RevMexAA (Serie de Conferencias), **40**, 130–130 (2011)

KINEMATIC STRUCTURES IN GALACTIC DISC SIMULATIONS

S. Roca-Fàbrega,[1] M. Romero-Gómez,[1] F. Figueras,[1] T. Antoja,[2] and O. Valenzuela[3]

N-body and test particle simulations have been used to characterize the stellar streams in the galactic discs of Milky Way type galaxies. Tools such as the second and third order moments of the velocity ellipsoid and clustering methods –EM-WEKA and FoF– allow characterizing these kinematic structures and linking them to the stellar overdensities and to the resonant regions all through the disc.

The study of the origin and evolution of moving groups in the Milky Way (MW) disk has been up to now mostly restricted to the solar radius (Antoja et al. 2009). Here, we propose to characterize the kinematics all throughout the disk. For that we use both N-body and test particle simulations developed by Martinez-Valpuesta et al. (2006) and Antoja et al. (2009), respectively. The test particle simulations consider an axisymetric potential and the bar and spiral non-axisymetric components (Pichardo et al. 2004).

After several tests, we have checked that the most powerfull tools to properly characterize the kinematic structures are the second (vertex deviation) and third order moments (radial and azimutal) of the velocity ellipsoid, the last ones being indicators of the skewness of the distribution. Friends of Friends (FoF) clustering algorithm needs improvement to reach our goals and Expectation Maximisation algorithm (EM-WEKA) does not work as they trace the density structure instead of the kinematic complexity. As for the clustering algorithms, it is important to know that EM is parametric (uses gaussian fitting) and computationally expensive, while FoF is none parametric and highly faster.

Figure 1 shows an example of the results obtained with the N-body simulation. In all cases, as in Theis & Vorobyov (2009), high values of vertex deviation (l_v) are obtained in zones with a density gradient (i.e. spiral arms). Preliminary results seem to indicate a different behaviour of the l_v gradient depending on the nature of the spiral arms: spiral arms generated from the galactic bar (N-body and test particles with only bar) show negative values in the concave spiral zones, whereas the opposite is observed in those spirals traced by the imposed analytical potential. As preliminary conclusions we confirm that resonant effects related to the large scale structure –bar and spirals– are plausible explanations for the origin of the moving groups (S. Roca-Fàbrega, Master Thesis 2010). Work is in progress to confirm the connection between third order moments and non-axisymmetric potential.

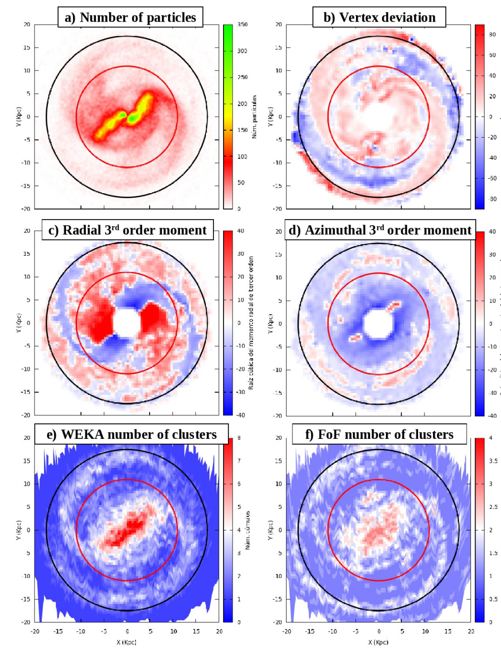

Fig. 1. N-body snapshot at 3.5 Gyr. At the top: density (left) and vertex deviation (right). Central: radial (left) and azimutal (right) third order moments. Bottom: EM-WEKA (left) and FoF (right) number of groups in the kinematic space. Resonance radius are indicated with circles.

This work was supported by the MICINN (Spanish Ministry of Science and Innovation) and FEDER through grant AYA2009-14648-C02-01 and CONSOLIDER CSD2007-00050.

REFERENCES

Antoja, T., et al. 2009, ApJ, 700, 78
Martinez-Valpuesta, I., et al. 2006, ApJ, 637, 214
Pichardo, B., et al. 2004, ApJ, 609, 144
Theis, C., & Vorobyov, E. 2009, Chaos in Astronomy (Berlin: Springer), 105

[1]ICCUB-IEEC, Universitat de Barcelona, Spain (sroca@am.ub.es).
[2]Kapteyn Astron. Institute, Groningen, The Netherlands.
[3]Instituto de Astronomía, UNAM, Mexico.