Project and Study Scientist Reports for AWG # 136

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Report compiled, using inputs from Study and Project Scientists by Jean Clavel, head Astrophysics & Fundamental Physics Missions Division,

3 Herschel: Goeran Pilbratt

Exactly one month after the launch, on June14, the Herschel cryo-cover was opened allowing the science instruments to see the sky for the first time. Observations using the PACS instrument of a large field around the spiral galaxy M51 were repeatedly executed with different settings, and produced impressive images at the three PACS wavelengths. The observations immediately confirmed the excellent optical performance of Herschel, something which could not be verified end-to-end by ground tests prior to launch.

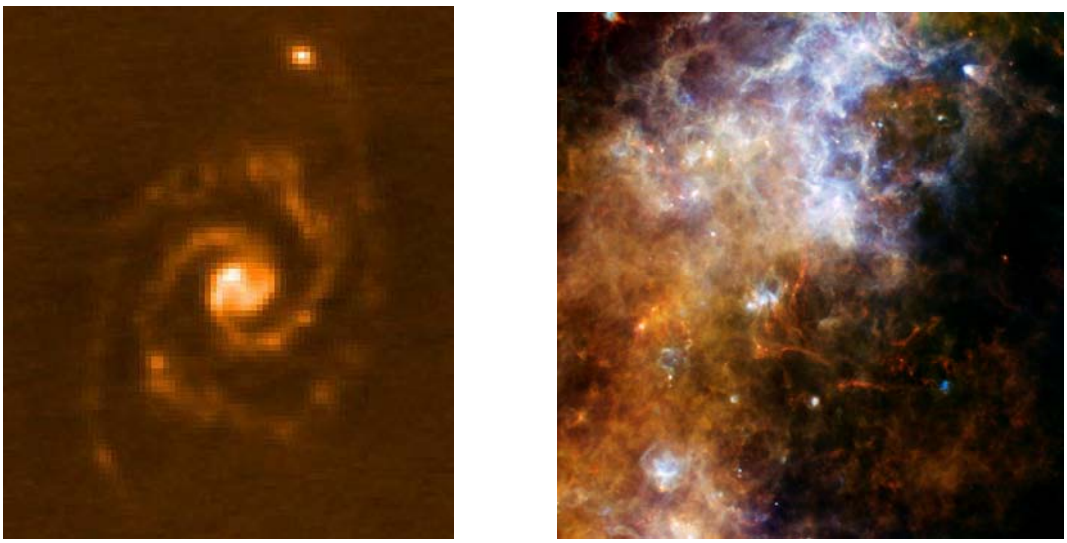
Two months after launch, Herschel had cooled down to its operational temperatures and commissioning of the spacecraft was completed. At this point, successful observations utilising all three instruments were carried-out. On July 21, the In-Orbit Commissioning Review was successfully completed and the responsibility for the mission was handed over to the Mission Manager, Dr. J. Riedinger. By then, the performance verification phase of the Observatory was already underway.

On August 2, the HIFI instrument suffered from a malfunction and has been unavailable since then. The malfunction was traced to a hardware failure in one the electronics boxes in the spacecraft service module. Fortunately, a full set of redundant hardware is available. Extensive investigations have been carried-out to identify the root cause of problem and design the safest way to restart and operate the instrument. Modifications of the instrument onboard software and other risk mitigating operational measures are being developed and tested; it is now expected to re-start HIFI in late November, with no loss of science capability. Since the instrument will have lost redundancy, a set of high priority observations will be carried out early on with HIFI after it is restarted.

In the interim, all observing time has been re-allocated to PACS and SPIRE. This necessitated significant re-planning of the Performance Verification Phase - nominally of three months duration - with a gradual transition to the subsequent Science Demonstration Phase (SDP). Recent PACS/SPIRE “parallel mode” observations of the galactic plane produced absolutely stunning results.

Currently about 70% of the Performance Verification activities have been executed and a number of observing modes have been released for use. The first SDP observations have recently been carried out and the data have been delivered to their owners, while the very first Routine Science Phase observations are imminent.

Another data processing workshop will take place at ESAC on 14-16 December 2009. It will be followed by presentations of the initial SDP results on 17-18 December 2009.



Left: the very first PACS observation of M51. Righ:t SPIRE/PACS parallel mode image of a field on the galactic plane. See http://herschel.esac.esa.int/latest_news.shtml *for all web-releases.*

4 Planck: Jan Tauber

Planck was launched on 14 May at 13:12 UT. The launch was flawless and delivered Planck to an excellent transfer orbit to L2. The main milestones achieved since launch are:

- The mid-course orbit manoeuvre was carried out on 9 June
- The sorption cooler and the LFI front-end amplifiers achieved their operating temperature (~20 K) on 15 June
- The dilution cooler and the HFI bolometers achieved their operating temperature of ~0.1 K on 3 July
- The last manoeuvre injecting Planck into its final orbit around L2 was carried out on 3 July
- The In-Orbit Commissioning Review successfully concluded on 24 July and marked the transition into the Calibration and Performance Verification (CPV) Phase. At this time, the management of the mission was also transferred from the Herschel-Planck Project Manager (T. Passvogel) to the Planck Mission Manager (D. Texier).
- The tuning of the two instruments was completed on 13 August at which time the two-weeks long First Light Survey (FLS) started
- The FLS was completed on 27 August and marked the start of the Routine Phase of the mission. The data acquired during the FLS was considered good enough to be included as part of the first survey.

