Wrinkles in the Gaia data unveil a dynamically young and perturbed Milky Way disk

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REG, Barcelona, 28/05/2018

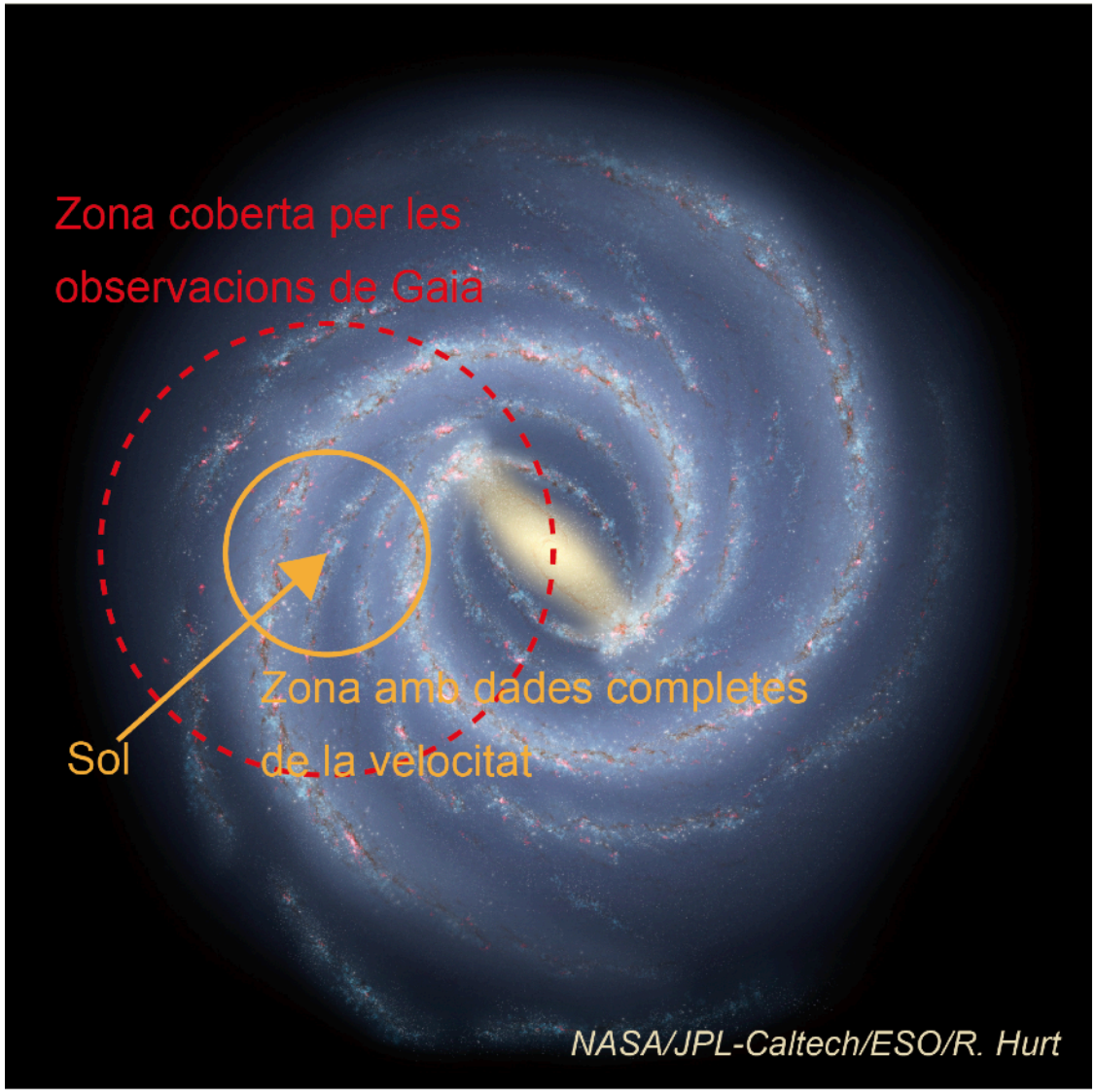
MARIE CURIE ACTIONS

ICCUB Institute of Cosmos Sciences

