

Scientific Report. GREAT grant.

Visit of Maria Czekaj to Institute UTINAM, Besançon Observatory,
30 January - 11 February 2011

Title: Galaxy modelling for preparing the Gaia analysis

Supervisors: Annie Robin, Francesca Figueras, Xavier Luri

Purpose of the visit: The PhD project of Maria Czekaj is done at the University of Barcelona. Her visit to the UTINAM Institute in Besançon was planned to allow discussions and intensive collaboration with Annie Robin.

Description of the work carried out during the visit:

In our project we aspire to develop a new version of the Besançon Galaxy Model, improving many features of its latest release.

During the stay in question, several pending issues have been terminated. We have examined the correctness of the new density calculation and treatment. Our approach to the subject of star formation rate implementation in the model was revisited. Special testing mechanisms have been developed and performed in order to definitively ensure that assigning ages to the stars is done properly. We have vastly discussed and tested the question of reproducing by the model the observed value of the local volume density and fitting the simulations to the local luminosity function. The mass-luminosity relation of the old and the new model has been compared and contemplated. We have compared simulations with Tycho-2 data in the direction to the Galactic North Pole, when the SFR was still constant and after that we have finally performed the first change in the SFR scenario.

Choosing the formula of SFR to be decreasing we had to recalculate the value of the Galactic potential, taking care for the dynamical self-consistency. The general insight in the potential code developed by Bienayme et al. (1987) was done.

Description of the main results obtained:

We consider those thirteen days as very fruitful. The number of issues we were able to discuss and work on is impressive. Our major achievement would be the fact that we have finished the programming phase concerning the introduction of IMF and SFR in the code. Although it would be correct to say that the final new model version is still under construction, we have in hands a reliable prototype version. Using that version we have compared our synthetic LF with the observed ones from Jahreiss (1997) and Kroupa (2000) (example Fig. 1). We have checked if our model is able to reproduce the value of the local volume density observed in stars, which is $0.039 M_{\odot}/pc^3$, when simulating a sphere around the Sun.

Since all our treatments were vastly tested and we believe in their correctness, it was possible to check for the very first time the performance of new SFR scenario. That step required the recalculation of the Galactic potential. The very first comparison of simulations with Tycho-2 suggested that the revision of the dynamical mass value used in the potential code is needed.

Future collaboration with host institution:

A constant collaboration between both parties is crucial for this project and in fact it is maintained by regular emails and video conferences. However, when coming to the programming work, especially if it concerns such a complex and large code that the model unquestionably is, meetings in person greatly facilitate the communication and speed up the work. Surely, a student will go to Besançon as soon as the financial issues permit. We will continue the work on the remaining issues, among other things, age-velocity relation,

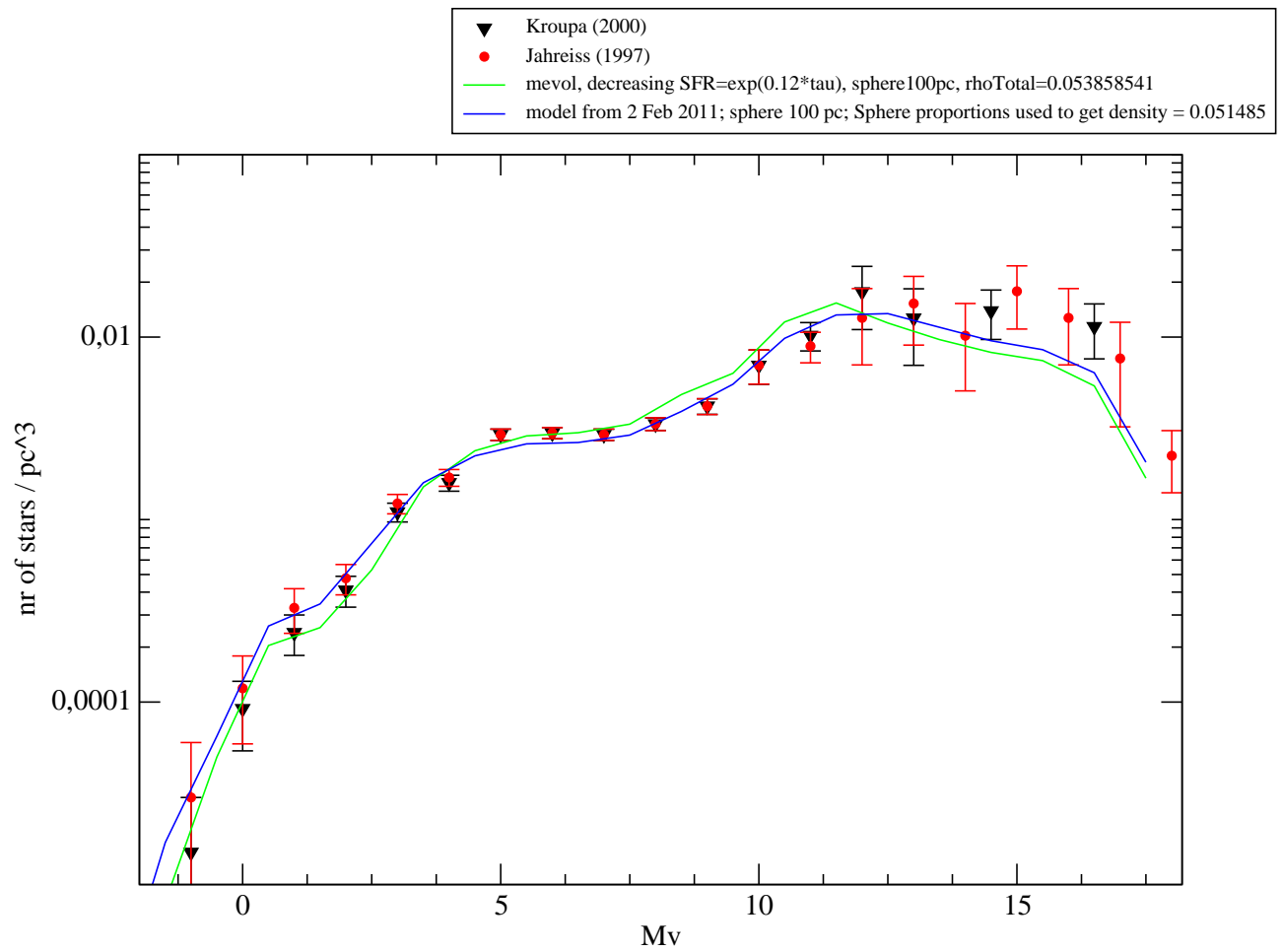


Figure 1: Comparisons of the Luminosity Functions.

binarities, improved kinematical description, meantime comparing the model with the vast amount of data available at present.