All the satellite services are nominal. The pointing performance is superb. The cryo-chain, a key element of the Planck payload, is stably supporting all the low-temperature stages required for the operation of the instruments. The performance of the two instruments has been extensively characterized during the Calibration and Performance Verification phase. Within the current measurement uncertainties, all the detector sensitivities are as predicted from the ground calibration campaigns. This means that all HFI detectors are at or close to their **goal** sensitivity levels, and all LFI detectors are within 40% of their requirement levels. One unexpected feature has been found: the HFI bolometers are detecting many more low-level glitches than expected. These glitches are understood to originate in galactic cosmic rays which generate secondary particles in the mechanical structures

supporting the detector assemblies. Currently they affect about 5% of the data in the key CMB channels. Even without any data treatment, this reduces the effective sensitivity of these detectors by at most a few percent, and has therefore no significant impact on the scientific objectives of the mission. Overall, the payload performance in flight is excellent and allows meeting the scientific objectives of Planck.

The final review marking the transition of the CPV Phase into the Routine Phase was held on 15-16 October. All systems were confirmed to be stably operating as planned and the complete ground segment to be operating nominally. The data processing chains in each of the two Data Processing Centres are functioning well from end to end.

Planck's nominal lifetime in routine operations is 15 months, allowing it to complete two full surveys of the sky within that period. Its actual lifetime is limited by the active coolers required to operate the Planck detectors. The in-flight characterization carried out during the CPV Phase has determined that the ^{3}He gas required for the dilution cooler will run out around the 1st of February of 2012. The sorption cooler can maintain the required cooling level until at least 15 January 2012. Therefore, the cooling system lifetime exceeds by ~14 months the nominal mission span. Increasing the operations of Planck by this amount will allow completing at least four full surveys of the sky instead of the nominal two initially planned. At its meeting of 2 October, SPC has conditionally approved a 12 months extension of Planck operations, subject to achievement of satisfactory in-orbit performance and positive recommendations by the AWG and SSAC.

The first set of science products will be released one year after the end of operations, with a second set foreseen one year later. However, the Early Release Compact Source Catalogue will be published already in November 2010 to permit follow-up of Planck-detected sources with other observatories, such as Herschel.

A first report to the astronomical community on the status of Planck was presented at the IAU General Assembly on 14 August. On 17 September, a set of images from the First Light Survey was released at http://www.esa.int/esaSC/SEM5CMFWNZF_index_0.html and http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=45543. This web release was very well received by the international press and has had very good resonance in the astronomical community.

A first meeting of the PI-led Consortia is planned on 5-6 November. About 300 members of the Consortia will attend.

A set of papers describing the performances and capabilities of Planck based on the results of the ground test and calibration campaigns has been submitted to Astronomy & Astrophysics and is in the refereeing process.

6 Projects under development

6.1 JWST: Peter Jakobsen

The NASA JWST Project is still engaged in planning for the revised June 2014 launch date. Optical cryo-testing and the measurement of final polishing "hit maps" for the JWST telescope prime mirror segments and the secondary, tertiary and fine steering mirrors continues per plan. The first segment to complete the full cycle will be the fully polished Engineering Development Unit (EDU), which will undergo final cryo-testing in January.

NASA GSFC has also recently taken delivery of the Integrated Science Instrument Module (ISIM) Flight Structure that will carry the four JWST instruments.

The NIRCam instrument is still having trouble meeting its original wavefront error requirements. Some degradation of the short wavelength NIRCam image quality is tolerable scientifically. However, given that the NIRCam instrument is also used to align and phase-up the JWST telescope, steps are being taken to assure that any relaxation of the NIRCam wavefront error be accurately determined beforehand and not be imprinted onto the primary mirror in orbit and thereby inadvertently propagated to the other instruments.

The build-ups of the MIRI and NIRSpec Flight Models are both well underway, albeit with some setbacks and delays.

An increasing number of MIRI sub-systems have been delivered to RAL for integration into the Flight Model. The design of the dichroic and grating wheel assemblies (DGAs) is undergoing minor revision after some misalignments were identified following vibration tests. The most schedule-critical subsystems, however, are currently the Focal Plane Detector System (provided by NASA/JPL) and the Input Optics and Calibration unit (provided by CSL, Belgium).

Integration of the NIRSpec Flight Model is presently on hold, awaiting delivery of the Zeiss-supplied Filter Wheel, which is experiencing problems with a black optical coating. The last of the three major optical subsystems of NIRSpec, the Camera Optics, has successfully passed cryo-testing, and is ready for integration. The subsystem presently causing most concern is the NASA-supplied Micro Shutter Array, where a (non-flight) qualification chip unexpectedly developed electrical shorts in its addressing circuitry during acoustic testing. Subsequent investigation revealed the shorts to be due to contamination by microscopic metallic particles, but the source of this contamination is still being investigated. At the time of writing it is not known whether the flight chips might be affected by the same problem.

