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 cosmic history of the Milky Way as traced by radial migration

Application Reference N°: 6692

1) Purpose of the visit

The purpose of the visit was to collaborate and interact with Pr. James Binney of Univ. Oxford, who is co-supervising my PhD along with Christophe Pichon (IAP - Paris). Our aim is to study, in the light of the upcoming GAIA data, the origin of the observed metallicity gradients within the Milky Way. These gradients are induced by the diffusion of stars through phase-space as a response to temporal fluctuations in the Galaxy's gravitational potential. Such a time dependence of the potential is due to the combination of the bar, clouds and lumpiness in the halo. We intend to focus on the effects on lumps in the halo.

To investigate this diffusion, we want to implement a “dressed” Fokker-Planck equation describing the diffusion of the stars in the galactic plane, induced by a fluctuating cosmic potential. Once complete, this investigation will be in a position to determine the metallicity-velocity dispersion relation as a function of position, quantity which will be accurately measured by GAIA. This investigation will also produce a statistical description of the typical fluctuations of the cosmic environment of L0 galaxies, a WKB theory of “dressed”

Fokker-Planck equation, and a framework to take into account the self-gravity of the cold component of a galactic disk.

2) **Description of the work carried out during the visit**

During my visit to Pr James Binney, we have been able to closely interact on the recent improvements and advances in the set up of the theoretical framework to describe the long-term evolution of a perturbed self-gravitating disk, thanks to a WKB-approach.

3) **Description of the main results obtained**

The main results obtained are :

+ Definition of the key parameters of the Schonrich&Binney model to describe the metal input throughout the disk.
+ Determination of the most relevant resonances responsible for the long-term diffusion of a galactic disk.
+ Study of the weakly damped modes of a galactic disk within the WKB formalism.
+ Determination of the typical temporal growth rate of the "temperature" of a disk, when heated via an external perturbation.

4) **Future collaboration with host institution (if applicable)**

In order to continue this close interaction, another visit to Oxford will most probably be considered. However, for the moment, no precise plans have been made.

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)***

This visit to Oxford allowed us to interact on subjects linked to the following publications :

+ Publication of the WKB-theory of the heating of a self-gravitating galactic disk via an external perturbation.
+ Publication of an analysis of a numerical experiment thanks to the framework of secular diffusion.

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

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