Scientific report for the GREAT exchange visit program (2012)

Visit Aims:

1. To build a work plan for the Australia-France GAIA team to implement using the Australian robotic optical facility.
2. To plan the schedule for specific testing in 2012 for the GAIA follow-up network.
3. Plan exchanges of researchers and PhD student training between the Australian and France institutes.

2. Description of the work carried out during the visit:

- Study of binary asteroid candidate (939) Isberga with P. Tanga et al. using Zadko (November 2011). The analysis is ongoing
- The paper: entitled "An optimal Mars Trojan asteroid search strategy", ref. MN-12-0809-L, has been accepted for publication in Monthly Notices of the Royal Astronomical Society Main Journal. The work was in collaboration with the host institute participant P. Tanga.

3. Description of the main results obtained;

- The collaborative visit has enabled the researchers to work on a publication describing the Australian participation in the Gaia Follow-Up Network. This work is continuing following the visit. The paper will be published in “Publications of the Astronomical Society of Australia” (fully refereed).
- Development progress of an image reduction pipeline for automation of photometric light curves with P. Tanga:

The visit has enabled PhD student M. Todd (from Australia) to access expertise at the host institute OCA for the continued development of an automated light curve generator for asteroid studies.

- Meetings with Bruno Sicardy from the Observatory of Paris where we discussed opportunities for observing future occultation events, specifically of Trans-Neptunians, after the Zadko building renovations and the planned camera upgrade.

4. Future collaboration with host institution

The project will build on the GAIA science collaboration between Observatoire Cote d’Azur, The University of Western Australia and Curtin University. These institutes manage the 1-m robotic Zadko Telescope (ZT) located in Western Australia (see project equipment below). The exchange program will allow the Australian and France scientists to plan and coordinate the GAIA follow-up

and GBOT tests for 2012 using the ZT. Furthermore, we will plan an exchange program of scientists to visit the Australia optical facilities.

Collaboration participation history by Australian team (2010-2011)

- Gaia-FUN-SSO workshop (Paris Dec 2010). Australian team establish collaboration with P. Tanga and W. Thuillot.
- GREAT network Workgroup C4 (Solar System) workshop "Solar System science before and after Gaia." Pisa, Italy (May 2011).
- Study of binary asteroid candidate (234) Barbara with P. Tanga et al. using Zadko (March 2011).
- Study of binary asteroid candidate (939) Isberga with P. Tanga et al. using Zadko (November 2011).
- Paper: An optimal Earth Trojan asteroid search strategy. Todd et al. 2011. MNRAS Letters (in press).
- Paper: Observing Earth Trojans with Gaia. Mignard, Tanga and Todd. 2011. Gaia DPAC Technical Note ref: GAIA-C4-TN-OCA-FM-051-I
- Development of an image reduction pipeline for automation of photometric light curves with P. Tanga.
- Observations of 2005 YU55 submitted to the GAIA follow-Up Network William Thuillot (GBOT).

5. Projected publications / articles resulting or to result from the grant (ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant);

- The collaborative visit has enabled the team to work on a publication describing the Australian participation in the Gaia Follow-Up Network. This work is continuing following the visit. The paper will be published in "Publications of the Astronomical Society of Australia" (fully refereed).
- Study of binary asteroid candidate (234) Barbara with P. Tanga et al. using Zadko (March 2011) to be published 2012.

Summary

The following is a summary of the status of Australian participation in the GAIA Follow-up Network.

Australian Infrastructure & Equipment

The Zadko Telescope– see Coward et al. (2010), is a purpose built 1 meter, robotic telescope, located about 80 km north of Perth, Western Australia. It was designed to monitor a previously unchartered region of the "transient sky". The Zadko Telescope is the only meter class telescope capable of deep imaging between the east coast of Australia and South Africa at a similar latitude. The Zadko Telescope, operated by UWA, is the Australian "node" of the TAROT robotic telescope network.

The 1-m ZT has the potential to contribute to the core goals of the GAIA follow-up network. Firstly, and most importantly, it is fully robotic and uses a

control system and automated image pipe-line that has been successfully employed for many years for GRB follow-up on the TAROT network. It allows for receiving automated alerts using computer socket connection, and automatic image processing for science by external users via web-page download. In the future, we plan to implement the VoEvent protocol, which may become the standard for communicating alerts between observatories.

There is excellent potential for the ZT to play an important role in the follow-up of GAIA alerts, both for science validation and science follow-up of GAIA alerts. In late 2011 and early 2012, the infrastructure for the facility will be upgraded to enable the above participation in GAIA related science.

To perform the above core GAIA science tasks as part of Workgroup C4 (Solar System) it is critical that the Australian team participates in the training network. The GREAT exchange program provides a valuable vehicle for consolidating and extending future student training for the France-Australia GAIA collaboration.