

Metsähovi Radio Observatory
Annual Report 2009

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1 Introduction

Metsähovi Radio Observatory, a research institute at Aalto University (formerly: Helsinki University of Technology, TKK), operates a 14 m diameter radio telescope at Metsähovi, the village of Kylmälä in Kirkkonummi, about 35 km west from the Otaniemi university campus.

Metsähovi is active in the following fields: radio astronomical research, multifrequency astronomy and space research, development of instruments and methods for radio astronomy, and (radio) astronomical education. Geodetic VLBI observations are also done in Metsähovi in collaboration with the Finnish Geodetic Institute.

In 2009 twenty-three scientists, engineers, research assistants and support personnel worked at the institute. In 2009 the total expenditure of Metsähovi Radio Observatory was 1 036 132 euros including salaries and the rent of the office and laboratory space at the Metsähovi premises. This was funded by TKK, the Academy of Finland, the European Union, and other outside sources.

The past few years have been full of organisational changes in our university. In 2008 Metsähovi was merged with the new faculty of Electronics, Communications and Automation but still maintained its status as a separate research institute. In 2009 preparations were made to create Aalto University (officially established 1.1.2010) through a merger between TKK, the Helsinki School of Economics and the University of Art and Design. These years of reformation have been full of increased administrative load. We are looking forward to the new university taking its form and becoming fully operational, when we will hopefully once again have time to concentrate on scientific research!

Merja Tornikoski
Director of the Aalto University Metsähovi Radio Observatory

2 Research Activities

In this chapter the main research activities at Metsähovi are introduced. Some of the project teams include also scientists working at other institutes. The contact person at Metsähovi is underlined in each project team list.

2.1 Radio Astronomical Instrumentation

Research Group at Metsähovi: Tornikoski, Mujunen, Kallunki, Kirves, Oinaskallio, Ritakari, Rönnberg

2.1.1 3 mm

Project team: Kirves, Mujunen, Oinaskallio, Kallunki, Rönnberg

Efforts continued to bring the IAP project SRW-B, the new HEMT front end based 3 mm receiver, into operational stage. In March 15th - 20th a visit to IAP at Nizhny Novgorod was realized, as agreed in previous year. Kirves, Mujunen, Kallunki and Wiik (Tuorla) participated. IAP staff demonstrated us the partly built up construction. During the visit it was agreed that there are minor chances that the receiver would be available in Metsähovi by the beginning of May. The receiver did not appear for the spring observing session, however. The shipment arrived finally in the end of August 2009, after several weeks of complicated customs procedures.

The IAP staff started assembling the complex right after its delivery to Metsähovi. The work included the assembly HEMT front end and LO1 synthesizer, which DA-Design delivered in April. Test run in laboratory revealed quite many issues for improvement, eg. the sensitivity, cabling, spurious and remote controlling and monitoring. Despite many weeks work, the receiver did not qualify for October session. In all we were not able to participate in GMVA sessions during year 2009.

2.1.2 Maintenance of receivers

Continuum receivers as well as 22 GHz and geodetic VLBI receivers operated without failures during year 2009.

2.1.3 Miscellaneous

Operational check was done for the receivers which have been non-functional several years. The 37 GHz solar receiver is basically operational. It is needing an installation to the standard platform to be useable. The response of the polarisation channels need to be checked and tuned by means of a known calibration source. The 43 GHz VLBI has one of its original LNAs functional which was verified with VNA measurement at MilliLab in Otaniemi. To be useable as a dual channel VLBI receiver it still needs two working cryogenic LNA modules.

CAD drawings were received for the pseudocorrelation receivers. This project (SRW-C) has been delayed due to the unfinished 3 mm receiver project.

In December Rohde & Schwarz FSUP phase noise signal analyser was borrowed for two weeks. The measurements produced valuable information about the quality of various oscillators in use at Metsähovi Radio Observatory. Hydrogen masers are working accurately and reliably. The reference frequency synthesizers in VLBI receivers perform reasonably. Some could be improved by phase locking loop filter adjustment.

Because of the ending of the current debt conversion contract in 31.12.2009 the ministry of employment and economy (TEM) queried about the delivery of the equipment. An opinion on the matter

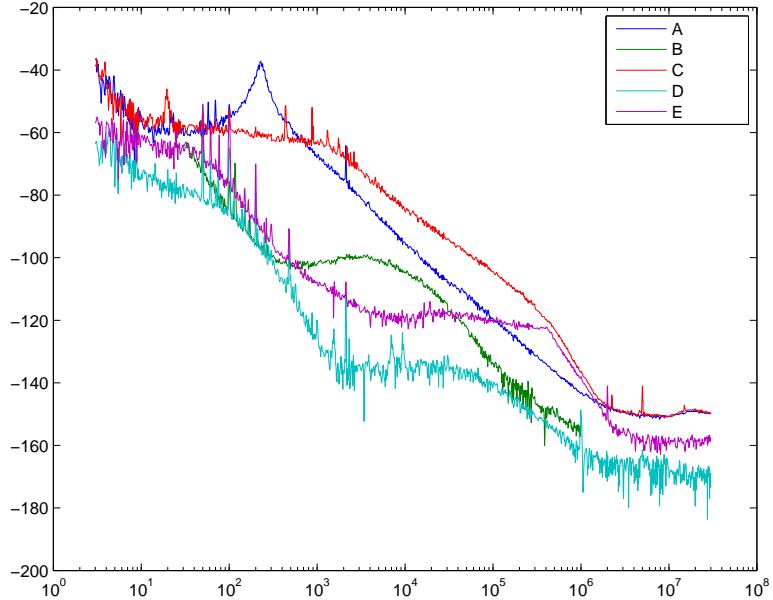


Figure 1: Various local oscillators performance, X-axis = frequency offset from carrier, Y-axis = phase noise dBc/Hz.

was reported to TEM in May.

Petri Kirves participated the RadioNet organised workshops in Göteborg (June) and Bonn (November). The former was about low noise cryogenic amplifiers which are standard building blocks in sensitive radio astronomic receivers. The latter workshop theme was multi-pixel receivers, used mainly at very large radio telescopes.

2.1.4 IT Infrastructure

Project Team: Mujunen, Lindfors, Aatrokoski

Data Storage

The NFS server housing the home directories (nova) was again upgraded with a new machine. It was discovered that the old server installed in 2008 had a hardware setup that was complex with eight disks and a bit suspect motherboard, and a bug in the Linux RAID10 implementation that caused occasional corruption. The new server has a server motherboard and only four disks in a RAID1+0 setup.

The data server housing the Metsähovi scientific data was upgraded to new hardware with RAID1 disks.

A new comprehensive backup system was developed to back up everything to the backup server in the clock cellar. The new system keeps daily versioned backups, and removes old backup versions on demand when disk space is running low during backup. At the end of the year the disks were upgraded to bigger ones as the amount of data to back up had yet again grown.

Virtualization

The two virtualization servers were changed to use Xen instead of KVM due to KVM stability problems causing hangs and crashes. The motherboards of the servers were also changed, partly in effort to fix the KVM problems, and partly due to other issues. At first Debian was used as the Xen host OS, but later it was changed to OpenSUSE due to some issues. OpenSolaris was also tested as a Xen host, but was found unsuitable for our hardware and purposes.

The apps2 replacement server orbit was put into production use, and apps2 was retired, and so was the old shell/multi-purpose server kurp.

Dedicated virtual machines were created for running IDL (Linux) and Autocad (Windows).

The winapps server originally running in VMWare was converted to KVM, and then later to Xen with the rest of the virtual machines.

Communications

The legacy phone numbers were transferred to the new VoIP telephone system, except for two that were left for fax and emergency use.

The Finnish Geodetic Institute's internet connection was set up to go through Metsähovi's 10 Gbps fiber connection.

Servers



Figure 2: Front and back views of the new server rack. On top of the middle rack: webcam pointed at the extra display (keyboard and main display are on a table on the front side of the rack). In the middle rack, from top to bottom: gigabit ethernet switch, media converters for internet and clock cellar fibers, fiber optic panel, KVM switch, controllable power sockets, remote keyboard device and its controller computer, UPS, UPS extra batteries.

A new rack was built for all the server machines, and the machines were moved from the old computer room to the new rack in the control room. The rack system consists of two old, emptied-out VLBA

tape recorder racks, which house the server machines, and one old HP 2100 rack between them that houses the ethernet switch, KVM switch, UPS and UPS batteries.

The UPS output is routed to 24 relay-controlled sockets. The relays are connected to a AVR micro-controller USB key, enabling the power to the sockets to be controlled individually via the controlling computer.

The server rack also has a remote display and keyboard. The display is just a web camera pointed at a duplicate console display, and the keyboard is another AVR device plugged between the actual keyboard and the KVM switch. This setup enables remote console access to the server machines in emergencies, though the display can be hard to read due to lighting conditions and camera autofocus.

The server rack gigabit ethernet switch is also an integral part of the new network topology. Previously the leaf switches servicing the new and old side office rooms were connected by a single gigabit fiber connection. The new topology is a star, with each of the leaf switches as well as the connection to the internet and to the clock cellar connected to the server rack central switch with gigabit fiber.

A new server for handling various infrastructure services, named infra, was installed. The services housed on this server include the WWW proxy, the localweb web server, secondary name server, print server, and samba domain controller.

Miscellaneous

All desktop computers were converted to Ubuntu, whereas previously there were also some Debian machines.

2.1.5 Hydrogen Maser

Project Team: Oinaskallio, Kallunki, Mujunen

Both Hydrogen Masers 69 and 70 continued to work throughout 2009 without any failures. Only the synthesizer value of H-maser 69 was adjusted seven times and H-maser 70 value was adjusted once during the year 2009. In Figure 3 the time differences between the H masers (69) and two GPS (HP-GPS and CNS-GPS) clocks is illustrated.

2.1.6 New Hardware

Project Team: Mujunen, Kallunki, Oinaskallio, Rönnberg

Antenna Motors

Both elevation and azimuth motors were replaced during the 2009 after previous ones broke. Elevation motors were changed in January 2009 and azimuth motors in July 2009. The old motors were repaired by changing the carbon brushes and turning anchor. Also torque vs. current characteristic of the antenna motors (new ones, repaired and used) was measured with special torque sensor and self-made test bench. Thus in the future it is possible, based on the existing statistic, to do motors life-time analysis. In Figure 4 test setup of the antenna motors is shown.

Sunant

The pointing of the Sunant antenna was further developed. Hard disk of the antup3-computer (antenna control computer) was broken in December 2009. Rest of the year antenna worked without

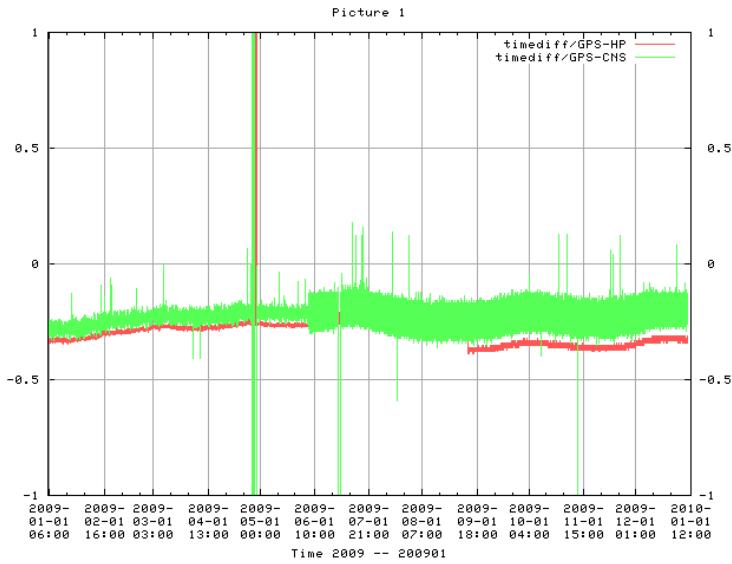


Figure 3: A time difference measurement between the H masers and the GPS clocks, GPS-HP and GPS-CNS, 2009-2010.

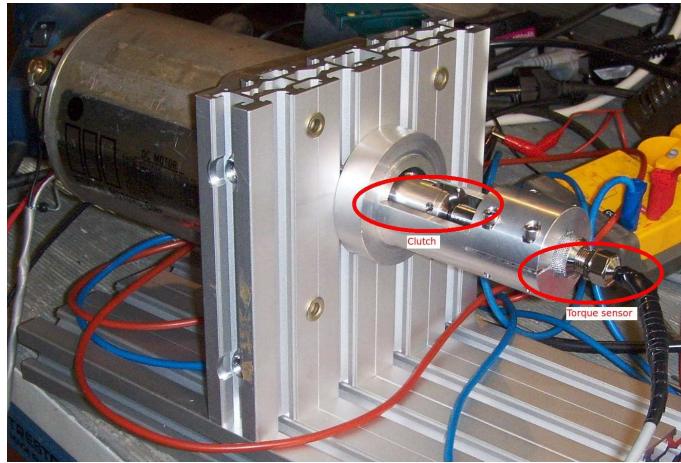


Figure 4: Test environment for the antenna motors.

any failures.

spektr3 - RFI measurement system

The spectrum analyzer of RFI measurement system was replaced in September 2009. New handheld FieldFox analyzer proved to be more reliable than previous CSA analyzer, especially during the network failures. System control software was further developed. Also some power supply wires on top of the roof were renewed.

