

## Short description written by each ESR and ER

Project acronym: **ELSA**  
Project ID (6 digits): **033481**  
Project Participant: Faculty of Mathematics and Physics, University of Ljubljana

You			Your stay in the network				
NAME, first name	Nationality	Previous place of work/education	Start date	Duration (months)	Category ESR/ER	Place	Country
RE FIORENTIN, Paola	Italian	MPIA, Germany	1.09.07	24	ER	Ljubljana	Slovenia

Despite my studies in Mathematics and (nuclear) Physics, my main research interests are in galaxy formation and evolution (with emphasis on what can be learned from our own Milky Way), tracers of structure formation, kinematics, and accretion, which I started to investigate during my PhD.

I completed my PhD with a thesis on *Detection of fossil structures in the Galactic halo by means of spectro-photometric and proper motion surveys*, at the University of Torino (Italy). My thesis addressed the problem of detecting substructures in the galactic halo using radial velocity, metallicity, proper motion, and photometric parallaxes for stellar tracers in the inner halo. Large fraction of the work was devoted to the stellar classification – in order to derive spectral type, absolute magnitude, and select halo stars – and to the analysis of selected tracers by means of statistical tools (e.g., two-point correlation function) in the velocity space.

After that I got a postdoctoral position at the Max-Planck-Institute für Astronomie (Heidelberg, Germany). Within the SDSS collaboration, I participated in the selection algorithm tests for SEGUE plates, as well as in extensive testing and development of the SDSS/SEGUE Stellar Parameter Pipeline; in particular, becoming familiar to the analysis of stellar spectra, I developed and implemented non linear classification models to estimate stellar atmospheric parameters (e.g., effective temperature, gravity, and metallicity) from spectroscopic and photometric data, which have been successfully adopted in the pipeline.

The *Interpretation of state-of-the-art real stellar spectra in preparation for the Gaia mission* is my research project within the ELSA Network. Currently, postdoctoral fellow at the University of Ljubljana (Slovenia), I work on the development and application of machine learning algorithms (e.g., Artificial Neural Networks, Support Vector Machines) for classification and astrophysical parameterization; as training grounds and complement to Gaia, I use data from SEGUE and RAVE, complementary on-going spectroscopic Galactic surveys.

In particular, the technique of Principal Components Analysis is investigated and implemented to optimally compress the spectra demonstrating its advantages by achieving preferential removal of noise and the ability to isolate rare types of stars with strong features which are filtered out along with bogus spectra. Special interest is devoted to recognition and analysis of spectroscopic binary stars, other objects with peculiar spectra (e.g., emission line objects, fast rotators), and new type of objects. I am working on further improving of these models and optimal combination of data aiming to extend the astrophysical parameter estimates to lower (less than 10 per pixel) signal-to-noise ratio.

Such efficient classification and parameter estimation effort is fundamental contribution to reach my objective to use these results (e.g., metallicity, surface gravity, effective temperature) to undertake more optimal studies of Galactic structure. From the analysis of these informations several science papers have been recently published, most notably the Nature paper on the dichotomy of the stellar halo and the paper on developing the metallicity map of the Milky Way. Currently, I am working on a new substructure identification effort.

My experience within the ELSA Network is certainly positive. As significant opportunities I had, I would like to highlight the frequent training activities, such as the ELSA Workshops, about science and techniques (software engineering and numerics), as well as communication and management; the possibility of interaction with other nodes (e.g., Heidelberg and Torino) and establish new collaborations with other researchers, also maintaining previous working relationships. I especially acknowledge the opportunity and support to attend and present research achievements at international conferences.