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**: The Open Clusters Chemical Abundances from Spanish Observatories Survey (OCCASO): Chemical Abundance determination of first year data*

Application Reference N°: 6660

1) Purpose of the visit

The Open Clusters Chemical Abundances from Spanish Observatories (OCCASO) survey is a long term project devoted to obtain chemical abundances in Open Cluster (OC) stars. The survey has been designed to replicate from the North the observations of the Gaia-ESO Survey (GES) from the South. This will allow us to double the number of OC homogeneously studied by GES. This will have strong implications in the analysis of existence of trends in the Galactic disc and to study some key objects like the oldest or the most metal-poor OCs or those systems studied by Kepler mission.

OCCASO has been selected as a long term project at the Roque de los Muchachos Observatory (La Palma, Spain) from fall 2013 to spring 2015. It is regularly awarded with observing time at the Calar Alto Observatory (Almeria, Spain) both in DDT and TAC assigned time. The first year of observations have been concluded recently. In total we have acquired spectra for more than 50 stars, many of them replicated with the different instruments used, in 15 Open Clusters (OCs). The final goal is to observe a total of 25 OCs with at least 6 stars observed in each of them.

As in GES, one of the OCCASO goals is to derive the chemical abundances using some of the most widely used tools available. In brief, all tools used to derive chemical abundances in stars can be divided in three groups. The first group is formed by those procedures with are based on the classical procedure of deriving chemical abundances from the equivalent widths of a selected sample of spectral lines. The second group includes those procedures in which the whole observed spectrum is compared with a grid

synthetic spectra of known features. This procedure is known as spectral synthesis. The third is an hybrid of the previous ones. Briefly, the idea is to compare the observed spectrum with synthetic spectra but only in a selection of spectral regions.

The purpose of my visit to Bologna was to interact closely with the developers of one of the most widely used tools to derive chemical abundances: DAOSPEC (Stetson & Pancino 2008, PASP, 120, 1332) and GALA (Mucciarelli et al. 2013, ApJ, 766, 78). The procedure consists on automatically measuring the equivalent widths on the spectral lines using DOOp (Cantat-Gaudin et al. 2014, A&A, 562, A10), an automatic wrapper for DAOSPEC and them to derive the chemical abundances for each star with GALA.

2) Description of the work carried out during the visit

My stay at the OABo have been used to deepened in my knowledge of the use of these tools. Moreover, this stay has coincided with the end of the stay of our PhD student, L. Casamiquela. She has been performing a three months stay at the OABo learning the use of these tools. After many tests performed during Casamiquela's stay we have decided the final best input parameters for DOOp and GALA in order to analyse the first year OCCASO data. In particular, we have performed many comparisons of the stellar atmospheric parameters (temperature, gravity, microturbulence, and metallicity) and abundances derived from spectra observed with different telescopes, with other results available in the literature, and with different stellar atmosphere models. These consistence tests are key to ensure the homogeneity of our results. Once the input parameters set, we have determined the final atmospheric parameters (temperature, gravity, microturbulence, and metallicity) and abundances for a handful of chemical species in all the stars observed until now, a total of 100 spectra. Finally, during my successful stay in Bologna we have also identify those chemical species that need a special treatment and we have decided a first procedure to derive their abundances.

3) Description of the main results obtained

The main results of my stay at OABo is that we have obtained the stellar atmosphere parameters and chemical abundances of the OCCASO first year data. The obtained stellar parameters will allow us to study in detail the chemical composition of each OCs. Moreover, we have performed very different comparisons with ensures the consistency and homogeneity of our sample which was one of the initial requirements of OCCASO. As it will be explained in section 5, these results will be publish in two different papers.

4) Future collaboration with host institution (if applicable)

OCCASO is still an ongoing project and therefore I will continue our close collaboration with OABo researchers in the near future. A part of OCCASO, I have been collaborating with OABo researchers for more than ten years in very different projects. I do not expect that this situation will change in the future.

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)*

With the result described in Section 3 we plan to publish at least two papers. We are working at the moment on the first of them, lead by myself. It consist in a detailed

description of the OCASSO survey, including the motivation, the description of the observation and data reduction and a discussion o the different procedures that we are using to derive chemical abundances. Moreover, we will present the stellar atmosphere parameters of all the star observed until know. From this data, we will include a detailed comparison among results obtained from spectra observed with different telescopes, with different tools, and with different stellar atmosphere models. We plan to submit this paper before the end of the year. In the second one, lead by L. Casamiquela, we will present the chemical abundances of alpha- and iron-peak elements in a total of 9 OCs. Those for which we have observed at least 6 stars in each of them. Our plan is to submit this paper during the first part of the next year.

6) **Other comments (if any)**

I would like to mention that I have taken my stay at the OABo to interact with P. Donati in a paper about the stellar content of the OC Trumpler 5. The paper with our results is in a very advance stay. My stay in Bologna has been used to speed up its conclusion.