Quality of supply - impromevents in MRO

Beginning of 2009 MRO launched to monitor quality of supply. During the year 2008 some inexplicable computers failures happened (computers rebooting), which suspected to be happening on insufficient power supply quality. In the figure monitored main voltage over two months is illustrated (10.7.-10.9.2009).

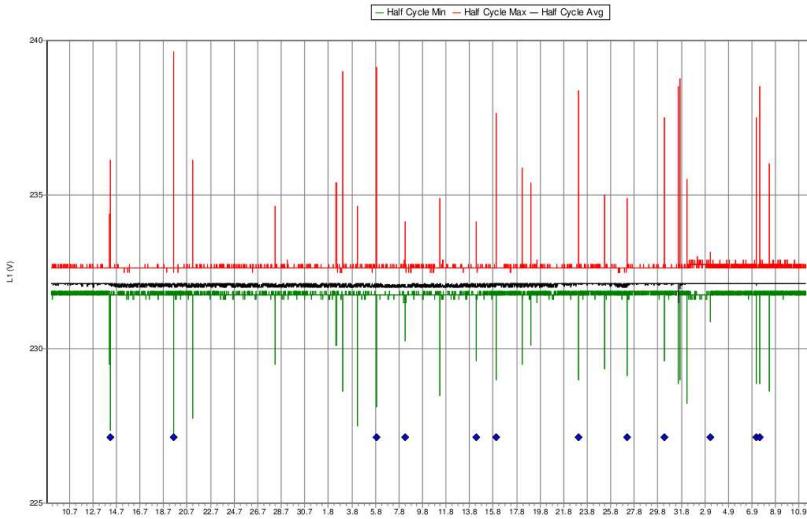


Figure 5: Variations of main voltage (10.7.-10.9.2009, taken from supply no. 59 (radome switchboard)). Measured with using Fluke VR170, voltage quality recorder.

Also two large uninterruptable power supply (UPS) units were installed (each one has capacity of 7560 VAh) during the 2009. Another one is feeding new network/computer rack and another one is feeding receiver unit (among others receivers and back-end). Both units have loading level around 1100-1200 VA, thus the UPS unit can feed the load around 5 hours.

Additionally, extra over voltage protection was installed to the radome switchboard's main supply, for example preventing over voltages caused by the lightning.

Monitor systems

New 86 GHz-VLBI HEMT receiver's monitor system was also built. The system makes it possible to monitor such as dewar temperatures and IF-part dc-power sources.

Purchasing of new measurement equipments

At the end of the year 2009 two new measurement devices were purchased to MRO; oscilloscope (LeCroy, WaveRunner 204Xi) and spectrum (signal) analyzer (Agilent Technologies, EXA 3 kHz - 26.5 GHz).

2.2 VLBI Instrumentation

Project team: Ritakari, Kirves

The new 86 GHz receiver arrived last June in our laboratory. Unfortunately, we could not use it during any of the two mm-VLBI session organized this year. The receiver manufactured in Russia is still lacking major fixes. On the other hand, our 43 GHz receiver has been out of order for the last years and it is still waiting to be repaired. The DA-Design receiver engineer is working on it. We hope to have it operative early next year.

Status of our VLBI hardware: a number of rack BBCs are broken and beyond worthwhile repair. We already have a quote and open order for one DBBC unit for geodetic purposes. For the time being we will use an iBOB 1xVSI as a 10G workaround design.

2.2.1 eVLBI and EU FP6 EXPReS

Project team: Ritakari, Wagner, Molera, Mujunen, Uunila

We have developed a new data storage system (4G-EXPReS) after comprehensive testing of SATA equipment that is capable of 4-6 Gbits today and 8 Gbps in the near future.

Based on COTS components and a standard 10G network card, a single 'gamer' computer can store or send network data such as raw Ethernet frames or iBOB/dBBC/etc UDP packets at above 4 Gbps (G. Molera, European 4 Gbps VLBI and e-VLBI, EXPReS09, Madrid, Spain, June 2009).

The 4G-EXPReS can be command compatible to the proposed Mark5C and allows to use better file formats. We used the 4G-EXPReS successfully to record low-speed water maser and spacecraft observations, have performed up to 7 Gbps Tsunami-UDP file transfers and have captured 2x2048 Gbps VLBI observations from iBOB UDP VDIF streams.

All the possible information about which hardware to buy, how to install the equipment or how to set up all the scripts are available in our web page documentation:

<http://www.metsahovi.fi/en/vlbi/ibob/4gexpres>

We used the computing and storage hardware including older PC-EVNs during 2009 for real-time transfer and recording of astro /geo e-VLBI sessions, processing for single dish spectroscopy in the Solar system using VLBI equipment, phase-locked spacecraft tracking experiments as well as 512MHz wide-band cosmic lensing detection.

2.3 VLBI Space Science Applications and Spacecraft tracking

Project team: Mujunen, Wagner, Molera

The observations of the ESA Venus Express spacecraft with the Mh radio telescope on X-band has continued during all the year. Other stations, like Wz, Mc, Ma and Nt, have also joined the sessions. Data is analyzed with ultra-high accurate processing software for phase-locked satellite tracking based on the phase referencing method (J. Wagner et al, Presentation at RadioNet FP6 Workshop, Yebes, Spain, Nov 2008).

Towards the end of the year Metsähovi has evolved into a kind of correlator center. New computers, lots of new RAID capacity, data archive, store and process multiple stations. We upgraded our internal storage capacity by adding two new computers. The current capacity is up to 50 TB.

Under ESA and the Finnish Academy we plan to expand our data handling capacity.

2.4 VLBI Observational Activities

Project team: Mujunen, Molera, Ritakari, Wagner, Uunila

Metsähovi performs both astronomical and geodetic VLBI observations in conjunction with three global networks of VLBI: the European VLBI network (EVN), the International VLBI Service (IVS; in collaboration with FGI), and the Global Millimeter VLBI Array (GMVA). Furthermore, Metsähovi has actively taken part in spacecraft VLBI tracking observations organized by Joint Institute for VLBI in Europe (JIVE) in cooperation with the European Space Agency (ESA) as well as real-time dUT1 experiments with Japan and Sweden.

2.4.1 VLBI Sessions in 2009

In 2009 Metsähovi took part in seven geodetic off-line and real-time e-VLBI sessions. The Global mm-VLBI Array (GMVA) observed one session with Metsähovi in October. Metsähovi participated in two EVN sessions in July and October.

2.4.2 EVN Eight Gigabit Experiment (2 * 4 Gbps)

Under the EVN n09k3 in October, Onsala, Jodrell Bank and Metsähovi performed the first 4 Gbps experiment in the EVN. It was a partial success. The Onsala 4G-EXPReS setup worked flawlessly at 4 Gbps through the experiment. The Metsähovi 4G-EXPReS worked perfectly too, but lack of disk capacity and not using Skype unfortunately led to the end that Onsala and Metsähovi did not have any common scans recorded.

We hope to repeat the exercise at the next opportunity with all three stations and then finally be able to use JIVE software correlator capacity to process this 12 Gbps observation.

2.4.3 e-VLBI sessions in 2009

In 2009 Metsähovi participated in several real-time VLBI sessions, so-called e-VLBI sessions. In an e-VLBI experiment the observational data collected with several antennas around world is transferred in real-time over the Internet to the correlator, where the data is analyzed and processed. The special e-VLBI events Metsähovi took part in 2009 were:

- 15th of January, the 24-hour e-VLBI experiment. The demonstration was held during the opening ceremony of the International Year of Astronomy in Paris at the UNESCO headquarters. During the 24 hours several sources were observed using Australian, Asian, European and American telescopes. All data was finally correlated at JIVE, Netherlands.
- 3rd of April, the 100 hours of e-VLBI experiment. During the weekend 100 hours of data were recorded and transferred to the correlator. Metsähovi was one of the twenty radio telescopes all around the world which participated in this demonstration.
- 8th of November, the IVS community organized another real-time session with a special focus on astrometric observation of the 295 ICRF2 sources in a single 24-hour session. The demonstration was a success with a new record of number of participating stations.

2.5 AMS-02

Project Team: Ritakari, Molera

The construction of the detector is progressing well at CERN in a specially-built clean room at the CERN Prévessin site. The data acquisition tests with the detector have been initially performed with ad-hoc software made by the detector groups, but the common HRDL/UDP-based data acquisition developed by Metsähovi will be tested later, probably in 2010. The current launch estimate for AMS-02 to be shipped to the ISS is in the 2010/2011 timeframe.

2.6 New quasar measurement software

Project team: Lindfors, Turunen

The quasar measurement program `contobs` has a long usage history at Metsähovi. It was written in the 1980s in the Ada programming language and ran on the MicroVAX computer. During the

1990s very few changes were made and in the 2000s we could observe an interesting phenomenon: if shortcomings were identified in `contobs` they were usually worked around in perl scripts that parse its output since people were reluctant to invest time in this aging architecture. This was not a very healthy situation since only certain types of modifications were possible at all. In particular, it was not possible to take advantage of new more accurate antenna pointing models and antenna offsets had to be manually tuned.

In 2007 a project was started to write a new and more modular measurement program consisting of the following pieces:

measure a driver program that reads command line arguments and talks to antenna control, data acquisition and logging daemons over the local network in order to observe a given source. This finally took advantage of the distributed observation system architecture that was introduced already in 1998 but still had some unused parts. In particular, the data acquisition computer `daqqr` was not used by `contobs` at all since MicroVAX could only use the old analog backend.

collect-results a program that reads and combines `measure` log and acquired data to calculate intermediate and final results for a given source.

This design emphasised the fact that while `measure` could only be run when antenna time was available, `collect-results` could be tested against saved data without the need to allocate antenna time. If a bug in `collect-results` is found we can regenerate all our past quasar results.

Unfortunately very quickly in 2007 it was determined that while average flux values were correct the standard deviation was too large. Despite intense debugging we could not figure out the problem and decided that the easiest step to proceed would be to port `contobs` to run on GNU/Linux and communicate over network in the same style as the new `measure` program.

The ported `contobs` went into normal use in 2008 and became more popular than the original one since it had a number of useful new features. For example, it could control the calibration diode automatically while previously a `contobs` waited for the human operator to control the calibration diode.

When `contobs` was in active use on GNU/Linux its inputs and outputs were carefully analyzed (using `tcpdump`, `tcpick` and `scapy` tools) to figure out why `measure/collect-results` produced larger standard deviations. Two problems were identified:

A subtle timing issue The system sometimes included samples that were outside integration period. This happened since samples were generated using a 1-second averaging period but `collect-results` did not know the length of this averaging period and treated samples as point-like values in time.

Error in the comparison process itself We naively used the ratio of source intensity and calibration diode intensity to compare `contobs` and `measure/collect-results`. In reality the process of producing final quasar results is more involved and includes the use of calibration sources on the sky. A naive comparison was done mainly because the real process was not easy to automate and relied on a large number of manual steps.

In 2009 the timing issue was fixed and `measure/collect-results` finally went into active use. We no longer depend on `contobs`.

2.7 Extragalactic Radio Sources

2.7.1 Active Galactic Nuclei

Project team: Tornikoski, Lähteenmäki, Hovatta, Nieppola, Tammi, Turunen, Valtaoja (Turku), Lainela (Turku)

Our results on the jet parameters of AGN were published in *Astronomy & Astrophysics* in the beginning of 2009. In this work we used the long-term data obtained at Metsähovi at 22 and 37 GHz to calculate various jet parameters. By decomposing the flux curves into exponential flares, we were able to determine the Doppler boosting factors for 87 sources. In addition, we obtained apparent speeds of the jets from the Monitoring Of Jets in Active galactic nuclei with the VLBA Experiments (MOJAVE) project. Using these values and the Doppler boosting factors, we were able to calculate the Lorentz factors and viewing angles for 67 sources. We found that Flat Spectrum Radio Quasars (FSRQs) are more Doppler boosted and have faster jets than BL Lacertae Objects (BLOs). Additionally, almost all the sources in our sample are seen at a small viewing angle of less than 20 degrees.

We initialized a study of the connection between the jet parameters and black hole masses of AGN. We obtained black hole masses for 45 sources from our collaborators at Universidad Nacional Autnoma de México (UNAM) and Instituto Nacional de Astrofisica, Optica y Elecronica (INAOE). We found only a weak correlation between the Doppler boosting factors and black hole masses and no correlation between the Lorentz factors (i.e. the jet speed) and black hole masses. Our most intriguing results was a significant negative correlation between the viewing angles and black hole masses. This is unexpected as the mass of the black hole should not depend on the angle at which we are viewing the source, unless the determination of the masses is somehow affected by the angle. Our results could indicate a wind-like component in the broad line region of AGN, which would over-estimate the black hole masses for sources viewed close to the jet axis. However, our results could be biased by the small range of viewing angles in our sample. The first preliminary results were presented in a conference Accretion and Ejection in AGN: A Global View in June 2009. Our study on the subject continues.

2.7.2 BL Lacertae Objects

Project Team: Tornikoski, Lähteenmäki, Nieppola, Hovatta

As a continuation to our studies of BL Lacertae Objects (BLOs), we published a paper on the variability of radio-bright BLOs in *Astronomical Journal* in 2009. The extensive work tackles radio variability of BLOs using several frequencies. The sample includes 24 of the radio-brightest BLOs and the data was acquired from both Metsähovi and the University of Michigan Radio Observatory. Variability was studied from two angles: theoretical time scales (structure function, discrete correlation function and periodogram) and observed variability as quantified straight from the flux 12 curves. The paper concludes that BLO variability is diverse, ranging from almost none at all to flares with a flux change of 10 Jy. The flares seem to adhere to the generalized shock model, though data are too sparse for truly conclusive modelling.