The second phase of the cryo-testing of the NIRSpec Demonstration Model (DM) at IABG in Ottobrunn was completed in late July. The NIRSpec Science Operations Team at ESTEC has been actively working with the ESA Project and the Prime Contractor to distil the "lessons learned" from these cryogenic tests and identify improvements to the facility and optical ground support equipment required for accurately calibrating the Flight Model prior to its delivery to NASA. The equivalent MIRI ground calibration effort coordinated through the MIRI Test Team is also progressing well. Based on the results obtained during testing of the MIRI Verification Model, the team is refining its data reduction techniques, and further developing the on-ground calibration procedures for the Flight Model.

Instrument operations development in collaboration with STScI remains steady for both NIRSpec and MIRI. Four joint STScI/ESA/NASA working groups are currently active on the topics of Target Acquisition, Operations, Calibration and Commissioning. Formulation of the mathematical basis of the “instrument model” underlying the NIRSpec multi-object data reduction pipeline is progressing well.

6.2 GAIA: Timo Prusti

On July the 1st, G. Sarri, formerly Payload Manager, was appointed Gaia Project Manager per interim in replacement of R. Schmidt who left the Directorate.

Segments of the 3.5-m diameter SiC torus supporting the payload and mirrors have been successfully brazed together. The torus is critical to guarantee the high level of stability necessary to achieve the astrometric accuracy of the mission. The torus is currently in a clean room at Astrium waiting for integration with the rest of the payload.

The problem with the non-uniformity of the CCD response has been traced to the detectors themselves rather than their electronics. There are unfortunately no solutions to cure the problem hardware-wise, but it is thought that the effect can be largely calibrated-out during the processing of the data on-ground. CCD Charge Transfer Inefficiency (CTI) seriously complicates the matter as part of the collected flux is lost during read-out and the signal is spread over several serial registers. The further away the source is from the read out node, the larger the effect. Astrium is currently testing configurations that mitigate the problem, but so far no remedy has been found which does not introduce undesirable side effects. The problem will hopefully be cured by modifying the on-board (and ground) processing software so as to correct for the loss and spread of the flux.

To summarise, there are now three CCD related problems that affect the final accuracy of the mission: the radiation damage, the serial register CTI and the non-uniformity at the CCD read-out node after the serial register. The CCD design, together with the Gaia scanning mode that limits the time available to read the serial registers leave little room for improvement hardware-wise. While investigations continue at Astrium, the Gaia Data Processing and Analysis Consortium (DPAC) is also searching for solutions. The main challenge lies in the fact that the three effects are closely interleaved and convolved with the very astrometric signal that one is attempting to measure. Furthermore, the corrections have to be implemented very early in the processing chain thereby requiring a modification of the overall architecture of the pipeline. How well this will cure the problems and what will be the impact on Gaia performances will only be known at the time of the Mission level Critical Design Review (CDR), in the fall of 2010.

The SOC/DPAC has successfully passed its CDR, with no major problems being identified. The DPAC Project Office, now fully operational, actively contributed to the review process.

The Gaia Science Team (GST), together with the DPAC Executive is currently specifying the requirements for the catalogue access, aiming both at early and multiple releases.

6.3 Lisa Pathfinder: McNamara

The first Fight Model (FM) subsystems of the LISA Technology Package (LTP, the LISA Pathfinder payload) have now been delivered: the Laser Modulator (LM) and the Data Management Unit (DMU). The LM is currently being incorporated into the laser assembly, while the DMU has already been integrated into the real-time test bed at Astrium GmbH. Several other LTP subsystems are expected before the end of this year. The main concern with the LTP lies with the test-mass caging mechanism which is delaying the delivery of the inertial sensor subsystem. The flight units of the central finger grabbing-and-release mechanism are ready for delivery; however, during testing, the hydraulic launch lock suffered a failure due to debris in the hydraulic system. The origin of the debris is currently being investigated.

Integration of the spacecraft continues at Astrium UK. Several units, including the on-board computer, power control unit, star-trackers, gyros, thruster power control unit and thermal blankets have already been mounted. Integration will continue until the end of the

year, when the spacecraft will be submitted to its first magnetic tests. Integration of the propulsion module is also progressing as planned. The FM tanks have already been integrated to the structure.

The Science and Technology Operations Centre (STOC) successfully passed its Critical Design Review, with only minor problems being identified. Development of the data analysis toolset by the LTP team is progressing well. The recently released version 2.1 of the software already contains all the functionalities required for the mission. Future activities will focus on the creation of complete data analysis pipelines.

The Science Team has also been investigating the suitability of a Highly Elliptical Orbit (HEO) for LISA Pathfinder. Such an orbit is being studied as a fallback option in the event that the new VEGA launcher, currently under development, does not meet its performance specifications and has to be substituted by a Rockot vehicle. Initial investigations confirm that the gravitational perturbation induced by the earth and the moon does not significantly affect the mission performances. The impact of earth illumination during perigee on the spacecraft thermal stability is currently being analysed.

