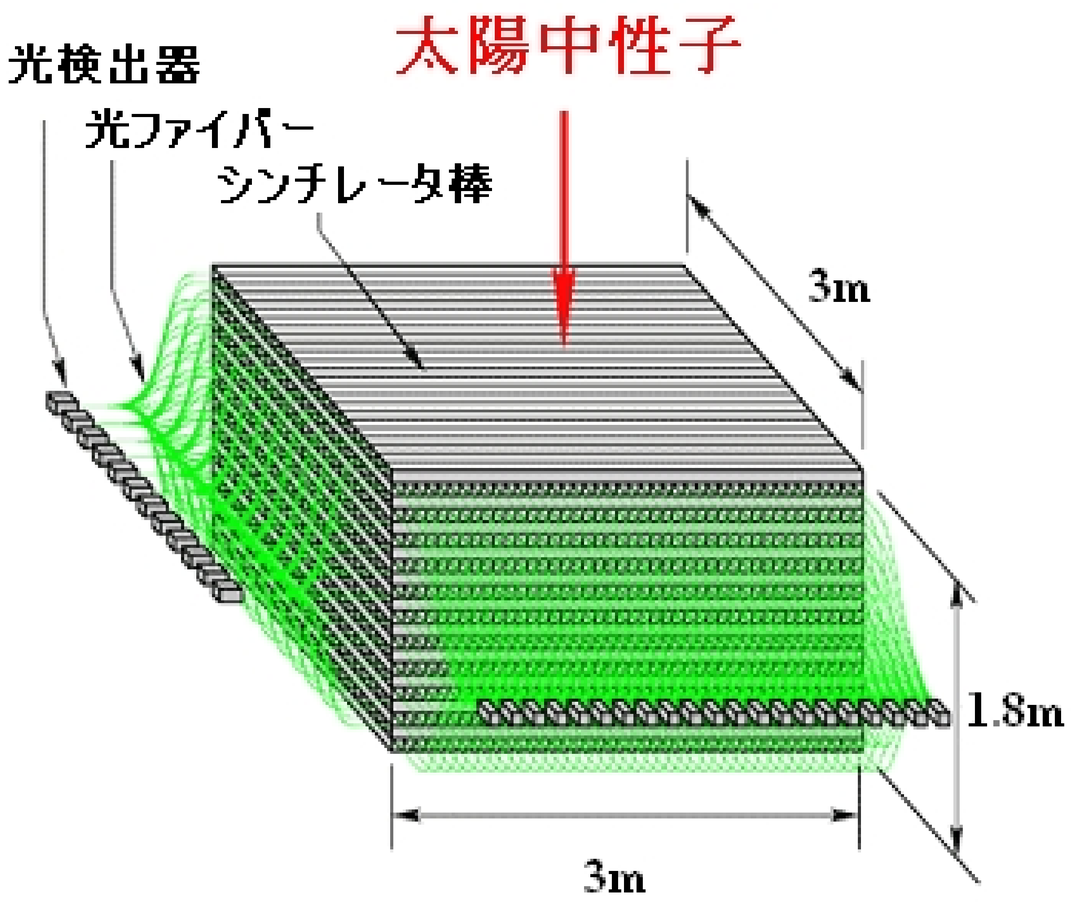

Figure 2: Schematic view of the detector.

Characteristics:

This detector (SciBar) consists of only scintillator blocks aligned orthogonally and can record the track of recoil proton. This detector was originally used in the accelerator experiment (Nitta, K., et. al., 2005 NIMA). The performance of the detector as the solar neutron detector is under study now.

Mini-SciBar Prototype

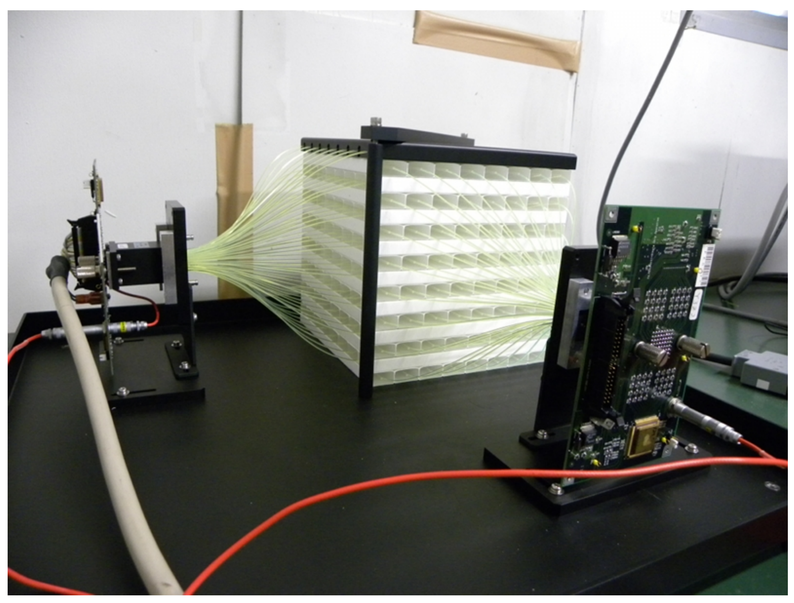

Figure 3: View of the prototype of the detector.

This is the prototype of the detector at a scaled size, to make some tests, to understand more about the capabilities of such detector, since it acts not only as a target but also as a tracker. This makes the detector powerful in terms of particle discrimination, detection efficiency and directional measurements.

Testing PMT linearity

Figure 4: Current experiment for PMT linearity and hit signal.

We are now performing several experiments to understand the process of PMT linearity by using 8 PMTs in an array and a LED Signal. I am also studying the data taking system during the test of PMTs.

Super Solar Neutron Telescope at Mexico

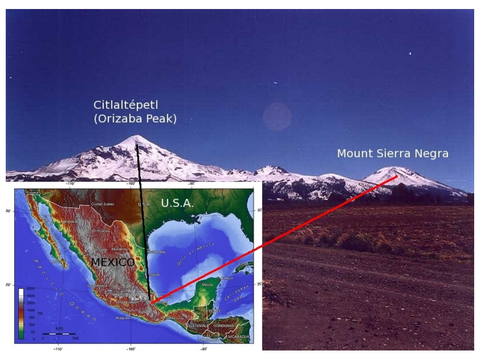

Figure 5: On the left, Pico de Orizaba at 5600m a.s.l. and on the right Mount Sierra Negra at 4600m a.s.l. viewed from the West, near Ciudad Serdán.

This site was selected because of the high altitude (4600 m a.s.l., 97.3W, 19.0N) and it is close to the Equator line, therefore it is possible to detect solar emissions throughout the year.

We are currently testing the prototype in Nagoya. It will be send to Mexico and installed at Mt. Sierra Negra this year in October. Hopefully, the full experiment will start in 2012.