2.7.3 Planck Satellite Science

Project Team: Lähteenmäki, Tornikoski, Aatroskoski, León-Tavares, Nieppola, Valtaoja (Turku)

The Planck satellite will map the sky at nine high radio frequencies from 30 GHz to 857 GHz, and measure the cosmic microwave background (CMB) radiation. At the same time all foreground radio sources in the sky, including extragalactic radio sources, will be observed, too. Planck will produce unique all sky catalogs of sources at several high radio frequencies. They will, finally, fill the gap in the present radio survey data. Planck was successfully launched on an Ariane 5, together with the

Herschel satellite, from ESAs Spaceport in Kourou, French Guiana, on May 14.

During the first half of the year, the preparatory work for Planck continued. Observations, analysis, and publication of our Planck-related AGN data were carried out in Metsähovi in cooperation with our collaborators worldwide.

In August Jonathan León-Tavares joined the Metsähovi Planck team. One of his tasks is operating the QDS software. He also participates in Core Team and Planck science project activities, and in Metsähovi AGN science in general.

After the arrival of the satellite to its final position at L2 in August, the planned multifrequency campaigns with our collaborators started vigorously. A reminder e-mail is sent every week to everyone who participates in the campaign. A wiki site and a webpage were set up, containing, for example, the satellite pointing schedule and source lists. Some of the first results were also published at the password protected wiki site.

A dedicated Planck Extragalactic Point Sources Working Group (WG6) post-launch meeting took place in Espoo, Finland, in September. A. Lähteenmäki arranged the meeting in Otaniemi, and a group of AGN researchers from Metsähovi participated. The main issue discussed was the supporting observations, both with satellites and with ground based instruments, and how to organize them effectively and collect the data. Pointing, calibration, and polarization measurements using extragalactic sources, and the Memorandums of Understanding (MoUs) to be signed by external collaborators were discussed, too.

The Planck LFI and HFI Joint Core Team meetings were held in Paris, France, in May, and in Bologna, Italy, in November. A. Lähteenmäki and J. León-Tavares participated. They also participated in a Planck LFI Core Team meeting in Bologna in September. In addition, the non-CMB Core Team CTA-09 stayed in touch with telecons twice a month, as did WG6 according to a more irregular schedule.

Quick Detection System (QDS)

QDS is a software package designed to detect interesting point sources (for example, active galactic nuclei, AGNs) in the time-ordered datastream of the Planck satellite within one or two weeks from the time of the observation. AGNs are rapidly variable, in the timescale of a few days to a few weeks, and any significant event must be investigated without delay. QDS makes this possible by alerting observatories for followup observations when it detects something interesting in the Planck data.

The software was completed in 2006. In 2009 the Planck satellite was finally launched and began its mission, and QDS also began its work. Some minor modifications were again required to interface with the Planck Low Frequency Instrument's Data Processing Center (LFI DPC) database, as well as other minor usability-enhancing changes that came up when actually using the software.

The first results, obtained during the First Light Survey (FLS), which started on August 13, were promising. The parameters of the QDS needed of course tuning, and the data also had to be calibrated with measurements of Jupiter which first appeared in the field of view of the satellite in November. Towards the end of the year QDS routine operations began. The QDS results have been compared to point source results derived from maps (J. Gonzalez-Nuevo et al.), and found to be in agreement. Therefore we conclude that the QDS is working as expected and is producing good data.



Figure 6: Upper row: Rollout of Ariane 5, carrying Planck and Herschel, from the Final Assembly Building to the launch pad at Europe’s Spaceport in Kourou, French Guiana, on May 13 (one day before liftoff). Ariane 5 on launch pad. The sky has cleared up and everything looks good for the launch on the next day. Middle row: May 14, 13:12 UT -liftoff!. The official reception celebrating the successful launch was held in Hotel des Roches in Kourou. The Finnish delegation from left, Pauli Stigell (Tekes), Anne Lähteenmäki (Metsähovi), Jussi Tuovinen (VTT), Kimmo Kaanto (Tekes) Lower row: Excursion to Iles du Salut off the coast of French Guiana. In this photo a Planck Scientist is posing on the main island, Ile Royale, while Devil’s Island can be seen in the background.

2.8 Galactic Sources

2.8.1 X-ray Binaries

Project team: Hannikainen, Koljonen, Savolainen

The X-ray binary group increased in number when Karri Koljonen returned to Finland after his year in the pre-doctoral program at the Harvard-Smithsonian Center for Astrophysics. We continued to work on the various topics and sources that had occupied us in the past: GX 9+9 and associated neutron star low-mass X-ray binaries, Cygnus X-3, multiwavelength observations of black hole X-ray binaries.

The paper on the relativistic ejection event observed with Australian telescopes from the black hole X-ray binary XTE J1550564 was properly published in 2009. This work combined radio images from the Australian Long Baseline Array with lightcurves from the Molonglo Observatory Synthesis Telescope and the Australia Telescope Compact Array. It was determined that the true inferred velocity of the ejecta was $\geq 0.8c$.

Involvement in observations on GRS 1915+105 with the European Space Agency's INTEGRAL satellite continued throughout 2009. Several Astronomer's Telegrams were issued on outbursting sources in the field-of-view, such as Aql X-1 and newly discovered sources. Collaboration with the University of Southampton continued in the field of globular clusters, and a paper on blue hook stars, a rare class of horizontal branch stars, in globular clusters was published. As part of a larger collaboration, multiwavelength observations of a recently discovered transient, XTE J1818245, were presented in a paper. These observations included X-ray data from INTEGRAL, RXTE and Swift; optical and IR data from REM and NTT; for the radio we had data from the VLA and VLBA.

2.8.2 The multiwavelength Nature of the Enigmatic Microquasar Cygnus X-3

Project team: Koljonen, Hannikainen, McCollough (Cambridge, MA), Pooley (Cambridge), Trushkin (Nizhnij Arkhyz), Droulans (Toulouse), Tavani (Roma), Kainulainen (Heidelberg)

Joining the Metsähovi crew at the beginning of the year 2009 and continuing on his thesis work under the guidance of Dr. Diana Hannikainen, Karri Koljonen tackled a huge multiwavelength data set on the microquasar Cygnus X-3 acquired during his stay at the Harvard-Smithsonian Center for Astrophysics in the previous years. The work branched into two directions, one of which involved the analysis of a multiwavelength data set from a major flare ejection event in the summer of 2006 that was observed by multiple X-ray satellites (INTEGRAL, Swift, RXTE) and ground-based observatories (e.g. Metsähovi, RATAN-600, AMI-LA, PAIRITEL), and the second concentrated on analyzing the disk/jet connection by using simultaneous, archived X-ray and radio observations of Cygnus X-3.

The first part of the year was more or less dedicated to the first project and initial results were presented in a talk at The Frascati Workshop: Multiwavelength Behaviour of High Energy Cosmic Sources, and in the subsequent proceedings. The main results of this work are that after a major flare event the radio spectra can be modeled by decreasing synchrotron radiation emission which extends up to X-ray region, plus a Comptonization component on top of it. The study also included a principal component analysis that indicated that only two components in the X-ray region are needed to explain the observed X-ray variability. This project is currently ongoing.

For the second part of the year the focus moved into the second direction and it proved to be a fruitful one as the results emerged as a submitted publication to MNRAS at the end of the year, as well as being part of a publication in Nature (Tavani et al., Extreme Particle Acceleration in the Microquasar Cygnus X-3). The main result of this work was that a previously unnoticed X-ray state was detected when simultaneous radio observations were taken into account. This state, that we named the "hypersoft" state, exists only in very brief intervals, which are dominated by a strong soft X-ray component but very weak or non-existent radio and hard X-ray components. In addition, only during this state gamma-ray flares were observed, unambiguously for the first time in the microquasar

population.

On the basis of expanding our knowledge on a larger sample of microquasars, Karri Koljonen applied for and was granted observing time at the Calar Alto observatory to monitor the microquasars Cygnus X-3, GRS 1915+105, SS 433 and Scorpius X-1 at infrared wavelengths.

2.8.3 Neutron Star Low-Mass X-ray Binaries

Project Team: Savolainen, Hannikainen, Paizis (Milan), Farinelli (Ferrara), Vilhu (Helsinki)

Petri Savolainen has worked at Metsähovi since January 2008 as a postgraduate student of Dr. Diana Hannikainen. He is a co-investigator in a project led by Dr. Paizis of INAF-IASF, Milan. The project studies bright Neutron Star Low-Mass X-ray Binaries (LMXBs) near the Galactic Center using the extensive amounts of data available to us from the European Space Agency's INTEGRAL satellite.

During 2009 Mr. Savolainen concentrated on an extensive review of INTEGRAL spectral data of four bright Atoll-type LMXBs and four Z-type LMXBs, from 2003 to the present. The focus was the difference in long-term temporal properties between the Atoll and Z sources: the over-a-decade long Rossi X-ray Timing Explorer All-Sky Monitor (RXTE/ASM) light curves exhibit apparent periodic modulation in the Atolls, while stronger short-term noise dominates in the Z sources. We have fitted a combined thermal and bulk motion Comptonization spectral model to INTEGRAL spectra from selected intervals, to see which spectral parameters correlate with the long-term modulation.

Initial results were presented in the posters' Long-term INTEGRAL observations of bright and persistent neutron star Low-Mass X-ray Binaries' and 'INTEGRAL long-term monitoring results on persistently bright NS LMXBs', at the XXVII IAU General Assembly in Rio de Janeiro, Brazil, August 3–7 2009, and X-ray Astronomy 2009, in Bologna, Italy, September 7–11 2009, respectively. They indicate that average spectral shape is independent of the modulation, which is most correlated with the normalization factors of the model.

As part of a larger project, Mr. Savolainen was also involved in a paper by L. Mainardi et al. In this work we fit INTEGRAL spectra of five bright neutron star Low-Mass X-ray Binaries from 2006–2007, also with the combined thermal and bulkComptonization model. Average spectra were created from individual observations with a similar hardness ratio (quotient of fluxes from two different energy bands) to get a better idea of the distinct spectral states exhibited by the sources. The results showed, among other things, that the component arising from the thermal Comptonization of soft seed photons from the accretion disc in the outer transition layer remained dominant and rather constant, while the component from the neutron star surface and inner transition layer was very variable, sometimes appearing as a simple blackbody and at other times showing both thermal and bulk motion Comptonization. The paper, titled Spectral evolution of bright NS LMXBs with INTEGRAL: an application of the thermal plus bulk Comptonization model, was published in *Astronomy and Astrophysics*, Volume 512.

2.9 Multifrequency Observing Campaigns

Project Team: Lähteenmäki, Tornikoski, Hovatta, Nieppola, Turunen, Savolainen, Tammi, Lavonen, Suutarinen

We took part in several multifrequency campaigns in 2009, and as usual, did individual observing requests, too. Typically we support the campaign with daily observations, and continue regular monitoring also before and after the core campaign. Metsähovi radio data are in high demand, and the number of campaigns and requests have steadily increased during the last few years. This is also reflected in the good number of publications using Metsähovi data.

Examples of recent campaigns are the WEBT and GASP collaborations on several sources in connection to satellite observations at high energies, particularly Fermi. We are also regularly observing

selected sources for VERITAS Blazar Science Working Group multiwavelength campaigns and support VERITAS Target of Opportunity campaigns. We also support, for example, MAGIC observations.

The largest observing campaign of the year was undisputedly the support campaign for Planck satellite (see "Planck satellite science" for details).

2.10 Solar Research

Project Team: Kallunki, Tornikoski, Lavonen, Riehokainen (University of Turku, Tuorla Observatory)

During 2009, period of the solar minimum, the main emphasis was on using the 37 GHz frequency band and on observing solar activity maps and tracking objects on solar disk during the summer months. The number of observation days was in total 49 in 2009. These data were used for studying quasi-periodic solar oscillations (quiet Sun areas, sunspots and faculae (normal / polar)) and differential rotation of the Sun, together data, which were obtained from our collaboration observer (Nobeyama Radio Heliograph).

In collaboration with RATAN-600 a multifrequency campaign was held in September 2009 (18.-27.9.2009). The campaign was targeted to study polar faculae. Additionally, some first sunspots of the new solar cycle were observed during this campaign.

The small radiotelescope (diameter 1,8 m) was used for continuous monitoring of the whole Solar disk at a frequency of 11,7 GHz. Observed data was also used for studying solar oscillations.

Also new software for visualization and plotting solar maps/tracks was developmented. A new software will be based on Matlab and it will replace the old IDL software.

2.11 Recreational Events & Keeping Fit

2.11.1 Visit to Tuorla

We had our annual recreational day on November 23rd. This year we visited Tuorla – first the recreational offering of the Tuorla guesthouse, archery, and then the Tuorla observatory and planetarium.

2.11.2 Metsähovi Christmas Party

The traditional Metsähovi Christmas party was held on December the 22nd, with porridge and ham and Christmas sauna. The same day was Solveig Hurtta's retirement.