7 Ongoing studies

7.1 IXO (formerly XEUS): Arvind Parmar

Recent IXO activities have focussed on the US Decadal Survey. The IXO team were asked around 50 questions on all aspects of the mission, including the science goals and requirements, payload details, mission design, implementation and major risks, technological maturity, mission operations, programmatic, schedule and costs. A 134-pages written response was submitted on August 3. Since no further requests have been received, it is assumed that all panel's concerns have been satisfactorily addressed. ESA staff attended dedicated Decadal review meetings and presented samples of the Si based High Precision Pore Optics to the panel members. A recent example, manufactured using an upgraded stacking robot, provides an angular resolution of 10" Half-Power-Diameter (HPD) for an entire optics module. This approaches the 5" HPD angular resolution requirement for IXO.

NASA has approved the GEMS (Gravity and Extreme Magnetism) mission to be part of its Explorer Program. GEMS is a dedicated X-ray polarimeter mission with a planned 2014 launch. It will act as a pathfinder for the polarimeter planned for IXO and will hopefully increase the overall interest in X-ray polarimetry. The IXO science requirements have been updated to make it clear that the proposed IXO polarimeter is an imaging instrument, unlike the one on GEMS.

All the instrument studies have now started. The last to get going was the High Time Resolution Spectrometer (HTRS) which was kicked-off with 6 CNES engineers present to support the study. All instruments are now covered since a team from Open University, UK, have offered to take the lead in supporting the off-plane grating study (one of 2 competing designs that have been proposed for the gratings).

The IXO System Studies started in early September and the first progress meetings have already been held. The contractors are still assessing the inputs provided to them. Mission Definition Reviews are foreseen at the end of the first phase of each contract where the trade-off investigations conducted will be presented and a mission configuration selected

for further study. Members of the Study Coordination Group, instrument representatives, and chairs of the Telescope and Instrument Working Groups have been invited to dedicated presentations from industry and to provide feedback on relevant issues.

7.2 LISA: Oliver Jennrich

Activities have been dominated by the need to support the Astronomy and Astrophysics Decadal Survey (Astro2010) of the US National Academy of Sciences.

A first Request for Information with 11 questions was submitted in May. It was answered in a 90 minute presentation delivered by the LISA Project team on June 10 in Pasadena. A second Request for Information was issued at the end of June with a total of 48 very detailed questions under the topics of science, payload instrumentation, mission design, spacecraft implementation, enabling technologies, mission operation, programmatic, and cost. This request was predominately focused on providing information relevant to the independent costing assessment that takes place as part of the reviewing process and only six of the 48 questions were science related. The LISA Project provided the requested information in a 102-page document at the end of July.

The results of the third round of the Mock LISA Data Challenge (MLDC) were presented at the 8th Edoardo Amaldi meeting in June at Columbia University; 15 different collaborations produced 17 different entries, covering all sub-challenges targeted at the various source classes. The entries were of high quality and successfully demonstrated the ability to extract the source parameters from the data stream. The fourth round of the MLDC is under preparation and will focus on the problem of simultaneous detection of all the different types of sources, i.e. 60 million galactic binaries, several super-massive black hole binaries and extreme mass ratio inspirals, signals from few tens of cosmic-string bursts, plus a detectable stochastic background. As of today, the MLDC has resulted in 26 publications in peer-reviewed journals.

First created for training purposes on the occasion of the summer school on GW astronomy held at Yunnan University in June and July, a parallel “MLDC for students” will continue under the supervision of the University of Texas at Brownsville (UTB).

The LISA technology development programme is progressing well, though some activities originally foreseen to start in late 2009 had to be rescheduled to early 2010. The development of a point-ahead mechanism to compensate for telescope aberration yielded excellent results and is close to completion. Activities on the optical bench technology and the telescope structure are in progress while an Invitation-to-Tender for the development of high-power laser systems has been issued.

7.3 Euclid: René Laureijs

The one year system studies have now been completed. Both industrial contractors, TAS-Italy and Astrium GmbH, gave their final presentations in mid-September, while the two payload consortia presented the results of their instrument studies in mid-October. Both TAS and Astrium came-up with feasible designs for a baseline mission consisting of a visible and NIR imaging photometer together with a slit-less NIR spectrometer. Several risks and critical issues have been identified which will need to be worked out during the definition phase, but no overall show stoppers have been identified. Both industrial studies flag the need to initiate the development of the telescope and the procurement of the detectors in early 2010 in order to meet a 2018 launch date. The studies are currently

subjected to an independent ESA internal technical review, which are being witnessed by external observers appointed by the SPC.

A science ground segment and operations concept has been agreed which includes a major contribution by the two instrument consortia. Preparation of the Assessment Study report is nearing completion. The report is backed-up by very extensive simulations performed by both consortia in order to demonstrate the end-to-end performances of the mission. It must be stressed that, despite a compressed schedule, the collaboration between the two instrument consortia and with the Science Study team has been excellent.

