



Research Networking Programmes

Short Visit Grant or Exchange Visit Grant

(please tick the relevant box)

Scientific Report

The scientific report (WORD or PDF file – maximum of eight A4 pages) should be submitted online within one month of the event. It will be published on the ESF website.

Proposal Title: Interferometric Observations of Benchmark Stars for the Gaia mission and the Gaia-ESO survey

Application Reference N°: 4652

1) Purpose of the visit

The European Space Agency's astrometric Gaia satellite will deliver data of an extraordinarily quality creating a precise three-dimensional map of more than a thousand million stars throughout our Galaxy. The astrophysical parameter determination of Gaia sources will be entirely based on model spectra. In order to account for deficiencies in the physics of the model used, the results of the parameter determination algorithms have to be calibrated. Therefore, a set of benchmark stars that are suited for testing stellar atmosphere models and synthetic spectra is required.

The purpose of the exchange visit was to select a set of stars that can be used as benchmark stars for the Gaia mission and the Gaia-ESO survey. These stars are defined as well-known, relatively bright stars for which atmospheric parameters (T_{eff} , $\log(g)$), and metallicities from many high-resolution spectroscopic studies are available. The stars are moreover suitable for high angular resolution observations using infrared interferometry. Interferometry in the near-infrared is the best method to probe the physical conditions near the stellar photosphere. These regions are minimally contaminated by line

blanketing, and the continuum opacity approaches its minimum value. This allows precise determination of atmospheric parameters based on consistent direct measurements of the angular diameters. These parameters will be used to improve stellar atmosphere models and synthetic spectra.

2) Description of the work carried out during the visit

The main content of the exchange visit was selection of suitable stars and preparation of a proposal using the Very Large Telescope Interferometer (VLTI) for the interferometric observations of these targets. The new reference stars were selected in close collaboration with the Gaia-ESO Public Spectroscopic Survey (Co-PIs G. Gilmore, S. Randich, all the Co-Is (M. Bergemann, K. Lind, C. Worley, P. Jofre, A. Korn, U. Heiter and M. Wittkowski) are Gaia-ESO Survey members) and members of the CoRoT astero-seismology team in synergy with other observational campaigns. The GBOG working group (Ground-based observations for Gaia) within the Gaia Data Processing and Analysis Consortium coordinates the collection of auxiliary data necessary for the calibration of the parametrization algorithms, such as the observations proposed here. For the selected targets, we have made a preliminary estimate of the angular diameters, and confirmed their suitability for interferometric observations with the near-infrared AMBER instrument at the VLTI. The objects satisfy the following selection criteria: a) accurate parallaxes ; b) suitable angular diameters, typically above 3 mas; c) high-resolution spectra available, optimally including optical and near-IR ranges (i.e. UVES, CRILES, HARPS); d) preliminary estimates of stellar parameters from spectroscopy; e) a wide coverage of the parameter space: the selected stars sample T_{eff} from 3000K to 5300K, $\log(g)$ between 0 and 3, and $[\text{Fe}/\text{H}]$ from -0.7 to +0.4.

3) Description of the main results obtained

The proposal 'Interferometric Observations of Benchmark Stars for the Gaia Mission and the Gaia-ESO Survey' was recommended by the OPC. All the time was allocated with priority class A, a total of 84 hours. The goal of the project is to collect high-precision, homogeneous, angular diameters of benchmark stars that are used as calibrating standards in spectroscopic surveys with focus on red giants.

3) Description of the main results obtained

4) Future collaboration with host institution (if applicable)

The data obtained from the observations will be after the delivery subsequently reduced, analyzed and modeled in a consistent manner. The project within a close collaboration with the host institution will in the future provide consistent and robust direct measurements of angular diameters, and thus precise determination of atmospheric parameters of the stars serving as Gaia benchmark stars.

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)*

6) Other comments (if any)