Figure 7: First row: Archery at Tuorla on our annual recreational day. Second row: Anne, the reincarnation of Wilhelm Tell. Lunch at Tuorla Guest House. Third row: Entering the planetarium. End of the planetarium show. They did not fall asleep, did they? Fourth row: The Tuorla mirror grinding workshop. 'So happy I don't have to make optical observations in these miserable rainy conditions!'



Figure 8: Upper row: The Christmas party at Metsähovi. Middle row: Christmas lunch and Solveig Hurtta's retirement. Lower row: Solveig Hurtta's retirement

3 Publications

3.1 International Journals

- 1 Pogrebenko, S. V.; Gurvits, L. I.; Elitzur, M.; Cosmovici, C. B.; Avruch, I. M.; Montebugnoli, S.; Salerno, E.; Pluchino, S.; Maccaferri, G.; Mujunen, A.; Ritakari, J.; Wagner, J.; Molera, G.; Uumila, M.: Water masers in the Saturnian system. *Astronomy and Astrophysics*, Vol. 494, pp. L1-L4, 2009.
- 2 Petrov, L.; Phillips, C.; Bertarini, A.; Deller, A.; Pogrebenko, S.; Mujunen, A.: Use of the long baseline array in Australia for precise geodesy and absolute astrometry. *Publications of the Astronomical Society of Australia*, Vol. 26, pp. 75-84, 2009.
- 3 Nieppola, E., Hovatta, T., Tornikoski, M., Valtaoja, E., Aller, M.F., Aller, H.D.: Long-term variability of radio-bright BL Lacertae objects. *The Astronomical Journal*, Vol. 137, pp. 5022-5036, 2009.
- 4 Miller-Jones, J.C.A.; Rupen, M.P.; Türler, M.; Lindfors, E.J.; Blundell, K.M.; Pooley, G.G.; Opacity effects and shock-in-jet modelling of low-level activity in Cygnus X-3. *Monthly Notices of the Royal Astronomical Society*, Vol. 394, pp. 309-322, 2009.
- 5 Hovatta, T.; Valtaoja, E.; Tornikoski, M.; Lähteenmäki, A.; Doppler factors, Lorentz factors and viewing angles for quasars, BL Lacertae objects and radio galaxies. *Astronomy & Astrophysics*, Vol. 494, pp. 527-537, 2009.
- 6 Böttcher, M.; Fultz, K.; Aller, H. D.; Aller, M. F.; Apodaca, J.; Arkharov, A. A.; Bach, U.; Berdyugin, A.; Buemi, C. S.; Calcidese, P.; Carosati, D.; Charlot, P.; Ciprini, S.; Di Paolo, A.; Dolci, M.; Efimova, N.V.; Forné Scurrats, E.; Frasca, A.; Gupta, A.C.; Hagen-Thorn, V.A.; Heidt, J.; Hiriart, D.; Konstantinova, T.S.; Kopatskaya, E.N.; Lähteenmäki, A.; Lanteri, A.; Larionov, V.M.; Le Campion, J-F.; Leto, P.; Lindfors, E.; Marilli, E.; Mihov, B.; Nieppola, E.; Nilsson, K.; Ohlert, J.M.; Ovcharov, E.; Pääkkönen, P.; Pasanen, M.; Ragozzine, B.; Raiteri, C.M.; Ros, J.A.; Sadun, A.; Sanchez, A.; Semkov, E.; Sorcia, M.; Strigachev, A.; Takalo, L.; Tornikoski, M.; Trigilio, C.; Umana, G.; Valcheva, A.; Villata, M.; Volvach, A.; Wu, J-H.; Zhou, X.: The WEBT Campaign on the Intermediate BL Lac Object 3C 66A in 2007-2008. *The Astrophysical Journal*, Vol. 694, pp. 174-182, 2009.
- 7 Horan, D.; Acciari, V.A.; Bradbury, M.; Buckley, J.H.; Bugaev, V.; Byrum, K.L.; Cannon, A.; Celik, O.; Cesaroni, A.; Chow, Y.C.K.; Ciupik, L.; Cogan, P.; Falcone, A.D.; Fegan, S.J.; Finley, J.P.; Fortin, P.; Fortson, L.F.; Gall, D.; Gillanders, G.H.; Grube, J.; Gyuk, G.; Hanna, D.; Hays, E.; Kerzman, M.; Kildea, J.; Konopelko, A.; Krawczynski, H.; Krennrich, F.; Lang, M.J.; Lee, K.; Moriarty, P.; Nagai, T.; Niemic, J.; Ong, R.A.; Pertinks, J.S.; Pohl, M.; Quinn, J.; Reynolds, P.T.; Rose, H.J.; Sembroski, G.H.; Smith, A.W.; Steele, D.; Swordy, S.P.; Toner, J.A.; Vassiliev, V.; Wakely, S.P.; Weekes, T.C.; White, R.J.; Williams, D.A.; Wood, M.D.; Zitzer, B.; Aller, H.D.; Aller, M.F.; Baker, M.; Barnaby, D.; Carini, M.T.; Charlot, P.; Dumm, J.P.; Fields, N.E.; Hovatta, T.; Jordan, B.; Kovalev, Y.A.; Kovalev, Y.Y.; Krimm, H.A.; Kurtanidze, O.M.; Lähteenmäki, A.; Le Campion, J.F.; Maune, J.; Montaruli, T.; Sadun, A.C.; Smith, S.; Tornikoski, M.; Turunen, M.; Walters, R.: Multiwavelength Observations of Markarian 421 in 2005-2006. *The Astrophysical Journal*, Vol. 695, pp. 596-618, 2009.
- 8 Hjalmarsdotter, L.; Zdziarski, A.A.; Szostek, A.; Hannikainen, D.C.: Spectral variability in Cygnus X-3. *Monthly Notices of the Royal Astronomical Society*, Vol. 392, pp. 251-263, 2009.
- 9 Savolainen, P.; Hannikainen, D.C.; Vilhu, O.; Paizis, A.; Nevalainen, J.; Hakala, P.: Exploring the Spreading Layer of GX 9+9 using RXTE and INTEGRAL. *Monthly Notices of the Royal Astronomical Society*, Vol. 393, pp. 569-578, 2009.
- 10 Hakala, P.; Hjalmarsdotter, L.; Hannikainen, D.; Muhli, P.: Light Curve Morphology Study of UW CrB Evidence for a 5 d Superorbital Period. *Monthly Notices of the Royal Astronomical Society*, Vol. 394, pp. 892-899, 2009.

- 11 Dieball, A.; Knigge, C.; Maccarone, T.J.; Long, K.S.; Hannikainen, D.C.; Zurek, D.; Shara, M.: Blue hook stars in globular clusters. *Monthly Notices of the Royal Astronomical Society*, Vol. 394, pp. L56-L60, 2009.
- 12 Ashdown, M. A. J.; Baccigalupi, C.; Bartlett, J. G.; Borrill, J.; Cantalupo, C.; de Gasperis, G.; de Troia, G.; Gorski, K. M.; Hivon, E.; Huffenberger, K.; Keihänen, E.; Keskitalo, R.; Kisner, T.; Kurki-Suonio, H.; Lawrence, C. R.; Natoli, P.; Poutanen, T.; Prezeau, G.; Reinecke, M.; Rocha, G.; Sandri, M.; Stompor, R.; Villa, F.; Wandelt, B.; The Planck Ctp Working Group: Making Maps from Planck LFI 30GHz Data with Asymmetric Beams and Cooler Noise. *Astronomy and Astrophysics*, Vol. 493, pp. 753-783, 2009.
- 13 Persson, C.M.; Olberg, M.; Hjalmarson, .; Spaans, M.; Black, J.H.; Frisk, U.; Liljeström, T.; Olofsson, A.O.H.; Poelman, D.R.; Sandqvist, Aa.: Water and ammonia abundances in S140 with the Odin satellite. *Astronomy & Astrophysics*, Vol. 494, pp. 637-646, 2009.
- 14 Rodriguez, Jerome; Chenevez, Jerome; Hannikainen, Diana: The ongoing outbursts of Aql X-1 and Ginga 1843+009 as seen with INTEGRAL/IBIS-ISGRI. *The Astronomer's Telegram*, 1977, 2009.
- 15 Hunstead, Dick; Campbell-Wilson, Duncan; Maccarone, Tom; Casella, Piergiorgio; Hannikainen, Diana: MOST Observations of GX 339-4. *The Astronomer's Telegram*, 1960, 2009.
- 16 Hannikainen, D. C.; Hunstead, R. W.; Wu, K.; McIntyre, V.; Lovell, J. E. J.; Campbell-Wilson, D.; McCollough, M. L.; Reynolds, J.; Tzioumis, A. K.: Revisiting the relativistic ejection event in XTE J1550-564 during the 1998 outburst. *Monthly notices of the Royal Astronomical Society*, Vol. 397, pp. 569-576, 2009.
- 17 Volvach, A.E.; Larionov, M.G.; Kardashev, N.S.; Lähteenmäki, A.; Tornikoski, M.; Hovatta, T.; Nieppola, E.; Torniainen, I.; Aller, M.F.; Aller, H.D.: Multifrequency study of variations of the radiation of blazar 0716+714. *Astronomy Reports*, Vol. 86, No 5, pp. 440-448, 2009.
- 18 Tornikoski, M.; Torniainen, I.; Lähteenmäki, A.; Hovatta, T.; Nieppola, E.; Turunen, M.; Lainela, M.; Valtaoja, E.; Aller, M.F.; Aller, H.D.; Mingaliev, M.; Trushkin, S.: Long-term radio behaviour of GPS sources and candidates. *Astronomical Notes/Astronomische Nachrichten*, Vol. 330, No 2/3, pp. 128-132, 2009.
- 19 Kurki-Suonio, H.; Keihänen, E.; Keskitalo, R.; Poutanen, T.; Sirviö, A-S, Maino, D.; Burigana, C.: Destriping CMB temperature and polarization maps. *Astronomy & Astrophysics*, Vol. 506, pp. 1511-1539, 2009.
- 20 Cadolle Bel, M; Prat, L.; Rodriguez, J.; Ribo, M.; Barragan, L.; Avanzo, P.D.; Hannikainen, D.C.; Kuulkers, E.; Campana, S.; Moldon, J.; Chaty, S.; Zurita-Heras, J.; Goldwurm, A.; Goldoni, P.: Detailed Radio to Soft -ray Studies of the 2005 Outburst of the New X-ray Transient Source XTE J1818-245. *Astronomy & Astrophysics*, Vol. 501, pp. 1-13, 2009.
- 21 Vilhu, O.; Hakala, P.; Hannikainen, D.C.; McCollough, M.; Koljonen, K.: Orbital modulation of X-ray emission lines in Cygnus X-3. *Astronomy & Astrophysics*, Vol. 501, pp. 679-686, 2009.
- 22 Kainulainen, J.; Lada, C.; Rathborne, J.; Alves, J.: The fidelity of the core mass functions derived from dust column density data. *Astronomy & Astrophysics*, Vol. 497, pp. 399-407, 2009. *Astronomy & Astrophysics*, Vol. 500, pp. 845-860, 2009.
- 23 Miettinen, O.; Harju, J.; Haikala, L.K.; Kainulainen, J.; Johansson, L.E.B.: Prestellar and protostellar cores in Orion B9. *Astronomy & Astrophysics*, Vol. 500, pp. 845-860, 2009.
- 24 Rathborne, J.M.; Lada, C.J.; Muench, A.A.; Alves, J.F.; Kainulainen, J.; Lombardi, M.: Dense cores in the pipe nebula: an improved core mass function. *The Astrophysical Journal*, Vol. 699, pp. 742-753, 2009.
- 25 Kainulainen, J. T.; Alves, J. F.; Beletsky, Y.; Ascenso, J.; Kainulainen, J. M.; Amorim, A.; Lima, J.; Marques, R.; Moitinho, A.; Pinhão, J.; Rebordão, J.; Santos, F. D. Uncovering the kiloparsec-scale stellar ring of NGC 5128. *Astronomy and Astrophysics*, Vol. 502, pp. L5-L8, 2009.