The Euclid Study Science team together with the instrument consortia are presently preparing a conference to be held in November at ESTEC. The Objective of this conference is to present the mission to the international astronomical community and to encourage feedback in advance of the Cosmic Visions review process.

7.4 PLATO: Malcolm Fridlund

The assessment study of PLATO has been completed and is currently being reviewed by ESA. Three studies have been carried out in parallel, two by industrial contractors and one by a scientific consortium. All three are based on a multi-aperture – required for a large Field-of-View (FOV) - telescope pointing towards the same region of space for up to three years. Each of the three studies has found slightly different technical solutions that meet the scientific objectives of Plato. The number of telescopes varies between 12 and 54 while their apertures range from 170 to 83 mm.

PLATO does not require separate technological development but several activities need to be started early in order to reduce risks and meet a 2018 launch.

- Due to the multi-aperture approach where each telescope has its individual camera, a large number of high performance CCD chips need to be manufactured. An early prototyping including design and qualification will be required.
- One design call for refractive telescopes with many relatively large lenses operating at low temperature. This unusual design would benefit from the early development and validation of an engineering model.
- One of the industrial designs utilizes a deployable sun-shield of a new type. This is required for the reflective solution in order to avoid vignetting over the wide FOV. The early design and development of a demonstrator would reduce the risks.

The Study Report is in the process of being finalized before its release to the astronomical community. The Science Study Team met several times over the summer and early fall in order to refine the scientific case and adjust it to the progress of the industrial and payload studies. The case is now quite solid, with Plato clearly providing an order-of-magnitude improvement over the NASA Kepler mission. In brief, more than a quarter of a million solar type stars will be searched for Earth-like planets. Over 20,000 of these will be bright enough for detailed characterization by astroseismology. The size, mass, orbits and fluxes of planets around such stars will therefore be determined to 1 or 2% accuracy while their age will be inferred with a precision of a few hundred million years. The data collected by Plato would thus allow for true comparative planetology.

7.5 SPICA: Ana Heras

The final presentations of the industrial studies on the SPICA Telescope Assembly by EADS Astrium and Thales Alenia Space took place at the end of July. Both industrial contractors confirmed the technical feasibility of the SPICA telescope and showed that their designs are compliant with the satellite allocations as provided by JAXA and with the mission scientific requirements, including those set by the coronagraph. The ESA Internal Review of the SPICA Assessment Study, addressing both the telescope and the SAFARI instrument, took place during the month of September.

The second SAFARI Instrument Technology Readiness Review was held at ESTEC on 15th July. The consortium presented the status of the various technologies and the plans to reach Technology Readiness Level (TRL) 5 by the third quarter of 2012. The critical elements identified concern the detectors, the scanning mechanism and the sub-K cooler. Bruce Swinyard will continue to act as Principal Investigator but SRON took-over from STFC as the lead funding agency for SAFARI. A Consortium meeting was organised at IFSI, Rome, on 15-16th September where members of the SRON SAFARI team were formally introduced in their new functions.

A high level Science Management Plan has been agreed with JAXA. A single Time Allocation Committee, with scientific representation from all countries participating to the projects, will be responsible for selecting the observing programme. Approximately 25% of the available time will be set aside for instrument builders (i.e. Guaranteed Time Observers) while 60% will be opened to the scientific community (Open Time), of which 22% will be reserved to astronomers from ESA member states. ESA's contribution to the science operations has preliminarily been agreed, including an ESA SPICA Science Centre at ESAC that will interface to the European community for all SPICA observatory related issues and to JAXA for all SAFARI operational matters.

The Assessment Study Report is nearing completion. Its preparation has been a major activity for all the teams involved in the project. A Joint European/Japanese SPICA Workshop took place on 6-8 July at Oxford, UK. The proceedings will be published electronically by EDP Sciences at the Web of Conferences. SPICA has been recommended by the National Academy of Japan as one of the three main missions in the Astronomy and Space Physics long term plan, together with participation to the Thirty Meter Telescope and LCGT, a gravitational wave detector. The SPICA capabilities to study planetary formation and exo-planet characterisation were presented at the conference "Pathways towards habitable planets", held in September in Barcelona.

JAXA/ISAS continues with the preparation of the System Requirements Review that will take place around the end of the year. In July, NASA released an Announcement of Opportunity for the study of a possible US participation to SPICA. The final decision is subject to the outcome of Decadal Survey process.

