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STELLAR ORBITAL STRUCTURES IN SLOWLY ROTATING BAR MODELS

L. Chaves-Velasquez[1], I. Puerari[1], and P.A. Patsis[2]

We investigate the regular and chaotic nature of stellar orbits in a galactic potential consisting of a disk, a halo, and a slowly rotating bar. The structural parameters of these models come from an N-Body simulation. We focus our study in four snapshots of the simulation. We treat each snapshot as a a time independent model. We have build characteristic curves and we found that in all cases X_1− and X_2−like orbits share the same characteristic curve as in Tsigaridi & Patsis (2015). We have implemented the GALI2 index in our calculations and we integrated for 10 Gyr in order to distinguish regions of order, chaos and stickiness.

The Hamiltonian of a system which is rotating with constant angular velocity Ω_b around the z axis is given by

$$H = \frac{1}{2}(p_x^2 + p_y^2 + p_z^2) + \Phi(x, y, z) - \Omega_b(xp_y - yp_x) \quad (1)$$

From this Hamiltonian we derived the equations of motion in the reference frame which corotates with the bar. In our snapshot “2”, corotation is located at a radius $2R_b$, where R_b is the semi-major axis of the bar. In order to study the stability of the orbits we have implemented the GALI2 index (Skokos et al. 2007) which is given by

$$GALI_2 = |\hat{\mathbf{w}}_1 \wedge \hat{\mathbf{w}}_2| \quad (2)$$

where $\hat{w}_1$ and $\hat{w}_2$ are deviation vectors. In order to compute the GALI2 index we have integrated the variational equations. In Figure 1 we show the degree of chaoticity of the studied orbits.

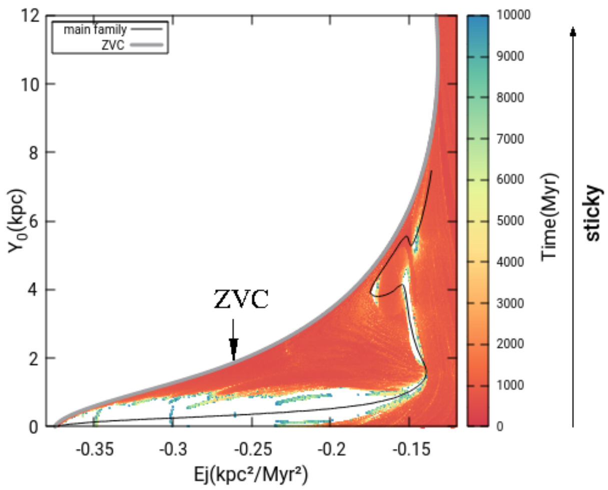

Fig. 1. Degree of chaoticity for orbits in snapshot “2”, at $t = 4.2$ Gyr after the start of the simulation. Model parameters are as in Manos & Machado (2014). ZVC points to the zero velocity curve, while the black line is the characteristic of the main family of the model. Chaotic initial conditions are indicated with colour. The colour bar shows the time at which a given orbit with $(Y_0, 0)$ initial conditions becomes chaotic. Orbits in red get chaotic at the begining of the integration, while orbits in green-blue get chaotic at the end of the integration; we identify these last orbits as sticky. At low energies, most of the orbits around the main family are regular (white areas).

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[1]Instituto Nacional de Astrofísica, Óptica y Electrónica, Calle Luis Enrique Erro 1, 72840, Santa María Tonanzintla, Puebla, México (leonardochaves83@gmail.com).

[2]Research Center for Astronomy and Applied Mathematics, Academy of Athens, Soranou Efessiou 4, GR-11527, Athens, Greece.