- 26 Villata, M.; Raiteri, C.M.; Gurwell, M.A.; Larionov, V.M.; Kurtanidze, O.M.; Aller, M.F.; Lähteenmäki, A.; Chen, W.P.; Nilsson, K.; Agudo, I.; Aller, H.D.; Arkharov, A.A.; Bach, U.; Bachev, R.; Beltrame, P.; Benítez, E.; Buemi, C.S.; Böttcher, M.; Calcidese, P.; Capezzali, D.; Carosati, D.; Da Rio, D.; Di Paola, A.; Dolci, M.; Dultzin, D.; Forné, E.; Gómez, J.L.; Hagen-Thorn, V.A.; Halkola, A.; Heidt, J.; Hiriart, D.; Hovatta, T.; Hsiao, H.Y.; Jorstad, S.G.; Kimeridze, G.N.; Konstantinova, T.S.; Kopatskaya, E.N.; Koptelova, E.; Leto, P.; Ligustri, R.; Lindfors, E.; Lopez, J.M.; Marscher, A.P.; Mommert, M.; Mujica, R.; Nikolashvili, M.G.; Palma, N.; Pasanen, M.; Roca-Sogorb, M.; Ros, J.A.; Roustazadeh, P.; Sadun, A.C.; Saino, J.; Sigua, L.A.; Sorcia, M.; Takalo, L.O.; Tornikoski, M.; Trigilio, C.; Turchetti, R.; Umana, G.: The GASP-WEBT monitoring of 3C 454.3 during the 2008 optical-to-radio and gamma-ray outburst. *Astronomy & Astrophysics*, Vol. 504, pp. L.9-L12, 2009.
- 27 Villata, M.; Raiteri, C.M.; Larionov, M.G.; Nikolashvili, M.G.; Aller, M.F.; Carosati, D.; Hroch, F.; Ibrahimov, M.A.; Jorstad, S.G.; Kovalev, Y.Y.; Lähteenmäki, A.; Nilsson, K.; Teräsranta, H.; Tosti, G.; Aller, H.D.; Arkharov, A.A.; Berdyugin, A.; Boltwood, P.; Buemi, C.S.; Casas, R.; Charlot, P.; Coloma, J.M.; Di Paola, A.; Di Rico, G.; Kimeridze, G.N.; Konstantinova, T.S.; Kopatskaya, E.N.; Kovalev, Yu. A.; Kurtanidze, O.M.; Lanteri, L.; Larionova, E.G.; Larionova, L.V.; Le Campion, J.-F.; Leto, P.; Linfors, E.; Marscher, A.P.; Marshall, K.; McFarland, J.P.; McHardy, I.M.; Miller, H.R.; Nucciarelli, G.; Osterman, M.P.; Pasanen, M.; Pursimo, T.; Ros, J.A.; Sadun, A.C.; Sigua, L.A.; Sixtova, L.; Takalo, L.O.; Tornikoski, M.; Trigilio, C.; Umana, G.; Xie, G.Z.; Zhang, X.; Zhou, S.B.: The correlated optical and radio variability of BL Lacertae WEBT data analysis 1994-2005. *Astronomy and Astrophysics*, Vol. 501, pp. 455-460, 2009.
- 28 Raiteri, C.M.; Villata, M.; Capetti, A.; Aller, M.F.; Bach, U.; Calcidese, P.; Gurwell, M.A.; Larionov, V.M.; Ohler, J.; Nilsson, K.; Strigachev, A.; Agudo, I.; Aller, H.D.; Bachev, R.; Berdyugin, A.; Böttcher, M.; Buemi, C.S.; Buttiglione, S.; Carosati, D.; Charlot, P.; Chen, W.P.; Forné, E.; Fuhrmann, L.; Gómez, J.L.; Gupta, A.C.; Heidt, J.; Hiriart, D.; Hsiao, W.-S.; Jelinek, M.; Jorstad, S.G.; Kimeridze, G.N.; Konstantinova, T.S.; Kopatskaya, E.N.; Kostov, A.; Kurtanidze, O.M.; Lähteenmäki, A.; Lanteri, L.; Larionova, L.V.; Leto, P.; Latev, G.; Le Campion, J.-F.; Lee, C.-U.; Ligustri, R.; Lindfors, E.; Marshcer, A.P.; Mihov, B.; Nikolashvili, M.G.; Nikolov, Y.; Ovcharov, E.; Principe, D.; Pursimo, T.; Ragazzine, B.; Robb, R.M.; Ros, J.A.; Sadun, A.C.; Sagar, R.; Semkov, E.; Sigua, L.A.; Smart, R.L.; Sorcia, M.; Takalo, L.O.; Tornikoski, M.; Trigilio, C.; Uckert, K.; Umana, G.; Valcheva, A.; Volvach, A.: WEBT multiwavelength monitoring and XMM-Newton observations of BL Lacertae in 2007-2008. Unveiling different emission components. *Astronomy & Astrophysics*, Vol. 507, pp. 769-779, 2009.
- 29 Chatterjee, R.; Marscher, A.P.; Jorstad, S.G.; Olmstead, A.R.; McHardy, I.M.; Aller, M.F.; Aller, H.D.; Lähteenmäki, A.; Tornikoski, M.; Hovatta, T.; Marshall, K.; Miller, H.R.; Ryle, W.T.; Chicka, B.; Benker, A.J.; Bottorff, M.C.; Brokofsky, D.; Campbell, J.S.; Chonis, T.S.; Gaskell, C.M.; Gaynullina, E.R.; Grankin, K.N.; Hedrick, C.H.; Ibrahimov, M.A.; Klimek, E.S.; Kruse, A.K.; Masatoshi, S.; Miller, T.R.; Pan, H.-J.; Petersen, E.A.; Peterson, B.W.; Shen, Z.; Strel'nikov, D.V.; Tao, J.; Watkins, A.E.; Wheeler, K.: Disk-Jet Connection in the Radio Galaxy 3C 120. *The Astrophysical Journal*, Vol. 704, pp. 1689-1703, 2009.
- 30 Volvach, A.E.; Larionov, M.G.; Kardashev, N.S.; Lähteenmäki, A.; Tornikoski, M.; Hovatta, T.; Nieppola, E.; Torniainen, I.; Aller, M.F.; Aller, H.D.: A Multi-Frequency Study of Brightness Variations of the Blazar 0716+714. *Astronomy Reports*, Vol. 53, No. 9, pp. 777-784, 2009.
- 31 Keskitalo, R.; Ashdown, M.A.J.; Cabella, P.; Kisner, T.; Poutanen, T.; Stompor, R.; Bartlett, J.G.; Borrill, J.; Cantalupo, C.; de Gasperis, G.; de Rosa, A.; de Troia, G.; Eriksen, H.K.; Finelli, F.; Gorski, K.M.; Gruppuso, A.; Hivon, E.; Jaffe, A.; Keihänen, E.; Kurki-Suonio, H.; Lawrence, C.R.; Natoli, P.; Paci, F.; Polenta, G.; Rocha, G.: Residual noise covariance for Planck low-resolution data analysis. *Astronomy and Astrophysics*, submitted, 2009.
- 32 Abdo, A.A.; Ackermann, M.; Ajello, M.; Axelsson, M.; Baldini, L.; Ballet, J.; Barbiellini, G.; Bastieri, D.; Baughman, B.M.; Bechtol, K.; Bellazzini, R.; Berenji, B.; Bloom, E.D.; Bonamente, E.D.; Borgland, A.W.; Bregeon, J.; Brez, A.; Brigida, M.; Bruel, P.; Burnett, T.H.; Calandro, G.A.; Cameron, R.A.; Caraveo, P.A.; Casandjian, J.M.; Cavazutti, E.; Cecchi, C.;

Celotti, A.; Chekhtman, A.; Chiang, J.; Ciprini, S.; Claus, R.; Cohen-Tanugi, J.; Collmar, W.; Conrad, J.; Costamante, L.; Cutini, S.; de Angelis, A.; de Palma, F.; do Couto e Silva, E.; Drell, P.S.; Dumora, D.; Farnier, C.; Favuzzi, C.; Fegan, S.J.; Focke, W.B.; Fortin, P.; Foschini, L.; Frailis, M.; Fuhrmann, L.; Fukazawa, Y.; Funk, S.; Fusco, P.; Gargano, F.; Gehrels, N.; Germani, S.; Giglietto, N.; Giordano, F.; Giroletti, M.; Glanzman, T.; Godfrey, G.; Grenier, I.A.; Grove, J.E.; Guillemot, L.; Guiriec, S.; Hanabata, Y.; Hays, E.; Hughes, R.E.; Jackson, M.S.; Jhansson, G.; Johnson, A.S.; Johnson, W.N.; Kadler, M.; Kamae, T.; Katagiri, H.; Kataoka, J.; Kawai, N.; Kerr, M.; Knödlseder, J.; Kocian, M.L.; Kuss, M.; Lande, J.; Longo, F.; Loparco, F.; Lott, B.; Lovellette, M.N.; Lubrano, P.; Madejski, G.M.; Makeev, A.; Max-Moerbeck, W.; Mazziotta, M.N.; McConville, W.; McEnery, J.E.; McGlynn, S.; Meurer, C.; Michelson, P.F.; Mitthumsiri, W.; Mizuno, T.; Moiseev, A.A.; Monte, C.; Monzani, M.E.; Morselli, A.; Moskalenko, I.V.; Nestoras, I.; Nolan, P.L.; Norris, J.P.; Nuss, E.; Ohsugi, T.; Omodei, N.; Orlando, E.; Ormes, J.F.; Paneque, D.; Parent, D.; Pavlidou, V.; Pelassa, V.; Pepe, M.; Pesce-Rollins, M.; Piron, F.; Porter, T.A.; Rain, S.; Rando, R.; Razzano, M.; Readhead, A.; Reimer, O.; Reposeur, T.; Richards, J.L.; Rodriguez, A.Y.; Roth, M.; Ryde, F.; Sadrozinski, H.-W.; Sanchez, D.; Sander, A.; Saz Parkinson, P.M.; Scargle, J.D.; Sgr, C.; Shaw, M.S.; Smith, P.D.; Spandre, G.; Spinelli, P.; Strickman, M.S.; Suson, D.J.; Tagliaferri, G.; Tajima, H.; Takahashi, H.; Tanaka, T.; Tanaka, Y.; Thayer, J.B.; Thayer, J.G.; Thompson, D.J.; Tibaldo, L.; Tibolla, O.; Torres, D.F.; Tosti, G.; Tramacere, A.; Uchiyama, Y.; Usher, T.L.; Vasileiou, V.; Vilchez, N.; Vitale, V.; Waite, A.P.; Wang, P.; Wehrle, A. E.; Winer, B.L.; Wood, K.S.; Ylinen, T.; Zensus, J.A.; Ziegler, M.; (The Fermi /LAT Collaboration) and Angelakis, E.; Bailyn, C.; Bignall, H.; Blanchard, J.; Bonning, E.W.; Buxton, M.; Canterna, R.; Carramiana, A.; Carrasco, L.; Colomer, F.; Doi, A.; Ghisellini, G.; Hauser, M.; Hong, X.; Isler, J.; Kino, M.; Kovalev, Y.Y.; Kovalev, Yu. A.; Krichbaum, T.P.; Kutyrev, A.; Lähteenmäki, A.; van Langevelde, H.J.; Lister, M.L.; Macomb, D.; Maraschi, L.; Marchili, N.; Nagai, H.; Paragi, Z.; Phillips, C.; Pushkarev, A.B.; Recillas, E.; Roming, P.; Sekido, M.; Stark, A.M.; Szomoru, A.; Tammi, J.; Tavecchio, F.; Tornikoski, M.; Tzioumis, A.K.; Urry, C.M.; Wagner, S.: Multiwavelength monitoring of the enigmatic Narrow-Line Seyfert 1 PMN J0948+0022 in March-July 2009, *The Astrophysical Journal*, Volume 707, Issue 1, pp. 727-737, 2009.

- 33 Acciari, V.A.; Aliu, E.; Aune, T.; Beilicke, W.; Benbow, W.; Böttcher, M.; Boltuch, D.; Buckley, J.H.; Bradbury, S.M.; Bugaev, V.; Byrum, K.; Cannon, A.; Cesarin, A.; Ciupik, L.; Cogan, P.; Cui, W.; Dickherber, R.; Duke, C.; Falcone, A.; Finley, J.P.; Fortin, P.; Fortson, L.; Furniss, A.; Galante, N.; Gall, D.; Gibbs, K.; Gillanders, G.H.; Grube, J.; Guenette, R.; Gyuk, G.; Hanna, D.; Holder, J.; Hui, S.M.; Humensky, T.B.; Kaaret, B.; Karlsson, N.; Kertzman, M.; Kieda, D.; Konopelko, A.; Krawczynski, H.; Krennrich, F.; Lang, M.J.; LeBohec, S.; Maier, G.; McArthur, S.; McCann, A.; McCutcheon, M.; Millis, J.; Moriarty, P.; Ong, R.A.; Otte, A.N.; Pandel, D.; Perkins, J.S.; Pichel, A.; Pohl, M.; Quinn, J.; Ragan, K.; Reyes, L.C.; Reynolds, P.T.; Roache, E.; Rose, H.J.; Sembroski, G.H.; Smith, A.W.; Steele, D.; Theiling, M.; Thibadeau, S.; Varlotta, A.; Vassiliev, V.V.; Vincent, S.; Wakely, S.P.; Ward, J.E.; Weekes, T.C.; Weinstein, A.; Weisgarber, T.; Williams, D.A.; Wissel, S.; Wood, M.(The VERITAS Collaboration); Pian, E.; Vercellone, S.; Donnarumma, I.; D'Ammando, F.D.; Bulgarelli, A.; Chen, A.W.; Giuliani, A.; Longo, F.; Pacciani, L.; Pucella, G.; Vittorini, V.; Tavani, M.; Argan, A.; Barbiellini, G.; Caraveo, P.; Cattaneo, P.W.; Cocco, V.; Costa, E.; Del Monte, E.; De Paris, G.; Di Cocco, G.; Evangelista, Y.; Feroci, M.; Fiorini, M.; Froysland, T.; Frutti, M.; Fuschino, F.; Galli, M.; Gianotti, F.; Labanti, C.; Lapshov, I.; Lazzarotto, F.; Lipari, P.; Marisaldi, M.; Mastropietro, M.; Mereghetti, S.; Morelli, E.; Morselli, A.; Pellizzoni, A.; Perotti, F.; Piano, G.; Picozza, P.; Pilia, M.; Porrovecchio, G.; Prest, M.; Rapisarda, M.; Rappoldi, , A.; Rubini, A.; Sabatini, S.; Soffitta, P.; Trifoglio, M.; Trois, A.; Vallazza, E.; Zambra, A.; Zanello, D.; Pittori, C.; Santolamazza, P.; Verrecchia, F.; Giommi, P.; Colafrancesco, S.; Salotti, L. (The AGILE Team); Villata, M.; Raiteri, C.M.; Aller, H.D.; Aller, M.F.; Arkharov, A.A.; Efimova, N.V.; Larionov, V.M.; Leto, P.; Ligustri, R.; Lindfors, E.; Pasanen, M.; Kurtanidze, O.M.; Tetradze, S.D.; Lähteenmäki, A.; Kotiranta, M.; Cucchiara, A.; Romano, P.; Nesci, R.; Pursimo, T.; Heidt, J.; Benitez, E.; Hiriart, D.; Nilsson, K.; Berdyugin, A.; Mujica, R.; Dultzin, D.; Lopez, J.M.; Mommert, M.; Sorcia, M.; de la Calle Perez, I.: Multiwavelength observations of a TeV-Flare from W Comae. *the Astrophysical Journal*, Volume 707, No. 1, pp. 612-620, 2009.
- 34 Tavani, M.; Bulgarelli, A.; Piano, G.; Sabatini, S.; Striani, E.; Evangelista, Y.; Trois, A.; Pooley,

