

POLISH REPORT TO JOSO ON SOLAR RESEARCH IN 2002 and 2003

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January 28, 2004

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**In 2002 and 2003 investigations of the Sun in Poland were reported
by:**

- The Astronomical Institute of Wrocław University
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(ul. Kopernika 11, 51-622 Wrocław)
- The Solar Physics Division of Space Research Centre of Polish Academy
of Sciences,
<http://www.cbk.pan.wroc.pl/>
(ul. Kopernika 11, 51-622 Wrocław)
- The Astronomical Observatory of Jagiellonian University,
<http://www.oa.uj.edu.pl/>
(Fort Skała, ul. Orla 171, 30-244 Cracow)
- Warsaw University Astronomical Observatory
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- Nicolaus Copernicus Astronomical Center, Warsaw
<http://www.camk.edu.pl/eng/>
(ul. Bartycka 18, 00-716 Warsaw)
- Toruń Centre for Astronomy, Nicolaus Copernicus University, Department
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1 The Astronomical Institute of Wrocław University (AI Wr.U)

The AI's Solar Physics Group consists of 15 people - professors 4, doctor habilitatus 1, Phd's 3, masters 2 and 5 technicians.

1.1 Observing facilities ($H\alpha$ hydrogen line)

Białków Observing Station (70 km towards North-West from Wrocław)

- Large Coronagraph 53/1450 [cm] - filtergrams taken in 0.5 Å or 3.0 Å passbands, with spatial resolution 0.3 arcsec.
- MSDP (Multi-Channel Subtractive Double-Pass spectrograph) fed by the Large Coronagraph - spectral imagery (dopplergrams, monochromatic images in various parts of a spectral line chosen for observations, intensity maps, $H\alpha$ line profiles - in the range ± 1.2 Å from the line center). Spatial resolution ~ 0.5 arcsec.
- In 2002 we have installed the SECIS eclipse observing system to our Multi-Channel Subtractive Double Pass spectrograph fed by the Large Coronagraph. The SECIS system was already used by joint British-Polish expeditions lead by Kenneth Phillips for observations of total solar eclipses in 1999 at Shabla, Bulgaria and in 2001 at Lusaca, Zambia. During the 2003 observational season we have used this setup for observations of flare evolution with a very high time resolution (20 $H\alpha$ spectral images per second). The collected observational material is presently under processing and analysis.
- Solar Horizontal Telescope was under renovation and modification in 2003. (15/500 [cm] - filtergrams (0.5 Å) of prominences at the limb and images of chromospheric structures seen on the disk, spatial resolution ~ 1 arcsec.)

Wrocław Observatory,

- Small Coronagraph 13/340 [cm] - filtergrams of prominences and limb flares (3 Å). The lists of Limb Flares and Active Prominences Observed at this place for the years 1978 - 2000 can be found at:
<http://www.astro.uni.wroc.pl/ldbbase/prot.htm>.

1.2 Matter of research

- Observations of $H\alpha$ structures and velocities in active regions.
- Observations of small-scale structures in prominences and flares.
- Investigations of evolution of active prominences, flares and X-ray ejecta. CME's - X-ray ejections relationship.
- Investigations of internal motions and oscillations in quiescent prominences.

- Evolution of flares, quiescent and active prominences.
- Search for high-frequency intensity modulation in the low corona and some coronal structures and search for short period coronal plasma intensity oscillations.
- Investigation of nano-flare heating of the solar corona and response of flare footpoints to non-thermal electron beams precipitation.
- Relation of radio spikes to solar eruptive phenomena.
- Investigation of turbulence and energy release in high-temperature flare kernels.
- Development of new model of electron acceleration in solar flares (collapsing magnetic traps).
- Plasma diagnostics and modelling of flare kernels and active prominences.

Co-operation

Most of the above mentioned investigations were performed in cooperation with the following astronomical institutions/groups: l'Observatoire de Paris-Meudon, I.A.S. Orsay, Goddard Space Flight Center, Institute of Astronomy of the Bulgarian Academy of Sciences, Institute of Astronomy of the Czech Academy of Sciences (Ondrejov Observatory), Mullard Space Science Laboratory, Rutherford Appleton Laboratory, Wrocław Division of the Space Research Centre of the Polish Academy of Sciences and Toruń Centre for Astronomy of the Nicolaus Copernicus University.