9 Satellites in orbit

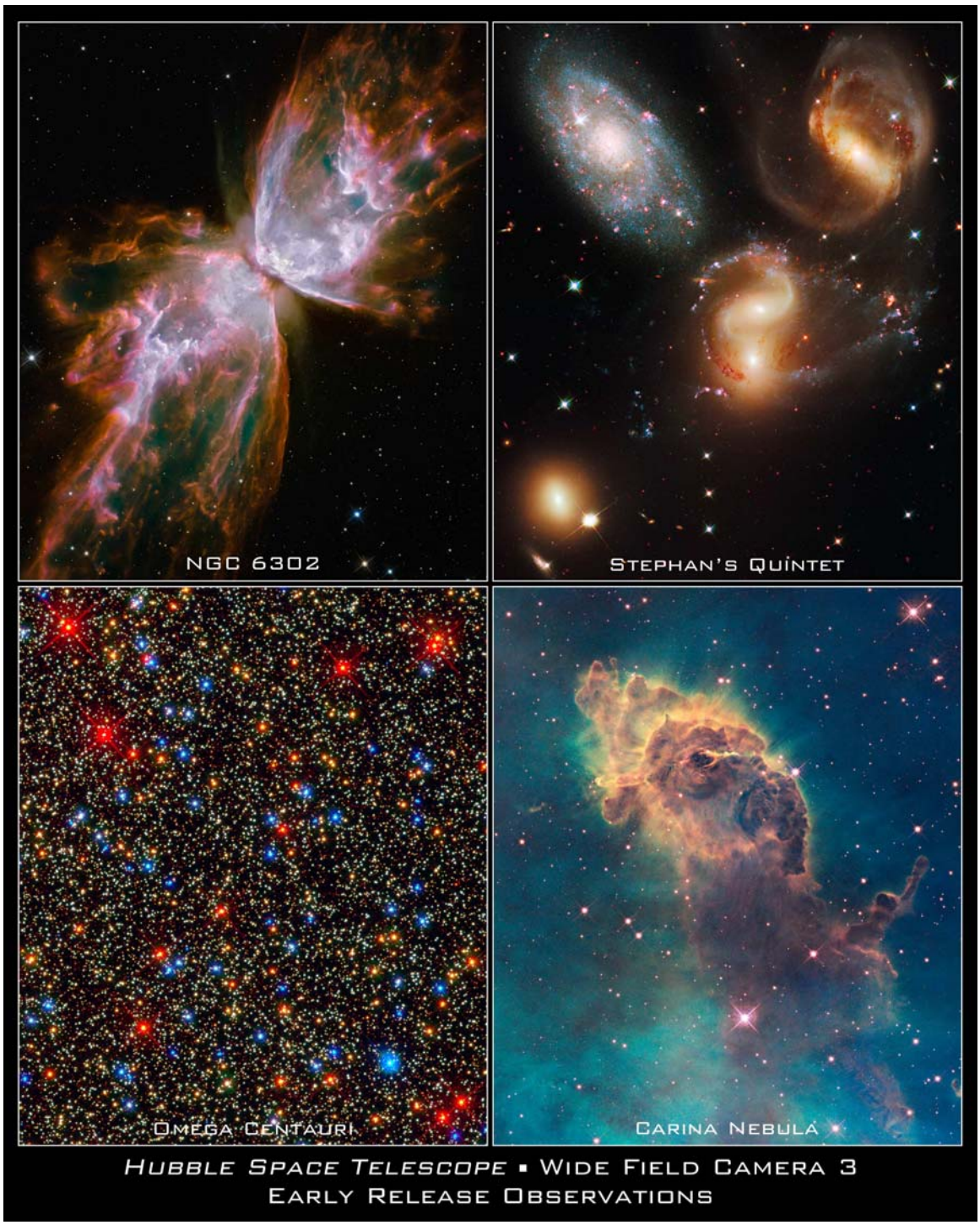
9.1 HST: Antonella Nota

Following a very successful Servicing Mission 4, Hubble has undergone an intense commissioning period. Servicing Mission Orbital Verification (SMOV) activities are nearing completion, with the formal SMOV Closure Review planned on November 18. In the meantime, Hubble has started taking scientific observations with a full complement of six instruments.

On September 9, NASA released the Hubble Early Release Observations (EROs). These are images and spectra designed and processed to illustrate the excellent performance of the various instruments. Four WFC3 ERO images are attached below. The accompanying press release was entitled “Hubble Opens New Eyes on the Universe”. Television coverage of the event included major European and American network news programs, all top newspapers in the US and Europe, many local television newscasts and about 530 online news sites and blogs. Coverage in Europe was excellent, with the BBC being the absolute first to show the Hubble images on their website. Coordinated by ST-ECF, astronomers in Europe were available on the phone to answer media questions.

During the month of September, Hubble took its 900,000th exposure since its launch in April 1990. This total includes internal calibration exposures as well as targeted observations using all eleven Science Instruments that have been or are still onboard HST (HSP, WFPC-1, FOS, GHRS, FOC, WFPC-2, STIS, NICMOS, ACS, WFC3, and COS). The 900,000th Hubble exposure was a STIS bias observation.

In parallel, a Call has been released for Multi-Cycle Treasury (MCT) Programs, with a deadline of November 18, 2009. Starting in Cycle 18, up to 750 orbits per cycle will be available for MCT Programs. The intent is to provide astronomers with the opportunity to tackle key scientific questions that cannot be fully addressed through the standard time allocation process. MCT programs must require at least 450 orbits and can request more than 1,000 orbits. Up to 500 orbits of General Observer (GO) observations and 250 orbits of Director's Discretionary time will be available in Cycles 18 and 19. Proposers may request additional orbits in future cycles, if scientifically justified. MCT Programs may address a broad variety of compelling scientific investigations, but they may also focus on one specific problem. MCT proposals will be assessed by a dedicated Time Allocation Committee. There will be no restriction or pre-selection of science topics.