G.; Trushkin, S.; Nizhelskij, N.A.; McCollough, M.; Koljonen, K.I.I.; Pucella, G.; Giuliani, A.; Chen, A.W.; Costa, E.; Vittorini, V.; Trifoglio, M.; Gianotti, F.; Argan, A.; Barbiellini, G.; Caraveo, P.; Cattaneo, P.W.; Cocco, V.; Contessi, T.; D'Ammando, F.; DelMonte, E.; DeParis, G.; DiCocco, G.; DiPersio, G.; Donnarumma, I.; Feroci, M.; Ferrari, A.; Fuschino, F.; Galli, M.; Labanti, C.; Lapshov, I.; Lazzarotto, F.; Lipari, P.; Longo, F.; Mattaini, E.; Marisaldi, M.; Mastropietro, M.; Mauri, A.; Mereghetti, S.; Morelli, E.; Morselli, A.; Pacciani, L.; Pellizzoni, A.; Perotti, F.; Picozza, P.; Pilia, M.; Prest, M.; Rapisarda, M.; Rappoldi, A.; Rossi, E.; Rubini, A.; Scalise, E.; Soffitta, P.; Vallazza, E.; Vercellone, S.; Zambra, A.; Zanello, D.; Pittori, C.; Verrecchio, F.; Giommi, P.; Colafrancesco, S.; Santolamazza, P.; Antonelli, A.; Salotti, L.: Extreme particle acceleration in the microquasar Cygnus X-3. *Nature* Vol. 462, Issue 7273, pp. 620-623, 2009.

- 35 Tauber, J.A.; Mandolesi, N.; Puget, J.-L.; Banos, T.; Bersanelli, M.; Bouchet, F.R.; Butler, C.R.; Charra, J.; Crone, G.; Dodsworth, J.; Efstathiou, G.; Gispert, R.; Guyot, G.; Gregorio, A.; Juillet, J.J.; Lamarre, J.-M.; Laureijs, R.J.; Lawrence, C.R.; Nørgaard-Nielsen, H.U.; Passvogel, T.; Reix, J.M.; Texier, D.; Vibert, L.; Zacchei, A.; Ade, P.A.R.; Aghanim, N.; Aja, B.; Alippi, E.; Aloy, L.; Armand, P.; Arnaud, M.; Arondel, A.; Arreola-Villanueva, A.; Artal, E.; Artina, E.; Arts, A.; Ashdown, M.; Aumont, J.; Azzaro, M.; Bacchetta, A.; Baccigalupi, C.; Baker, M.; Balasini, M.; Balbi, A.; Banday, A.J.; Barbier, G.; Barreiro, R.B.; Bartelmann, M.; Battaglia, P.; Battaner, E.; Benabed, K.; Beney, J.-L.; Beneyton, R.; Bennett, K.; Benoit, A.; Bernard, J.-P.; Bhandari, P.; Bhatia, R.; Biggi, M.; Biggins, R.; Billig, G.; Blanc, Y.; Blavot, H.; Bock, J.J.; Bonaldi, A.; Bond, R.; Bonis, J.; Borders, J.; Borrill, J.; Boschini, L.; Boulanger, F.; Bouvier, J.; Bouzit, M.; Bowman, R.; Bréelle, E.; Bradshaw, T.; Braghin, M.; Bremer, M.; Brienza, D.; Broszkiewicz, D.; Burigana, C.; Burkhalter, M.; Cabella, P.; Cafferty, T.; Cairola, M.; Caminade, S.; Camus, P.; Cantalupo, C.M.; Cappellini, B.; Cardoso, J.-F.; Carr, R.; Catalano, A.; Cayón, L.; Cesa, M.; Chaigneau, M.; Challinor, A.; Chamballu, A.; Chambelland, J.P.; Charra, M.; Chiang, L.-Y.; Chlewicki, G.; Christensen, P.R.; Church, S.; Ciancietta, E.; Cibrario, M.; Cizeron, R.; Clements, D.; Collaudin, B.; Colley, J.-M.; Colombi, S.; Colombo, A.; Colombo, F.; Corre, O.; Couchot, F.; Cougrand, B.; Coulais, A.; Couzin, P.; Crane, B.; Crill, B.; Crook, M.; Crumb, D.; Cuttaia, F.; Dörl, U.; da Silva, P.; Daddato, R.; Damasio, C.; Danese, L.; d'Aquino, G.; D'Arcangelo, O.; Dassas, K.; Davies, R.D.; Davies, W.; Davis, R.J.; De Bernardis, P.; de Chambure, D.; de Gasperis, G.; De la Fuente, M.L.; De Paco, P.; De Rosa, A.; De Troia, G.; De Zotti, G.; Dehamme, M.; Delabrouille, J.; Delouis, J.-M.; Désert, F.-X.; di Girolamo, G.; Dickinson, C.; Doelling, E.; Dolag, K.; Domken, I.; Douspis, M.; Doyle, D.; Du, S.; Dubruel, D.; Dufour, C.; Dumesnil, C.; Dupac, X.; Duret, P.; Eder, C.; Elfving, A.; Enßlin, T.A.; Eng, P.; English, K.; Eriksen, H.K.; Estaria, P.; Falvella, M.C.; Ferrari, F.; Finelli, F.; Fishman, A.; Fogliani, S.; Foley, S.; Fonseca, A.; Forma, G.; Forni, O.; Fosalba, P.; Fourmond, J.-J.; Frailis, M.; Franceschet, C.; Francheschi, E.; Franois, S.; Frerking, M.; Gómez-Reñasco, M.F.; Górska, K.M.; Gaier, T.C.; Galeotta, S.; Ganga, K.; García Lázaro, J.; Garnica, A.; Gaspard, M.; Gavila, E.; Giard, M.; Giardino, G.; Gienger, G.; Giraud-Heraud, Y.; Glorian, J.-M.; Griffin, M.; Gruppuso, A.; Guglielmi, L.; Guichon, D.; Guillaume, B.; Guillouet, P.; Haissinski, J.; Hansen, F.K.; Hardy, J.; Harrison, D.; Hazell, A.; Hechler, M.; Heckenauer, V.; Heinzer, D.; Hell, R.; Henrot-Versille, S.; Hernández-Monteagudo, C.; Herranz, D.; Herreros, J.M.; Hervier, V.; Heske, A.; Heurtel, A.; Hildebrandt, S.R.; Hills, R.; Hivon, E.; Hobson, M.; Hollert, D.; Holmes, W.; Hornstrup, A.; Hovest, W.; Hoyland, R.J.; Huey, G.; Huffenberger, K.M.; Hughes, N.; Israelsson, U.; Jackson, B.; Jaffe, A.; Jaffe, T.R.; Jagemann, T.; Jessen, N.C.; Jewell, J.; Jones, W.; Juvela, M.; Kaplan, J.; Karlman, P.; Keck, F.; Keihänen, E.; King, M.; Kisner, T.S.; Kletzkine, P.; Kneissl, R.; Knoche, J.; Knox, L.; Koch, T.; Krassenburg, M.; Kurki-Suonio, H.; Lähteenmäki, A.; Lagache, G.; Lagorio, E.; Lami, P.; Lande, J.; Lange, A.; Langlet, F.; Lapini, R.; Lapolla, M.; Lasenby, A.; Le Jeune, M.; Leahy, J.P.; Lefebvre, M.; Legrand, F.; Lemeur, G.; Leonardi, R.; Leriche, B.; Leroy, C.; Leutenegger, P.; Levin, S.M.; Lilje, P.B.; Lindensmith, C.; Linden-Vørnle, M.; Loc, A.; Longval, Y.; Lubin, P.M.; Luchik, T.; Luthold, I.; Macias-Perez, J.F.; Maciaszek, T.; MacTavish, C.; Madden, S.; Maffei, B.; Magneville, C.; Maino, D.; Mambretti, A.; Mansoux, B.; Marchioro, D.; Maris, M.; Marliani, F.; Marrucho, J.-C.; Martí-Canales, J.; Martínez-González, E.; Martín-Polegre, A.; Martin, P.; Marty, C.; Marty, W.; Masi, S.; Massardi, M.; Matarrese, S.; Matthai, F.; Mazzotta, P.; McDonald, A.; McGrath, P.; Mediavilla, A.; Meinhold, P.R.; Mélin, J.-B.; Melot, F.; Mendes,

L.; Mennella, A.; Mervier, C.; Meslier, L.; Miccolis, M.; Miville-Deschenes, M.-A.; Moneti, A.; Montet, D.; Montier, L.; Mora, J.; Morgante, G.; Morigi, G.; Morinaud, G.; Morisset, N.; Mortlock, D.; Mottet, S.; Mulder, J.; Munshi, D.; Murphy, A.; Murphy, P.; Musi, P.; Narbonne, J.; Naselsky, J.; Nash, A.; Nati, F.; Natoli, P.; Netterfield, B.; Newell, J.; Nexon, M.; Nicolas, C.; Nielsen, P.H.; Ninane, N.; Noviello, F.; Novikov, D.; Novikov, I.; O'Dwyer, I.J.; Oldeman, P.; Olivier, P.; Ouchet, L.; Oxborow, C.A.; Pérez-Cuevas, L.; Pagan, L.; Paine, C.; Pajot, F.; Paladini, R.; Pancher, F.; Panh, J.; Parks, G.; Parnaudeau, P.; Partridge, B.; Parvin, B.; Pascual, J.P.; Pasian, F.; Pearson, D.P.; Pearson, T.; Pecora, M.; Perdereau, O.; Perotto, L.; Perrotta, F.; Piacentini, F.; Piat, M.; Pierpaoli, E.; Piersanti, O.; Plaige, E.; Plaszczynski, S.; Platania, P.; Pointecouteau, E.; Polenta, G.; Ponthieu, N.; Popa, L.; Pouleau, G.; Poutanen, T.; Prézeau, G.; Pradell, L.; Prina, M.; Prunet, S.; Rachen, J.P.; Rambaud, D.; Rame, F.; Rasmussen, I.; Rautakoski, J.; Reach, W.T.; Rebolo, R.; Reinecke, M.; Reiter, J.; Renault, C.; Ricciardi, S.; Rideau, P.; Riller, T.; Ristorcelli, I.; Riti, J.B.; Rocha, G.; Roche, Y.; Roger Pons, R.; Rohlfs, R.; Romero, D.; Roose, S.; Rosset, C.; Rouberol, S.; Rowan-Robinson, M.; Rubiño-Martin, J.A.; Rusconi, P.; Rusholme, B.; Salama, M.; Salerno, E.; Sandri, M.; Santos, D.; Sanz, J.L.; Sauter, L.; Sauvage, F.; Savini, G.; Schmelzel, M.; Schnorhk, A.; Schwarz, W.; Scott, D.; Seiffert, M.D.; Shellard, P.; Shih, C.; Sias, M.; Silk, J.I.; Silvestri, R.; Sippel, R.; Smoot, G.F.; Starck, J.-L.; Stassi, P.; Sternberg, J.; Stivoli, F.; Stolyarov, V.; Stompor, R.; Stringhetti, L.; Strommen, D.; Stute, T.; Sudiwala, R.; Sugimura, R.; Sunyaev, R.; Sygnet, J.-F.; Turler, M.; Taddei, E.; Tallon, J.; Tamiatto, C.; Taurigna, M.; Taylor, D.; Terenzi, L.; Thuerey, S.; Tillis, J.; Tofani, G.; Toffolatti, L.; Tommasi, E.; Tomasi, M.; Tonazzini, E.; Torre, J.-P.; Tosti, S.; Touze, F.; Tristram, M.; Tuovinen, J.; Tuttlebee, M.; Umana, G.; Valenziano, L.; Valle, M.; van der Vlis, M.; Van Leeuwen, F.; Vanel, J.-C.; VanTent, B.; Varis, J.; Vassallo, E.; Vescovi, C.; Vezzu, F.; Vibert, D.; Vielva, P.; Vierra, J.; Villa, F.; Vittorio, N.; Vuerli, C.; Wade, L.A.; Walker, A.R.; Wandelt, B.D.; Watson, C.; Werner, D.; White, M.; White, S.D.M.; Wilkinson, A.; Wilson, P.; Woodcraft, A.; Yoffo, B.; Yun, M.; Yurchenko, V.; Yvon, D.; Zhang, B.; Zimmermann, O.; Zonca, A.; Zorita, D.: Planck pre-launch status: The Planck mission. *Astronomy & Astrophysics*, accepted November 2009.

