# Related activities

We report here on the “other” activities which, although not strictly related to the DPAC efforts, are intimately related to the scientific nature of the Italian involvement in the Gaia mission. These activities have to do for the most part with the several scientific initiatives that directly or indirectly relate to Gaia and offer the opportunity to present to the general scientific community worldwide the importance of the Italian effort for the Gaia mission. These activities are given high visibility in the ASI contract to the extent that they must not just be mentioned in the PR’s but meeting contributions and actual science articles constitute contract deliverables.

## **THE DPAC WG Ground-Based Observations for Gaia (GBOG)**

The main activities of GBOG are to coordinate ground-based activities in DPAC, to interact at a higher level with the observing institutions (for example ESO), to disseminate information between different CUs concerning observation and data analysis techniques. From Italy there are two CU representatives in GBOG (Altavilla for CU5 and Clementini for CU7). However, in the reporting period, there has been no meeting or telecom of the GBOG group.

A proposal has been submitted to ESO, in order to observe again most if not all GBOT star fields 24 hours after each observation. The goal is to be able to determine the apparent magnitudes of hundreds of asteroids that are routinely found in GBOT frames. In this way, it should be possible to complement Gaia detections of a subsample of these objects, and derive for them the absolute magnitude, needed also to estimate the albedo. The proposal is currently under examination by ESO.

## **THE DPAC CU9 (Catalog Access)**

**Project description.** CU9 is the last DPAC coordination unit, in charge of the design and implementation of the Gaia archive. The SDP was completed in December 2013 (GAIA-C9-PL-ESAC-WOM-086). The Italian team is participating to the CU9 effort with Marrese, Marinoni, Vallenari, Sordo, and Pancino.

**WP 947 – Cluster Validation (Vallenari, Cantat-Gaudin, Marrese, Sordo, Pancino)**

Several tests aimed to assess the quality of the GDR1 were developed, involving TGAS, photometry and completeness using open and globular clusters. The tests were delivered and implemented in ESAC. They were validated on simulated or ground based data and then applied to two preliminary solutions of the TGAS astrometry. Cross-match of external HST data in globulars was calculated at the ASDC and used for the validation.

Finally the tests were applied to final TGAS data, and to the GDR1 data in general. Several problems and issues were spotted.

Several test reports were produced. They are kept confidential on svn, but they should be considered issued, since they were submitted to GPACE/ GST to assess the quality of the DR1 data.

**WP 957 – Auxiliary data (Sordo)**

Sordo has coordinated the delivery of auxiliary data for GDR1 to CU9. She was responsible of the update of the related DM. A document is compiled describing the DM and it is available on svn (GAIA-C9-TN-ESAC-EUM-034) and will be soon finalized.

**CU9 activities** (Vallenari, Marrese, Spagna, ~~Giuffrida~~, Marinoni, Cantat-Gaudin, Pancino, Smart).

Open clusters as tests for Gaia data. The algorithms for TGAS testing were developed. Tristan Cantat, supported by non-ASI funds was actively involved in the work. The algorithms involving tests on TGAS proper motions and parallaxes were integrated in the Gaia system and tested on simulated and real data from a preliminary TGAS solution. Auxiliary data for TGAS tests were collected from literature search. Two TN (TGC-01 and AV-016) describing the auxiliary data and the TGAS tests are on SVN.

Auxiliary data on globulars for the tests on the first data release positions were collected.

The binary stars in the TGAS results were used to test the quality of the parallaxes and importantly their errors by Smart.

The borsa begun in 2015 under the GENIUS FP7 program in collaboration with the Teramo Observatory to develop intra catalog access tools for the Gaia archive continues. The National Coordinator was Smart and the local Coordinator Buonanno (OATe).

## **THE PARTICIPATION IN THE “GREAT” INITIATIVE**

**Project description.** GREAT (Gaia Research for European Astronomy Training) is a pan European science driven research infrastructure which will facilitate, through focused interaction on a European scale, the fullest exploitation of the ESA Gaia 'cornerstone' astronomy mission, enabling the European astronomy community to provide answers to the key challenges in our understanding of the Galaxy and Universe. The GREAT ITN project ended on 28 February 2015.