9.2 XMM-Newton: Norbert Schartel

The XMM-Newton observatory continues to operate nominally. As of October 13, 61.6 % of AO-8 (A & B priority) observations have been successfully carried-out. Completion of the AO-8 programme is expected by end of April 2010, in line with the planned start of AO-9 observations.

Several Targets-of-Opportunity were observed during the reporting period, namely NOVA LMC 2009 (twice), Cygnus X-1, CAL 83, PHL 1092, GRB090709A, SGR 0418+5729, XTE J1652-453 and IGR J17511-3057.

Version 9.0 of the XMM-Newton Science Analysis system was released in June. The main improvements are: (1) a package, developed by NASA/GSFC, supporting the analysis of extended sources (2) an application for generating EPIC spectra with fluxes in physical units, (3) a task for producing true colour images and (4) an upgrade to the task which adds high resolution spectra. Version 6.0 the Science Archive (XSA) was released in July. The new version includes better search algorithms and access to the incremental (Delta-3) Slew Survey Source Catalogue. The update covers 3800 square-degrees and contains 1554 new sources. The total sky coverage of the slew catalogue is now around 40%.

The ninth XMM-Newton Announcement of Opportunity (AO-9) closed on the 9th of October. In total, 539 valid proposals were received requesting 111688 ks of science time, resulting in an oversubscription factor of **7.7**. Seventy proposals for "Large Programs" were submitted. Triggered or Target of Opportunity observations are requested by 34 proposals, while 9 proposals have been received for the joint XMM-Newton Chandra program and 2 proposals for the joint XMM-Newton ESO (VLT and VLTI) program. Proposals from 399 different principal investigators in 24 countries have been submitted. Including co-investigators, about 1400 individual scientists from 35 countries participated to AO-9.

About 50 scientists participated to the scientific workshop “Supersoft X-ray Sources – New Developments” held in May at ESAC. The proceedings will be published as a regular issue of the Astronomical Notes. The next workshop entitled “Ultra-Luminous X-ray sources and Middle Weight Black Holes” is planned for 24-26 May 2010. Prof. R. Mushotzky (University of Maryland) chairs the scientific organising committee.

Nature published an article (2009, Nature 459, 540) by A. Fabian et al. about the first detection of relativistically broadened iron K- and L-shell transitions in the XMM-Newton spectrum of the Seyfert 1 galaxy 1H 0707-495. A second Nature article (2009, Nature 460, 73) by S.A. Farrell et al. reports the discovery of an ultra-luminous X-ray (ULX) source serendipitously detected with XMM-Newton in the edge-on spiral galaxy ESO 243-49. The source variability together with its luminosity sets a conservative lower limit to the mass of the black hole of ~500 M_0. An article by S. Mereghetti et al. appeared in Science (2009, Science 325, 1222) about an ultra-massive, fast-spinning white dwarf in a peculiar binary system. Using XMM-Newton data, the authors show that the mass of the white dwarf is at least 1.2 solar mases, based on dynamical measurements alone. This massive white dwarf is in a post-common envelope binary system with a hot sub-dwarf companion. It is likely to reach the Chandrasekhar limit and explode as a type Ia supernova.

As of October 13, 2227 articles directly based on XMM-Newton observations have appeared in the refereed literature, of which 257 are from 2009.

9.3 Integral: Christoph Winkler

INTEGRAL science operations continue smoothly with the spacecraft, instruments and ground segment performing nominally.

Target of Opportunity observations were performed of the accreting X-ray pulsar A 0535+26 and the newly discovered millisecond X-ray pulsar IGR J17511-3057. Six GRB were detected in the FOV.

The 2nd AO-7 call opened on 25 May to solicit data rights proposals for targets located in the FOV of the 26 AO-7 observing proposals approved previously. By the deadline of July 3, 72 proposals had been received requesting data rights on 608 targets. The total number

of AO-7 proposals (data rights + standard observations + key programmes) is 148, somewhat lower than for AO-5 (182) and AO-6 (194). It should be noted however, that the AO-5 and AO-6 programmes included an observation of the Galactic Centre (GC) region which, on its own, attracted 52 (AO-5) and 46 (AO-6) data rights proposals, respectively. The only approved AO-7 GC observation will make its data publicly available immediately and therefore does not require data rights proposals. The Time Allocation Committee recommended approving 62 data rights proposals.