- 36 Chenevez, J.; Rodriguez, J.; Wilms, J.; Cadolle Bel, M.; Hannikainen, D.: INTEGRAL/JEM-X sees a flare from IGR J19112+1358 and gives a refined position. *The Astronomer's Telegram*, Vol. 2298, November 2009.
- 37 Rodriguez, J.; Chenevez, J.; Cadolle Bel, M.; Wilms, J.; Kuulkers, E.; Hannikainen, Diana: INTEGRAL detects Aql X-1 in outburst in hard state. *The Astronomer's Telegram*, Vol. 2299, 2009.
- 38 Kurki-Suonio, H.; Keihänen, E.; Keskitalo, R.; Poutanen, T.; Sirviö, A.S.; Maino, D.; Burigana, C.: Destriping CMB temperature and polarization maps. *Astronomy & Astrophysics*, Vol. 506, no. 3, pp. 1511-1539, 2009.

3.2 International Conferences

- 1 Savolainen, P.; Hannikainen, D.C.; Paizis, A.; Farinelli, R.; Kuulkers, E.; Vilhu, O.: Long-term INTEGRAL observations of bright and persistent neutron star Low-Mass X-ray Binaries. XXVII IAU General Assembly, August 3–10, Rio de Janeiro, Brazil, 2009.
- 2 Savolainen, P.; Hannikainen, D.C.; Vilhu, O.; Paizis, A.; Nevalainen, J.; Hakala, P.: Using INTEGRAL AND RXTE to explore the Spreading Layer of GX 9+9. 7th INTEGRAL Workshop, Copenhagen, Denmark, September 8–11, 2008, *Proceedings of Science*, 2009.
- 3 Kranich, D.; Paneque, D.; Cesarini, A.; Falcone, A.; Giroletti, M.; Hoversten, E.; Hovatta, T.; Kovalev, Y.Y.; Lähteenmäki, A.; Nieppola, E.; Pagani, C.; Pichel, A.; Satalecka, K.; Scargle, J.; Steele, D.; Tavecchio, F.; Tescaro, D.; Tornikoski, M.; Villata, M.: Multiwavelength Observations of Mrk 501 in 2008. *Proceedings of the 31 st ICRC*, Lódź, submitted, 2009.
- 4 Molera Calvés, G.; Wagner, J.; Ritakari, J.; Mujunen, A.: European 4 Gbps VLBI and e-VLBI. The 8th International e-VLBI Workshop, Madrid, Spain, June 22–26, 2009. *Proceedings of Sci-*

ence, accepted 2009, published online at <http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=82>, pp. 83.

- 5 Hovatta, T.; Tammi, J.; Tornikoski, M.; Valtaoja, E.; Torrealba, J.; Chavushyan, V.; Arshakian, T.G.; Cruz-Gonzales, I.: Connection between Jet Parameters and Black Hole Masses in Quasars. ASP Conference Series, submitted, 2009.
- 6 Tammi, J.; Hovatta, T.: Thermal non-jet flares in Active Galactic Nuclei, ASP Conference Series, submitted, 2009.
- 7 Savolainen, P.; Hannikainen, D.C.; Paizis, A.; Farinelli, R.; Kuulkers, E.; Vilhu, O.: INTEGRAL long-term monitoring results on persistently bright NS LMXBs. Proceedings of X-ray Astronomy, September 7–11, 2009, Bologna, Italy, submitted, 2009.
- 8 Nenonen, S.; Hannikainen, Diana; Orava, R.; Lipsanen, H.; Suni, I.; Elsevier, B.V.: Radiation Imaging Detectors. Proceedings of the 10th International Workshop on Radiation Imaging Detectors, Volume 607, Issue 1, 2009.
- 9 Cosmovici, C.B.; Pogrebenko, S.; Pluchino, S.; Montebugnoli, S.; Bartolini, M.; Zoni, L.; Flamini, E.; Gurvits, E.; Molera Calvés, G.: The ITASEL project: Italian search for Extraterrestrial Life. Conference at Search for Life in the Universe at STSI, Baltimore, MD, USA, May 4–7, 2009.
- 10 Cimo, G.; Gurvits, L.I.; Pogrebenko, Sergei; Campbell, R.M.; de Pater, I.; Vermeersen, B.; Zegers, T.; Oberst, J.; Nothnagel, A.; Pätzold, M.; Mujunen, Ari; Molera, Guifré, Charlot, P.; Frey, S.; Montebugnoli, S.: Planetary Radio Interferometry and Doppler Experiment (PRIDE) for the Europa Jupiter System Mission. European Planetary Science Congress 2009, Vol. 4, EPSC2009-209, Potsdam, Germany, September 2009.
- 11 Pogrebenko, S.V.; Gurvits, L.I.; Elitzur, M.; Cosmovici, C.B.; Avruch, I.M.; Montebugnoli, S.; Salerno, E.; Pluchino, S.; Maccaferri, G.; Mujunen, Ari; Ritakari, Jouko; Wagner, Jan; Molera, Guifré; Uunila, Minttu: Water masers in the Kronian System. European Planetary Science Congress EPSC Abstracts, EPSC2009-200, Vol., 4, Potsdam, Germany, 2009.
- 12 Pogrebenko, S.V.; Gurvits, L.; Elitzur, M.; Cosmovici, C.B.; Avruch, I.M.; Pluchino, S.; Montebugnoli, S.; Salerno, E.; Maccaferri, G.; Mujunen, Ari; Ritakari, Jouko; Molera, Guifré; Wagner, Jan; Uunila, Minttu; Cimo, G.; Schilliro, F.; Bartolini, M.: Water Masers in the Kronian System. Icy bodies in the Solar System Proceedings, IAU Symposium, No. 263, Rio de Janeiro, Brazil, August 3–7, 2009.
- 13 Pogrebenko, S.V.; Gurvits, L.; Elitzur, M.; Cosmovici, C.B.; Avruch, I.M.; Pluchino, S.; Montebugnoli, S.; Salerno, E.; Maccaferri, G.; Mujunen, Ari; Ritakari, Jouko; Wagner, Jan; Molera, Guifré; Uunila, Minttu: Water vapour maser emission in the Saturnian System. XXVII General Assembly of the IAU, Icy bodies in the Solar System Proceedings, Rio de Janeiro, Brazil, August 3–7, 2009.
- 14 Pogrebenko, S.V.; Wagner, Jan; Molera Calvés, Guifré et al.: Software spectrometer developments at Metsähovi Radio Observatory and JIVE. 7th Radionet Engineering Forum, Bonn, Germany, June 2008, Document: NA4-EN-SU-020, <http://www.radionet-eu.org/rda/showitem.php?itemid=200>, online July 30, 2009.
- 15 Pogrebenko, Sergei; Wagner, Jan: Vector Phase Cal extraction, IVS VLBI2010 Workshop on Future Radio Frequencies and Feeds. Wettzell, Höllenstein, Germany, elektroninen julkaisu: <http://www.wettzell.ifag.de/veranstaltungen/vlbi/frff2009/frff2009.html>, 2009.

3.3 National Conferences

- 1 Ritakari, J.; Wagner, J.; Molera, G.: Recent achievements at Metsähovi Radio Observatory. XXXI Finnish URSI Convention on Radio Science, Electromagnetics 2008, Espoo 28 October 2008, Proceedings of the URSI XXXI Convention on Radio Science, submitted, 2008.

3.4 Laboratory Reports

- 1 Tornikoski, M., Mujunen, A., Holmberg, B., Hurtta, S. (editors): Metsähovi Radio Observatory Annual Report 2008. Metsähovi Reports HUT-KURP-36, 36 p., 2009

3.5 Other Publications

- 1 Ilona Torniainen: Multifrequency studies of gigahertz-peaked spectrum sources and candidates. Thesis for the degree of Doctor of Science in Technology, 2009.
- 2 Kallunki, Juha: Possibilities of the Metsähovi radiotelescopes for solar observations. (Metsähovin radioteleskooppien käyttömahdollisuudet aurinkohavaintoihin) Lisensiaatintutkimus, TKK / Teknillisen fysiikan laitos, 2009. - 85 s. -
- 3 Talvikki Hovatta: Radio variability of active galactic nuclei: analysis of long-term multifrequency data. Thesis for the degree of Doctor of Science in Technology, 2009.
- 4 Kallunki, Juha: Auringon aktiivisuuden vaihtelut ja vaikutukset lähiympäristöön. Sähkö & Tele-lehti, 7, s. 13-15, 2009.
- 5 Molera Calvés, Guifré, Wagner, Jan: Software spectrometer setup instructions and test data, Metsähovi Memo. <http://www.metsahovi.fi/en/vlbi/spec/swspectrometer.shtml>, 2009.
- 6 Ritakari, Jouko; Wagner, Jan; Molera, Guifré, Uunila, Minttu; Mujunen, Ari et al. from the EXPREs team: 100 hours of Astronomy: demonstration observations in IYA 2009. European VLBI Network Newsletter, No. 23, <http://www.jive.nl/dokuwiki/doku.php/evnnews:evnnews>, 2009.
- 7 Wagner, Jan: 10 and 40 Gbit/s burst mode observations, Metsähovi Memo. Elektroninen julkaisu: <http://www.metsahovi.fi/en/vlbi/10gbps/BurstMode>, 2009.
- 8 Wagner, Jan; Molera Calvés, Guifré: Building a 4G-EXPReS Linux Raid Data Acquisition System, Metsähovi Memo. Elektroninen julkaisu: <http://www.metsahovi.fi/en/vlbi/ibob/4gexpres>, 2009.
- 9 Wagner, Jan: Channelizer monitoring with VSI4SPEC software. Tietokoneohjelma, <http://www.metsahovi.fi/en/vlbi/vsib-tools/vsi4spec.shtml>, 2009.
- 10 Wagner, Jan; Molera Calvés, Guifré et al.: Demonstration radio observations of spacecraft. Biennal Report 2007-2008 Joint Institute for VLBI in Europe, Dwingeloo, pp. 62, 66-67, 2009.
- 11 Wagner, Jan: iBob wideband IF streaming and VDIF utilities. Tietokoneohjelma: <http://www.metsahovi.fi/en/vlbi/ibob/ibobSampler>, 2009.
- 12 Wagner, Jan; Molera Calvés, Guifré: Metsähovi Summer Update, European VLBI Network Newsletter, No. 24. elektroninen julkaisu: <http://www.astro.uni.torun.pl/magda/EVNNEWSLETTER>, 2009.
- 13 Wagner, Jan; Molera Calvés, Guifré; Ritakari, Jouko, Mujunen, Ari; Uunila, Minttu; Casey, Simo: TKK/Metsähovi radio observatory e-VLBI news, European VLBI Network Newsletter, No. 22. elektroninen julkaisu: <http://www.jive.nl/dokuwiki/doku.php/evnnews:evnnews>, 2009.
- 14 Wagner, Jan: UDTFS: A remote file system based on UDT4 and FUSE. tietokoneohjelma: <http://www.metsahovi.fi/en/vlbi/10gbps/udtfs/>, 2009.

4 Visits to Foreign Institutes

Sydney Institute for Astronomy, School of Physics, the University of Sydney, Australia, 14.12.2008 – 8.1.2009, D. Hannikainen

Lund University, Sweden, 3.2.2009, M. Tornikoski

Uppsala University, Sweden, 4.6.2009, M. Tornikoski

Department of Astronomy, Stockholm University, Sweden, 4.6.2009, D. Hannikainen

INTEGRAL Science Data Center, Versoix, Switzerland, 7 – 8.10.2009, D. Hannikainen

ESAC, Madrid, Spain, 14.10.2009, D. Hannikainen

University of Barcelona, Barcelona, Spain, 19.10.2009, D. Hannikainen

Istituto di Astrofisica Spaziale e Fisica Cosmica, Bologna, Italy, 2 – 6.11. 2009, A. Lähteenmäki, M. Tornikoski, J. Leon-Tavares,

Pulkovo Observatory, Russia, 22 – 25.11.2009, J. Kallunki

5 Visiting Scientists

Prof. Thierry Courvoisier, Integral Science Data Centre, Geneva, Switzerland, 6 – 9.5.2009

Dr. Vyacheslav Vdovin, Institute of Applied Physics Russian Academy of Sciences, Russia, 20 – 25.8.2009, 15 – 21.9.2009

Alexander Shtanyuk, Institute of Applied Physics Russian Academy of Sciences, Russia, 20 – 26.8.2009, 12 – 18.11.2009

Oleg Bolshakov, Institute of Applied Physics Russian Academy of Sciences, Russia, 12 – 18.11.2009

Gustyakov, Vladimir, Institute of Applied Physics Russian Academy of Sciences, Russia, 15 – 21.9.2009

6 Theses

Thesis for the degree of Doctor of Science in Technology: Talvikki Hovatta: Radio variability of active galactic nuclei: analysis of long-term multifrequency data.



Figure 9: Talvikki Hovatta, opponent Prof. Thierry Courvoisier, and custos Prof. Martti Halilainen.



Figure 10: Talvikki Hovatta and Prof. Thierry Courvoisier discussing.



Figure 11: Prof. Thierry Courvoisier and Talvikki Hovatta on the board.

