

Name of research institute or organization:

Physikalisches Institut, Universität Bern

Title of project:

SONTEL - Solar Neutron Telescope for the identification and the study of high-energy neutrons produced in energetic eruptions at the Sun

Project leader and team:

Prof. E.O. Flückiger, project leader

Dr. R. Bütikofer

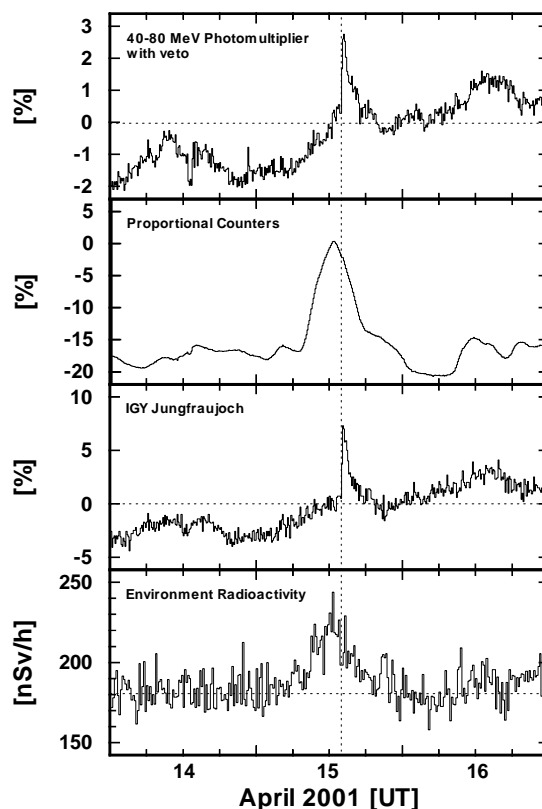
Mr. M.R. Moser

Project description:

Since 1998 a cosmic ray detector conceived as a Solar Neutron Telescope (SONTEL) has been in operation at Gornergrat as the European cornerstone of a worldwide network for the study of high energy neutrons produced during energetic processes at the Sun. Observations of solar neutrons can provide unique information on the acceleration of particles in association with solar flares and coronal mass ejections.

In 2001 operation of SONTEL has been continued, in collaboration with our Japanese colleagues. Only minor maintenance work on the hardware was necessary. The laboratory container had to be slightly modified for additional cooling during the summer season.

From March 29 to April 15, 2001, nine large solar flares were reported by the GEOS satellites with magnitude $X > 1.0$. For six of them, the most suitable positions to detect solar neutrons by detectors of the global solar neutron network were on the European continent. In association with the large solar flare on April 12, 2001, weak evidence was found for a simultaneous observation of solar neutrons near Earth by the Gornergrat and Mt. Aragats (Armenia) neutron telescopes. During the solar event of April 15, 2001, the worldwide network of neutron monitors recorded a ground level enhancement (GLE). An increase in the counting rate due to relativistic solar particles was also observed by



Comparison of SONTEL data with Jungfrauoch IGY neutron monitor data and environmental radioactivity measurements at Gornergrat around the GLE on 15 April 2001.

SONTEL, similar to the count rate increase of the neutron monitors at Jungfraujoch, as illustrated in the figure. As the event occurred around 15 UT, the detector at Gornergrat was in a favorable position to detect solar neutrons. However, in the analysis made so far no evidence was found for the presence of high energy solar neutrons near Earth during this event.

Within a special campaign in spring 2001 the environmental radioactivity was measured at Gornergrat in order to identify the cause of unusual increases in the SONTEL count rate which occur mainly during periods with precipitations. For the GLE on April 15, 2001, the corresponding recordings are also shown in the graph. The increase in the SONTEL and neutron monitor count rates due to solar particles occurred after 15 UT (marked by the vertical dashed line). However, the count rate of the proportional counters as well as the intensity of the environmental radioactivity show an increase that started several hours before the solar event and that lasted almost half a day. A study has been initiated to investigate the unknown reasons for this interesting phenomenon.

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Key words

Astrophysics, cosmic rays, solar neutrons

Collaborating partners/networks:

Solar Neutron Telescope Network (<http://stelab.nagoya-u.ac.jp/ste-www1/div3/CR/Neutron/index.html>)

Prof. Y. Muraki, Prof. Y. Matsubara, Dr. T. Sako, Dr. H. Tsuchiya, Solar Terrestrial Environment Laboratory, Nagoya University, Nagoya 464-8601, Japan

T. Sakai; Physical Science Lab., College of Industrial Technology, Nihon University, 2-11-1 shin-ei, Narashino-shi, Chiba 275, Japan

Prof. A. Chilingarian, Cosmic Ray Division, Yerevan Physics Institute, Yerevan, 375036, Armenia

Scientific publications and public outreach 2001:

Bütikofer, R., E.O. Flückiger, Y. Muraki, Y. Matsubara, T. Sako, H. Tsuchiya, and T. Sakai; The upgraded solar neutron detector at Gornergrat, Proc. 27th International Cosmic Ray Conference **8**, 3053-3055, 2001

Flückiger, E.O., R. Bütikofer, A. Chilingarian, G. Hovsepyan, Y. Muraki, Y. Matsubara, T. Sako, H. Tsuchiya, and T. Sakai; Search for solar neutrons in association with large solar flares in July 2000 and March/April 2001, Proc. 27th International Cosmic Ray Conference **8**, 3044-3047, 2001

Address:

Physikalisches Institut, Universität Bern
Sidlerstrasse 5, CH-3012 Bern

Contacts:

Rolf Bütikofer Tel. +41 31 631 4058 e-mail: rolf.buetikofer@phim.unibe.ch
URL: <http://kspc4.unibe.ch/sontel.html>