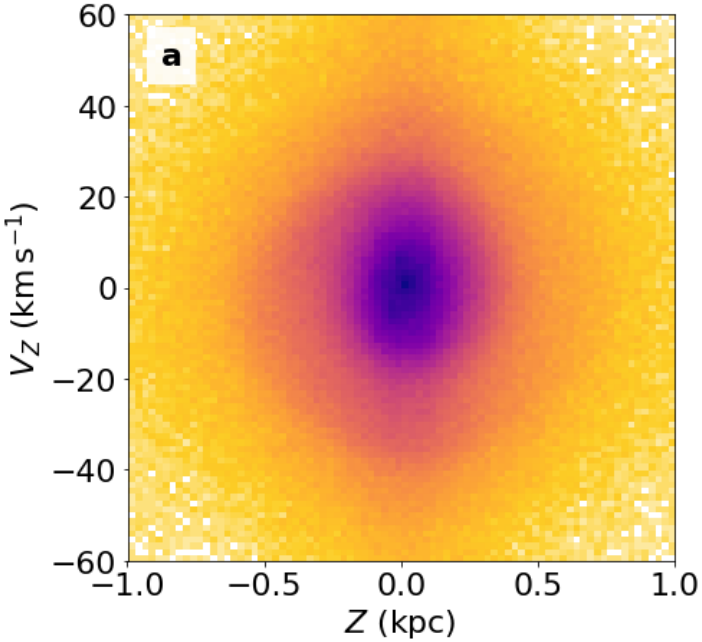
EXCELENCIA MARÍA DE MAEZTU

UNIVERSITAT DE BARCELONA

Gaia DR2

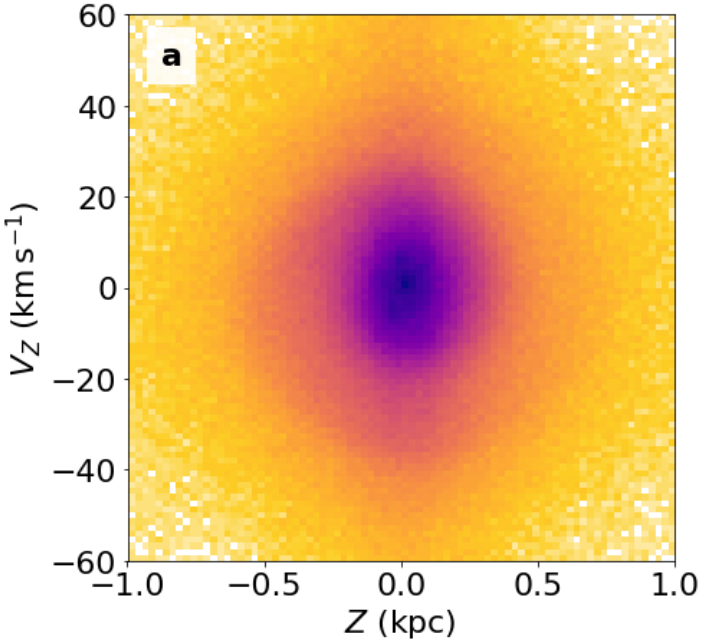

Zona coberta per les
observacions de Gaia
Zona amb dades completes
de la velocitat
Sol
NASA/JPL-Caltech/ESO/R. Hurt