7 Teaching

S-92.4305 Special Problems in Space Technology, M. Tornikoski, A. Lähteenmäki

8 Other Activities

Scientific Associate in the Planck satellite's LFI consortium, M. Tornikoski

Referee for the Publications of the Astronomical Society of Japan, M. Tornikoski

Referee of observing proposals for the Global Millimetre VLBI Array, M. Tornikoski

Evaluator for a research funding application to the European Centre for Arctic Environmental Research in Ny-Ålesund, M. Tornikoski

Planck satellite Co-Investigator, Planck Scientist, A. Lähteenmäki

Academy of Finland Research Fellow 1.8.2005 — 31.7.2010, A. Lähteenmäki

Evaluator for an astronomy essay writing competition for Nordic highschool students arranged by Nordic Optical Telescope Scientific Association (NOTSA), October 2009, A. Lähteenmäki

Pre-examiner, PhD thesis, Oulu University, D. Hannikainen

8.1 Participation in Boards and Committees

Steering group member of the Ministry of Education graduate school of astronomy and space physics, A. Lähteenmäki

Member of the Planck/TEKES 70 GHz instrument steering group, A. Lähteenmäki

Associate member of the Very Energetic Radiation Imaging Telescope Array System (VERITAS) collaboration, M. Tornikoski, A. Lähteenmäki

Member of the EXPReS eVLBI Science Advisory Group, A. Lähteenmäki

Member of the Graduate School Board of the Faculty of Electronics, Communications and Automation, A. Lähteenmäki

Scientific Committee, International Workshop on Radiation Imaging Detectors. D. Hannikainen

Helsinki University Observatory, board member (substitute), D. Hannikainen

Finnish Astronomical Society, treasurer, K. Koljonen

Finland's delegate to the Scientific Comission J (Radio Astronomy) of the International Union of Radio Science (URSI), M. Tornikoski

Member of the Finnish National committee of COSPAR (Committee on Space Research), M. Tornikoski

Member of the Onsala Space Observatory Time Allocation Committee (OSO + APEX time allocation), M. Tornikoski

ESF Committee for Radio Astronomy Frequencies, CRAF, Finland's representant, J. Ritakari

EXPReS Consortium Board, chairman, A. Mujunen

8.2 International Meetings and Talks

Onsala Space Observatory Time Allocation Committee meeting (OSO + APEX time allocation) Lund, Sweden, 3.2.2009, M. Tornikoski

EVN Technical Operations Group (TOG), Torun, Poland, 18 – 19.4.2009, J. Ritakari, G. Molera

The Fifth IVS Technical Operations Workshop, Haystack, MA, USA, 24.4 – 1.5.2009, G. Molera, J. Wagner

Planck Joint Core Team meeting, Paris, France, 28.4 – 1.5.2009, A. Lähteenmäki

Planck and Herschel launch event, Cayenne and Kourou, French Guiana, 11 – 17.5.2009, A. Lähteenmäki

The Committee on Radio Astronomy Frequencies (CRAF) meeting, Paris, France, 14 – 15.5.2009, J. Ritakari

EVN Consortium Board of Directors, Onsala, Sweden, 25.5.2009, A. Mujunen

The Frascati Workshop: Multiwavelength Behaviour of High Energy Cosmic Sources, Vulcano, Italy, 25 – 30.5.2009, D. Hannikainen, K. Koljonen

Physics of Relativistic Flows: An observational view, Stockholm, Sweden, 1 – 3.6.2009, D. Hannikainen

Onsala Space Observatory Time Allocation Committee meeting (OSO + APEX time allocation) Uppsala, Sweden, 4.6.2009, M. Tornikoski

The information event on the 7th Call for proposals under the e-infrastructures Activity of the Capacities Specific Programme, Brussels, Belgium, 18 – 19.6.2009, A. Mujunen

The 8th International e-VLBI Workshop: Science and Technology of Long Baseline Real-Time Interferometry, Madrid, Spain, 22 – 26.6.2009, G. Molera

Accretion and Ejection in AGN: A Global View, Como, Italy, 22 – 26.6.2009, T. Hovatta, J. Tammi

Radionet 1st Engineering Forum Workshop, Gothenburg, Sweden, 23 – 24.6.2009, P. Kirves

XI International Workshop on Radiation Imaging Detectors, Prague, Czech Republic, 28.6 – 2.7.2009, D. Hannikainen

Dynamic Solar Corona, Joint Solar Eclipse Meeting, CAS-IAU, Suzhou, China, 23 – 27.7.2009, J. Kallunki

XXVII IAU General Assembly, Rio de Janeiro, Brazil, 3 – 10.8.2009, P. Savolainen

XXIV International Conference of Physics Students, Split, Croatia, 12 – 18.8.2009, P. Savolainen

Planck Extragalactic Working Group WG6 meeting, Espoo, Finland, 3 – 5.9.2009, A. Lähteenmäki, M. Tornikoski, J. León-Tavares, J. Aatroskoski, E. Nieppola, J. Tammi

Planck LFI Core Team meeting, Bologna, Italy, 7 – 8.9.2009, A. Lähteenmäki, J. León-Tavares

X-ray Astronomy 2009, Bologna, Italy, 7 – 11.9.2009, P. Savolainen

EU FP7 proposal planning meeting, Dwingeloo, Netherlands, 13 – 16.9.2009, A. Mujunen.

7th AGILE Workshop, Frascati, Italy, 29.9 – 1.10.2009, D. Hannikainen

2nd High Energy Phenomena in Relativistic Outflows conference, Buenos Aires, Argentina, 26 – 30.10.2009, J. Tammi

Planck Joint Core Team and Planck Consortia meetings, Bologna, Italy, 2 – 6.11.2009, A. Lähteenmäki, M. Tornikoski, J. León-Tavares

The European VLBI Network Consortium Board of Directors, Jodrell Bank Observatory, United Kingdom, 11 – 12.11.2009, A. Mujunen.

Radionet 2nd Engineering Workshop, Bonn, Germany, 16 – 17.11.2009, P. Kirves

EVN TOG meeting and DBBC Technical Workshop, Bonn, Germany, 2 – 5.12.2009, G. Molera, J. Wagner

8.3 National Meetings and Talks

Seminar, Observatory, Helsinki University, 13.11.2009, D. Hannikainen

8.4 Public Relations

"Kahden keikka avaruuteen", interview for Tiede 4/2009, M. Tornikoski

"Valoa miljardien vuosien takaa", interview for Helsingin Sanomat 8.5.2009, T. Hovatta

Interview for Radiaattori (YLE Radio 1), February 2009, A. Lähteenmäki

"Suomalaiset tieteen etulinjassa" interview for Euroopan Tiede ja Teknologia 2/2009 (Tekes magazine), A. Lähteenmäki

8.4.1 Ladies' Day at the faculty

Ladies's Day at TKK, 5.3.2009, T. Hovatta, D. Hannikainen, A. Lähteenmäki, M. Tornikoski

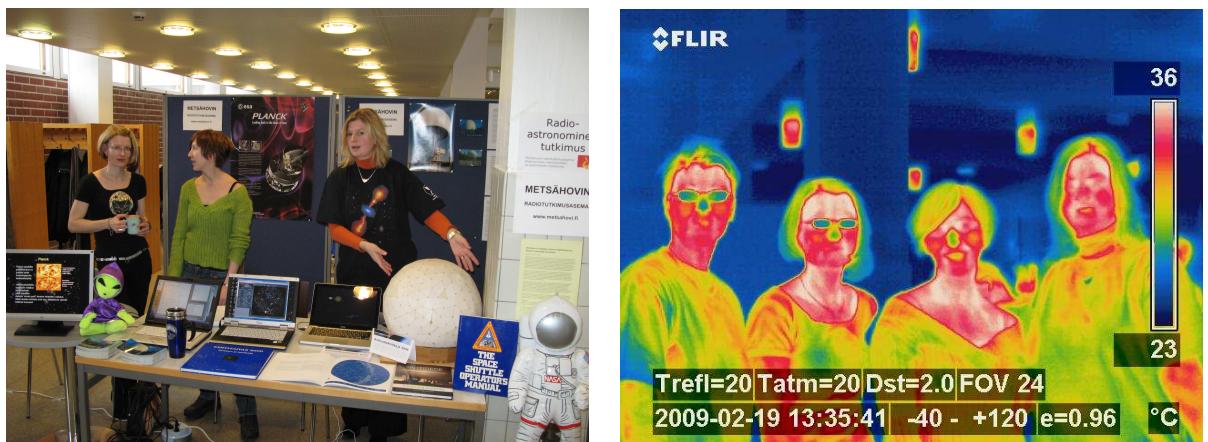


Figure 12: Left: Metsähovi stand at the Ladies' Day. Radio astronomical observations were shown in real-time, and we also had presentations about the research in Metsähovi. Right: The Metsähovi staff ladies from our Ladies' Day stand in infrared (this was one of the hands on -experiments presented by other units). From left to right: Merja Tornikoski, Anne Lähteenmäki, Talvikki Hovatta and Diana Hannikainen.

On March 8th the ETA faculty had a "ladies' day" -event, where departments, companies and student clubs had their stands and gave pr presentations to high school students. The target audience were primarily female students, but also some male students were present.

Metsähovi had a stand there, too, and our female staff members answered questions and gave short presentations about our research to the interested audience.

Press conference preceding the launch of the Planck satellite, 27.4.2009, A. Lähteenmäki
<http://suomenkuvalehti.fi/kuvat/2009/04/27/anne-lahteenmaki>

Interview for the Academy of Finland science portal Tietysti.fi, "Researcher of the month", September 2009, A. Lähteenmäki
<http://www.tietysti.fi/fi/T/Nuoret/Uusin-silmin/Esittelyssa-kuukauden-tutkija/Anne-Lahteenmaki/>

Eiran aikuislukio, Maailmankuva ja universumi, 19.11.2009, D. Hannikainen

Suomen Matemaatikko-, Fyysikko- ja Tietojenkäsittelytieteilijäliitto, Tähdet, tähdet: ikuisuksiin ajan taa, 24.11.2009, D. Hannikainen

9 Personnel in 2009

Permanent Positions funded by the Helsinki University of Technology

| | | |
|----------------------------|--|--------------------------|
| Tornikoski, Merja, Prof. | Director of the institute Docent of Radio Astronomy and Space Technology | Merja.Tornikoski@hut.fi |
| Holmberg, Birgit, Ms. | Department Secretary, from 1.8.2009 | birgit@kurt.hut.fi |
| Hurtta, Solveig, Ms. | Department Secretary, part-time | Solveig.Hurtta@hut.fi |
| Mujunen, Ari, M.Sc. (Tech) | Laboratory engineer | Ari.Mujunen@hut.fi |
| Oinaskallio, Erkki, Mr. | Technician | Erkki.Oinaskallio@hut.fi |
| Rönnberg, Henry, Mr. | Mechanician | |

Scientific and Technical Staff Funded by Research Contracts

| | | |
|-------------------------------------|--|----------------------|
| Aatroskoski, Juha, M.Sc.(Tech) | System administrator | jha@kurt.hut.fi |
| Hannikainen, Diana, Ph.D. | Researcher, until 31.10.2009 | diana@kurt.hut.fi |
| Hovatta, Talvikki, M.Sc. (Tech) | Researcher, until 31.7.2009 | tho@kurt.hut.fi |
| Kallunki, Juha, Lic.Sc. (Tech) | Operations engineer | kallunki@kurt.hut.fi |
| Kirves, Petri, M.Sc. (Tech) | Operations engineer | pkirves@kurt.hut.fi |
| Lavonen, Niko, student | Research assistant, full time 15.5.-31.8.2009 part-time 1.9.-31.12.2009 | nlavonen@kurt.hut.fi |
| Leon-Tavares, Jonathan, Ph.D | Post-doc Researcher, from 1.8.2009 | leon@kurt.hut.fi |
| Lindfors, Timo, student | Research assistant, part time 1.1-31.5.2009, full time 1.6.-31.12.2009 | lindi@kurt.hut.fi |
| Lähteenmäki, Anne, D.Sc.(Tech.) | Academy Research Fellow | alien@kurt.hut.fi |
| Molera Calves, Guifre, M.Sc. (Tech) | Researcher | gofrito@kurt.hut.fi |
| Nieppola, Elina, M.Sc. | Researcher, on maternity leave 1.1.2009- 3.8.2009 | eni@kurt.hut.fi |
| Ritakari, Jouko, M.Sc. (Tech) | Researcher | jr@kurt.hut.fi |
| Savolainen, Petri, M.Sc. | Researcher | psa@kurt.hut.fi |
| Turunen, Miika, student | Research assistant part-time 1.1-31.5.2009 and 1.9-31.12.2009, full time 1.6.2009-31.8.2009 | maturun@kurt.hut.fi |
| Uunila, Minttu, M.Sc. | Researcher, on maternity leave 1.1.2009- 31.12.2009 | minttu@kurt.hut.fi |
| Wagner, Jan, M.Sc. (Tech) | Researcher | jwagner@kurt.hut.fi |

Metsähovi Advisory Board

| | |
|------------------------|-----------------------------------|
| Jokela, Petteri, Dir. | Valtaoja, Esko, Prof. |
| Korpela, Seppo, Dir. | Tiuri, Martti, Prof.emer. (Chair) |
| Koskinen, Hannu, Prof. | Nygren, Tuomo, Prof. |