~~Pancino participated to the preparation of a new ITN fund request, in the Horizon 2020 framework and the Marie Curie Initial Training Network action, entitled~~ *~~“Gaia – ITN”~~*~~, which foresees the participation of INAF as a main node, with two ESR in Padova and Bologna. The deadline for the presentation of the proposal to ERC was 13 January 2016. Unfortunately, the proposal was immediately below the cutoff line and was rejected.~~

As a development of the former GREAT ESF, a COST Action Proposal OC-2016-1-20726 "*GAIA Astrometry Innovation Network: Exploring the Universe*" was ~~successfully~~ submitted to the COST Open Call OC-2016-1 by Walton on April 2016. Bragaglia, Clementini and Marconi participated as Secondary Proposers on behalf of other Italian Colleagues both in DPAC (e.g. Ripepi, Musella, Leccia) and outside DPAC. Unfortunately, it was just below the cutoff and it was not accepted. A novel proposal is to be submitted for the December 2016 deadline, along the same line of research and with the same participants, both among Secondary Proposers and interested Italian personnel (e.g., Altavilla, Bellazzini, Montegriffo in Bologna).

~~The Italian community is participating (in particular: interest has been expressed by Bragaglia, also on behalf of Altavilla, Bellazzini, Montegriffo, Pancino in Bologna and many more in other Institutes).~~

**Participation to Conferences and Meetings**

* Clementini participated in the meeting: “*Giornate di Osservatorio (OABo)*”, 18-19 February 2016, presenting the talk: “Projects on the cosmic distance scale and stellar populations based on variables”; and participated via skype in ISSI-BJ Workshop “*Astronomical distance determination in the space age*”, Beijing, May 2016 presenting the talk “Cepheids & RR Lyrae in the Gaia era”.

**People: Fellowships and exchange visits**

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## **THE Gaia ESO Survey (GES)**

**Project description.** Among the GREAT projects, the Gaia-ESO Survey (GES) was designed during 2010, was accepted by ESO in 2011, and the actual observations started on 31 December 2011. ESO assigned 300 nights to GES in 5 years (at a rate of approximately 6 nights per month), to gather high- and medium resolution spectra with FLAMES of ~100,000 stars belonging to all Galactic components: halo, bulge, thin and think disc, and open clusters of all ages. GES data will complement Gaia by obtaining precise radial velocities of faint (V > 17 mag) stars in the same spectral region covered by Gaia RVS, in a blue spectral region useful for chemical analysis (and in other regions for the open clusters), and by providing astrophysical parameters and precise abundances of elements other than iron and the alpha-elements in various spectral ranges. Recently the ESO Survey Review Panel formally awarded the GES consortium with the last 60 nights plus 40 nights of compensation time, to complete the survey observations in the next 1-2 years.

**GES Activities**. Randich is co-PI of the GES proposal. Micela and Vallenari are members of the GES steering committee, while Bragaglia, Pancino and Lanzafame are leading three key working groups, which are WG4 “*Cluster stars target selection*”, WG5 “*Calibrators and standards*”, WG12 “*Pre-Main Sequence spectrum analyses*”, respectively.

In the reporting period, operations proceeded in routine mode, in terms of observations preparation and data analysis. Several new science verification papers have been drafted or submitted to A&A, and a few others were accepted.

The internal fifth data release (iDR5) is being prepared, while spectra and measurements from the iDR4 were selected and sent to ESO for a public release through the Phase3 portal.

* ~~Bragaglia, Randich, Sordo and Vallenari contributed to the activities of WG10 and WG11 (spectrum analysis of FGK stars, both in clusters and in the field) and Lanzafame to the WG10, WG11, and the coordination of WG12 activities.~~
* ~~Bragaglia, Lanzafame, Pancino, Randich, Sordo, Spagna, Vallenari participated in the preparation of many of technical and scientific papers based on GES activity.~~
* ~~Several telecons were organized/attended by all team members.~~

## **SUPPORTING “APACHE” AND “HARPS-NORTH” EXTRASOLAR PLANETS PROJECTS**

The Global Architecture of Planetary Systems (GAPS) programme with HARPS-N at TNG has been extended by INAF until the end of AOT32 (February 2016). The radial-velocity survey of a sample of bright M dwarfs monitored by APACHE which are going to be observed very frequently by Gaia is one of the key GAPS programme elements. The first important result emerging from the survey is the detection of a Super Earth companion (8 MEarth) to a nearby M1 Dwarf with a period of 13 days (Affer et al., in preparation).