Vertical phase space

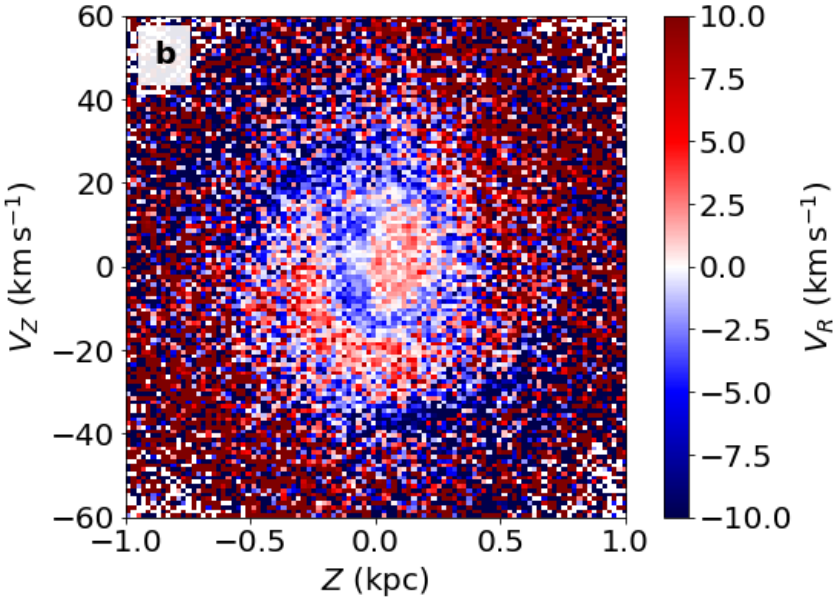


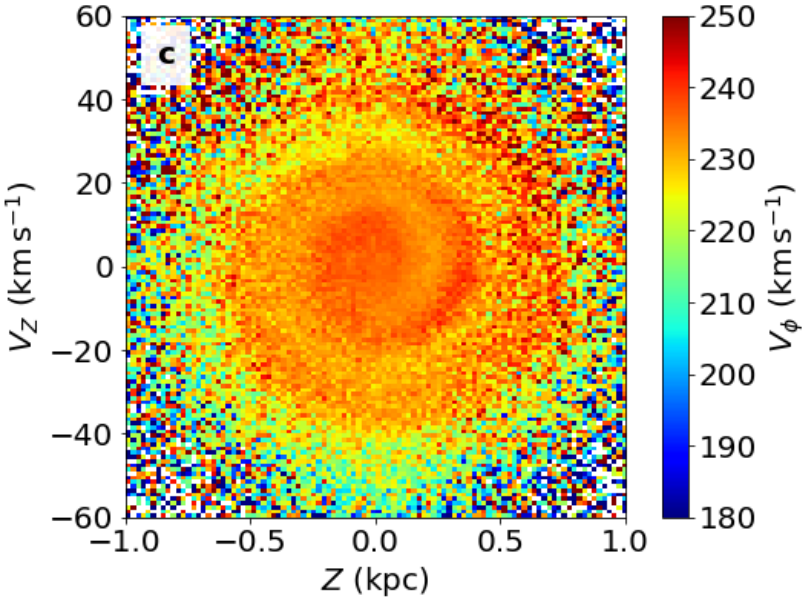
Gaia DR2

Vertical phase space



Gaia DR2





What is this spiral ?

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Phase mixing due to the Galactic potential: steps in the position and velocity distributions of popped star clusters

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ABSTRACT
As star clusters are expected to form with low star formation eff
ter is expelled quickly and early in their development: the star
an unbound stellar system, evolving in the Galactic potential. I
have demonstrated the existence of a stepped number density d
ter popping, both in vertical position and vertical velocity, witl
Christmas tree. Using numerical and analytical methods, we i
structure, which arises due to the phase mixing of the out-of-equ
mined entirely by the background analytic potential. Consideri
we construct a theoretical model to describe the time evolution o
of stars in a Miyamoto-Nagai disk potential and a full Milky-W
bulge, halo and disk components, which is then compared witl
our theoretical model, we investigate the possible observational
of detection.

