

Italian initiatives in space weather.

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Italian newspapers have recently addressed “space weather” issues especially under the impact of news about the loss of telecommunication satellites; this effect is more real to southern countries public opinion than power lines failure which happens at higher latitudes. The attention of the general public is anyhow alerted to this type of phenomena at this time.

Specific initiatives related to space weather prediction or alert are not known to the author in the national framework. The Italian contribution to this discipline is nevertheless remarkable in the field of scientific investigation of the phenomena involved in solar-terrestrial relationship.

In the following a brief outline will be given of the national research groups which act in the various segments of the process which brings activity on the surface of the Sun to interact with human life on Earth.

SOLAR PHYSICS

Ground based observations.

Observations of the surface of the Sun are carried out by different groups at various wavelengths.

Optical data are taken and studied by means of solar observatories:

At the French-Spanish-Italian observatory THEMIS, Canary Islands, the IPM (Italian Panoramic Monochromator) is in operation at the telescope focal plane, and is to be used for studies of MHD behavior of magnetic structures and convective properties.

At the Rome Observatory, the first of the PSPT's (Precision Solar Photometric Telescope) is operational and will take images of the full solar disk at photospheric and chromospheric wavelengths.

Helioseismology is studied also with the objective of analysing energy transport mechanisms in the lower photosphere and in the chromosphere.

The groups involved in such research are at:

Tor Vergata University, Rome
Rome Astronomical Observatory
Florence University
Arcetri Astronomical Observatory, Florence
Naples University
Capodimonte Astronomical Observatory, Naples
Istituto di Fisica dello Spazio Interplanetario, CNR, Rome
La Sapienza University, Rome.

The broad scientific objectives of these groups are the investigation of solar variability on various time scales as an input function to the mechanism of solar terrestrial relations.

At the Trieste Astronomical Observatory two multichannel radiopolarimeters are operational and are used to monitor solar radio flux at various frequencies, including 10.7 cm from which the classical daily index is determined. The system is used to study energy release in solar flares and emission and propagation mechanisms.

1.2 Space borne observations.

The main Italian contribution to space borne observations relevant to the study of solar physics is UVCS (UltraViolet Coronagraph Spectrometer) on the ESA mission SOHO. This instrument was built by NASA and ASI (the Italian Space Agency).

The scientific institutions involved were the Universities of Florence, Padova and Torino, with support from the Observatories of Catania, Palermo and Trieste.

Ultraviolet spectroscopy of the outer solar corona, from 1.3 solar radii to 10 solar radii, is carried out by UVCS groups to measure directly:

- coronal velocities (through direct Doppler effect and Doppler dimming)
- temperature of the ejected plasma
- abundance of various minor ions.

SOLAR WIND STUDIES.

The investigation of solar wind properties and of their variation with time is carried out at the University of L'Aquila, at the University of Tor Vergata, Rome and at IFSI/CNR.

Magnetic clouds, corotating solar wind beams and MHD discontinuities are studied with special attention to interplanetary perturbations in the Earth's magnetosphere. Data from the WIND satellite are used in the framework of collaboration with NASA and MIT.

At the University of Calabria the propagation of energetic solar particles in the magnetic turbulence of the solar wind is studied through numerical simulation.

SOLAR WIND/MAGNETOSPHERE/IONOSPHERE INTERACTION

Plasma transfer through the magnetopause, from the solar wind into the magnetosphere, is studied at IFSI/CNR, Rome, on the data of the instrument ESIC; this is an electrostatic analyser with time of flight measurements, which provides 3D distribution functions of four ion species once every 1.5 seconds, with excellent angular and energy resolution. The instrument is on board the EQUATOR-S satellite of MPE and DLR, Germany, and has operated for several months.

A similar instrument built under the responsibility of IFSI/CNR will be part of the CLUSTER-II payload to be launched for solar wind and magnetosphere studies in the year 2000. This will be part of the CIS instrument (CLUSTER Ion Spectrometer, Principal Investigator H. Reme, CNES, France)

Magnetospheric substorms are investigated at IFSI/CNR from the point of view of "time intermittency" and studies of AE-index fluctuations have shown that the magnetosphere is in a non-equilibrium dynamical configuration. The ring current has been modeled based on AMPTE CHEM data, in a collaboration with MaxPlanck Lindau.

Ground based studies are being undertaken based on instrumentation that is going to be installed at the CNR arctic base in NyAlesund, Svalbard. An all-sky camera of the same type of those already available in a meridional chain operated by the Finnish Meteorological Institute, will be placed at NyAlesund, at

sufficient distance from that of Longyearbien to make tomographic studies of the aurora possible.

Several instruments are available for magnetosphere/ionosphere interaction at the Italian Antarctic base in Terra Nova Bay. The Istituto Nazionale di Geofisica, Rome, operates a DC magnetometer, an ionosonde and a riometer; the University of l'Aquila operates a search coil magnetometer and IFSI/CNR, in cooperation with ENEA, is installing a multispectral all-sky camera which will be operational starting in the southern winter of 1999. IFSI/CNR, in cooperation with LPCE of CNRS Orleans, is preparing for the installation of a SUPERDARN radar in the island of Kerguelen, where it will operate crossed with the Japanese radar at Syowa. The southern network of SUPERDARN will be thus extended 180 degrees around the southern magnetic pole.

The Istituto Nazionale di Geofisica in Rome and the University of l'Aquila operate magnetic stations at mid latitudes in Italy; magnetometers are operated at Castel Tesino and l'Aquila, and a search coil system is available at l'Aquila.

Modeling on two and three dimensions ionospheric parameters, electron density profiles and TEC on regional and planetary scale is one of the scientific objectives for the group at the Istituto Nazionale di Geofisica, and is at the base of their involvement in the European COST251 action, in which IROE/CNR and ICTP/Trieste also participate.