An additional significant signal in the radial-velocity time series with a period of some 30 days was interpreted as due to stellar activity thanks to the fundamental support of the APACHE photometric data.

Another target part of the APACHE survey began being monitored with HARPS-N when the K2 space telescope uncovered three transiting Super Earths orbiting around it, the third companion situated at the margin of the Habitable Zone of the star. The object is now part of a collaboration agreement between GAPS and the GTO programme to secure intensive monitoring (hundreds of observations) with the objective of determining the masses and thereby, in combination with the radius estimates, the composition of the three planets.

## **THE PARTICIPATION TO THE WEAVE PROJECT**

Participants: Vallenari, Randich, Lanzafame, Frasca, Bragaglia, Bellazzini, Smart, Lattanzi

Vallenari as Italian executive participate to the monthly teleconf of the WEAVE projects, coordinating the Italian participation. As member of the Science Team, she coordinates the open clusters survey. Vallenari prepared all the documentation for the Science Review, with the collaboration of Bragaglia, Frasca, Lanzafame, Randich. A meeting of the Italian community participating to WEAVE was organized by Vallenari in Rome (31 May 2016) and Vallenari, Bragaglia, Frasca presented talks. Two meetings are organized in the next months (Weak of WEAVE, Leiden 26 Nov-2 Dec; WEAVE All Hands meeting 19-21 Dec, Cambridge) and Vallenari, Bragaglia will participate.

Project description. WEAVE is a new wide-field spectroscopy facility proposed for the prime focus of the 4.2m William Herschel Telescope. The facility comprises a new 2 degree field of view prime focus corrector with a 1000-multiplex fibre positioner, a small number of individually deployable integral field units, and a large single integral field unit. The IFUs and the MOS fibres can be used to feed a dual-beam spectrograph that will provide full coverage of the majority of the visible spectrum in a single exposure at a spectral resolution of ~5000 or modest wavelength coverage in both arms at a resolution ~20000.

The instrument is expected to provide spectroscopic sampling of the fainter end of the Gaia astrometric catalogue, chemical labelling of stars to V~17, and dedicated follow up of substantial numbers of sources from the medium deep LOFAR surveys.

Project status. The instrument is expected to be on-sky by mid 2018. The project is now fully funded by the WEAVE Consortium, and fully on track.

Weave science case on open clusters was revised. The configuration tool for fibre positioning was run to assess the degree of feasibility of the proposed targets, since positioning about 1000 fibres is an dense and centrally concentrated field is far from trivial. This was done for all the targets and has lead to a revision of the Survey plan and Science case. Synergies with outer disk HR survey was explored. A final list of targets was derived and sent to the Survey Team. Vallenari and Bragaglia, have organized a WEAVE meeting in Rome to present the project to the Italian community at large and promote the scientific exploitation of the data.

Target clusters young, intermediate age and old were selected, their color-magnitude diagrams and data were collected to produce a survey plan document. In each field a preliminary and provisional target selection was operated. The list of targets was sent to the WEAVE Science Team. The configuration tool for fibre positioning was run to assess the degree of feasibility of the proposed targets, since positioning about 1000 fibres is an dense and centrally concentrated field is far from trivial.

Vallenari as Italian executive participate to the monthly teleconf of the WEAVE projects, coordinating the Italian participation. ~~As member of the Science Team, she coordinates the open clusters survey.~~ Vallenari prepared all the documentation for the Science Review. Bi-monthly telecons are held bye the Science Team Leads and Vallenari, as coordinator of the open clusters survey, and Bragaglia, as her substitute, participate to them.