2 Solar Physics Division of Space Research Centre

The staff counts 11 people, three senior researchers, two research assistants two engineers, optician, one technician, system administrator and secretary. Three of them are only part-time jobs in our Lab. Therefore, we recorded substantial loss (5 people) in staff forced by enormous economic pressure related with continuously decreasing funding of academic institutes in Poland (0.3 % of GNP product has been allocated to science over the last two years). On the positive side, one of our assistants (Szymon Gburek) successfully defended PhD thesis work http://www.cbk.pan.wroc.pl/phd_theses/Gburek_PhD_thesis.pdf.gz related to determination of *Yohkoh* SXT PSF.

2.1 Matter of research

- **Determination of coronal plasma composition** from the analysis of X-ray line and continuum. In collaboration with MSSL and RAL, (UK)

and NRL (USA). RESIK data have been analysed in this respect, in addition to the *Yohkoh* BCS spectral measurements. Enhanced abundance of potassium has been reported in respective ApJ letter.

- **Yohkoh SXT PSF determinations** project has been partly accomplished for SXT thin Al filter using so called blind deconvolution algorithm for PSF determination.
- **TRACE image deconvolution** project has been progressing. New technique of blind deconvolution has been applied in order to determine TRACE PSF.
- **Precise co-alignment of solar images from different instruments** has been applied for images taken by TRACE, SXT and HXT. Occulting limb has been used as a reference for flare events seen behind the disk.
- **DEM maximum likelihood algorithm** has been further developed and used for analysis of time variation of temperature structure of flaring plasma.

2.2 Experimental projects

- **Diogenes - Flat Scanning Bragg Spectrometer** has been operating aboard *CORONAS-F* (IZMIRAN) solar observatory for about two months in August – September 2001. The instrument collected 2500 high resolution X-ray spectra in vicinity of Ca XIX, S XV and Si XIII resonance lines.
- **RESIK - Bent Crystal Bragg Spectrometer**, has been collecting spectra in four X-ray bands: 3.3 - 3.9 Å, 3.8 - 4.3 Å, 3.3 - 3.9 Å, 4.3 - 4.9 Å and 5.0 - 6.1 Å over approximately 15 months between February 2002 and may 2003. Many new lines are observed in the spectra. The analysis of the data is in progress.

All published papers containing the results of described analysis are available at:
<http://www.cbk.pan.wroc.pl/publications.htm>

3 The Astronomical Observatory of Jagiellonian University

3.1 Observing facilities

Since October 1995 a new 8 m antenna is in operation. Feed: WJ-48603 (0.25-2.00 GHz), circular polarization. Spectral analyser: HP8590B, source calibration noise - HP 346B. The entire solar-disk observations are carried out daily at 10 frequencies: 275, 405, 670, 810, 925, 1080, 1215, 1350, 1620, 1755 MHz (each bandwidth - 5 MHz). Observations at frequencies 945, 980, and 1450 MHz had to be stopped because of strong disturbances from TV, radar and other sources. The

data are presented daily. <http://www.oa.uj.edu.pl/slonce/index.EN.html>. Older data (from October 2002) are available from the archive <http://www.oa.uj.edu.pl/slonce/index.EN.html>)

3.2 Matter of research

- **Investigations** of solar periodicities in radio data.

4 Warsaw University Astronomical Observatory

The staff working on solar-related problems consists of one professor, one PhD scientist and two assistants. One thesis work is in preparation.

4.1 Matter of research

- **Sunspots**
- **Magnetic activity of cool stars**
- **Convection, hydrodynamic simulations**

5 Nicolaus Copernicus Astronomical Center, Warsaw

The staff interested in solar-related problems consists of one professor and four senior scientists. One person interested in magnetospheric radiophysics works in Toruń branch.

5.1 Matter of research

<http://www.camk.edu.pl/eng/research.html>

- **Modelling of solar internal structure**
- **Astroseismology**

6 Toruń Centre for Astronomy NCU, Sun Radio Patrol Group

There is one person making observations of the solar radio activity at 127 MHz. The observations are being reported on the web page <http://www.astro.uni.torun.pl/gg/>. The access to archival data is also possible from this web page.