Seven years of successful INTEGRAL operations have been celebrated at "The Extreme Sky" workshop in Otranto (Italy), from 13th to 17th October. The 4th IBIS/INTEGRAL catalogue of hard X-ray sources (A.J. Bird et al., ApJS, 2009, accepted) was presented. It contains 331 new sources compared to the 3rd catalogue (421 sources in total, published in 2007). Of these new sources, 120 are associated with extragalactic sources while only 25 are associated with known Galactic sources, and the remainder remain so far unidentified. The fact that most of the new sources are unidentified suggests that INTEGRAL observations along the Galactic Plane have reached a depth such that previous X-ray observations are no longer able to provide associations with known sources. Further observations of the Galaxy will undoubtedly continue to uncover new sources; prompt follow-up is of critical importance to understand their true nature. Many of the new INTEGRAL sources found in or near the Galactic Plane are extragalactic. INTEGRAL has proved particularly adept at uncovering this obscured population. As of the end of August, the number of refereed articles using INTEGRAL data published since launch is 478, of which 70 are from 2009.

9.4 Suzaku (ASTRO-E2): Arvind Parmar

Suzaku was launched in July 2005. Following the early failure of its prime instrument, it has been performing astronomical observations with the remaining X-ray CCD cameras and hard X-ray detector. Scientists from institutes located in ESA Member States are authors of 63-refereed papers that make use of Suzaku data. The data have been obtained through four annual European Suzaku Announcements of Opportunity.

The fifth Suzaku European Announcement (AO-5) opened on 1 September 2009 with a deadline of 20 November 2009 at 16:30 CET. It solicits proposal for observations to be conducted from April 2010 and March 2011. As before, JAXA/ISAS has kindly offered scientists from institutes located in the ESA Member States 8% of the observing time. European proposers are expected to involve one, or more, Japanese co-investigators. More information can be found at http://www.rssd.esa.int/Suzaku.

9.5 Akari (ASTRO-F): Alberto Salama

AKARI continues routine operations in its post-helium phase with no major problems. The AO-2 warm phase European Open Time programme completed on 14 October with 655 observations successfully executed. AO-3 closed in July with under-subscriptions both at ISAS/JAXA and ESA. The European Time Allocation Committee reached the expected return of 10% of the total observing time by completing programmes executed in the first year of the warm phase. Due to conflicts with the Japanese programme, only 70% of the European observations could be scheduled. The Japanese Open Time programme was similarly affected, and only 15% of observing time was filled, compared to the 20% allocated. A special issue of A&A dedicated to AKARI is being prepared for publication in the spring of 2010. The All-Sky Survey FIR Point Source Catalogue is being finalised for release before the end of 2009, after a one year proprietary period. The MIR all-sky

survey, an add-on to the mission, will result in a catalogue which is being prepared with strong ESA participation for internal release in 2009.

9.6 CoRoT: Malcolm Fridlund

Except for the failure of Data Processing Unit #1 (DPU-1) CoRoT continues to operate nominally after more than 1000 days in space. The failure of DPU-1 means that the payload operates with only one half the Field-of-View. Despite several attempts, the contact with the data acquisition chain going through DPU-1 could not be re-established. A final experiment using a spare address on the unit was carried out in early October 2009 with negative result. The CNES investigation concluded that either the DPU, the power supply to the DPU or the interface to the spacecraft failed. It is worth noting that, unlike DPU-2, DPU-1 had experienced several anomalies during the first 2 years of operations. CNES has requested that ESA continues to provide technical support to DPU-2 should further problem arise. For memory, the DPU was developed by the Research and Scientific Support Department of ESA.CNES has approved an extension of the mission from 1 April 2010 to 31 March 2013.

Following the loss of DPU-1, observations are now split in two parts. CoRoT first points towards one half of the originally planned field for 85 to 90 days; the process is then repeated for the second half of the field. The smaller field-of-view implies that there are fewer stars per pointing and thus more telemetry bandwidth available. This means that it is now possible to observe more stars in 3 wavelength-bands (2000 instead of 500) and sample a larger number of target with a high time resolution (32s instead of 512s). CoRoT has now completed 11 individual observations producing about 100,000 light curves. The expectations are that a similar amount of data will be secured during the extended mission phase.

On September 16, a joint ESO-CNES-ESA press release unveiled the mass of CoRoT-7b an exoplanet with only 5 times the mass of the earth. In total, 7 confirmed planets have been found with CoRoT. Articles announcing the discovery of 4 additional exoplanets are in preparation while a further 5 exoplanets are in the final process of confirmation with follow-up observations. In total, more than 80 planet candidates are currently being followed up.

Asteroseismologic light-curves of over 100 stars have been collected, whose spectral types ranges from Solar to hot B, including a few red giants. A number of new and interesting results have been published on the oscillations of solar-type stars and red giants while small amplitude pulsations have been reported in hot stars.

As of September 2009, 58 articles based on CoRoT have been published in the refereed literature since launch. An additional 55 articles will appear in a special issue of Astronomy & Astrophysics to be published on October 22. Articles have also started to appear based on publicly available CoRoT data.

A formal collaboration agreement between NASA and CNES was signed on 17 September. The NASA Exoplanet Science Institute will receive the complete CoRoT data-set and mirror the CoRoT archive; it will also develop software for the reduction and interpretation of CoRoT data. In exchange, the CoRoT mission receives up to 60 nights of guaranteed time on the Keck telescope for follow-up observations of exoplanet candidates. Ten nights have already been awarded.