Key words: star clusters, phase mixing

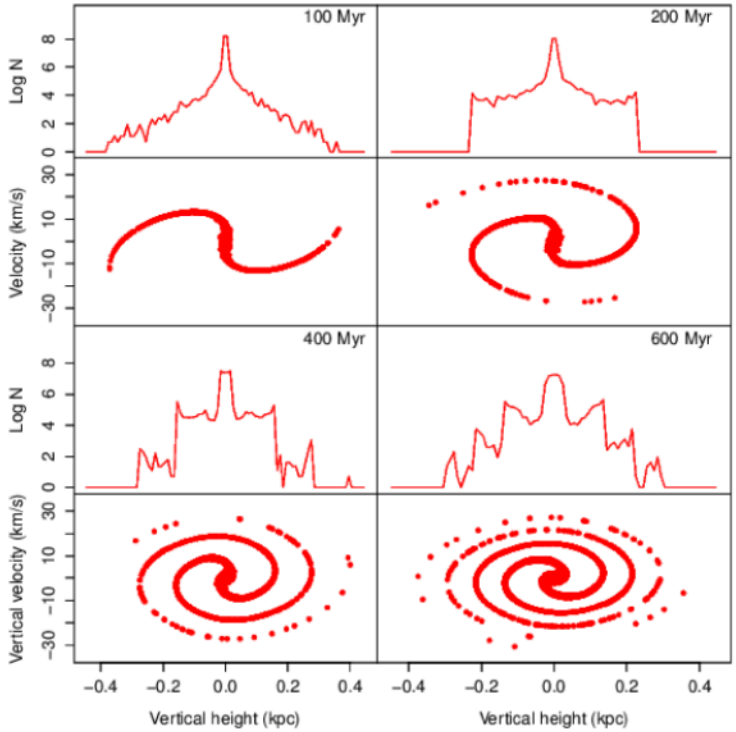
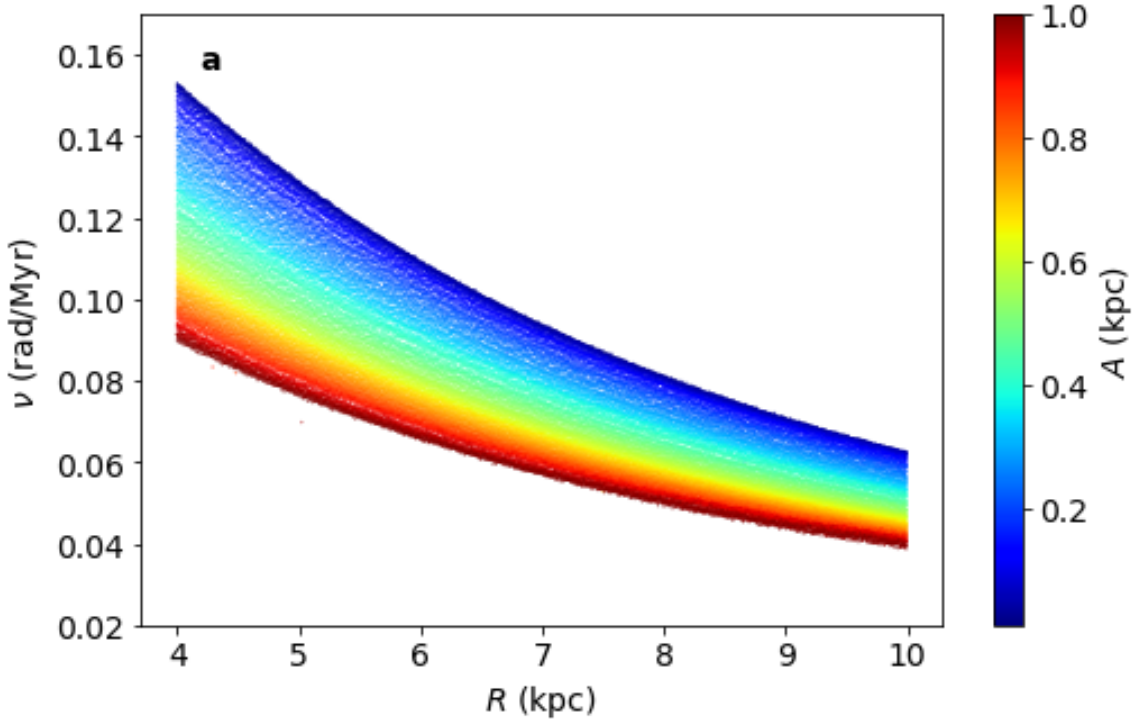


Figure 2. Phase space spiral and log vertical number density using 10^4 N-body particles from a $10^5 M_\odot$ popping star cluster in a background Miyamoto-Nagai disk potential, with parameters as specified in Section 3.

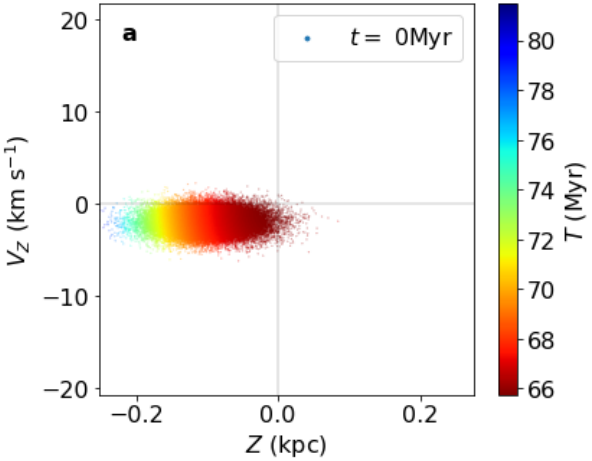
Model: Vertical frequencies

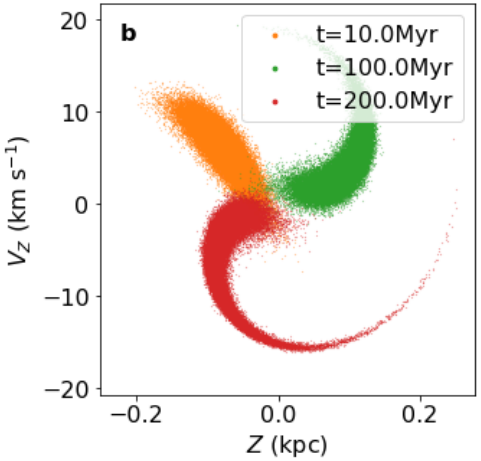
$$\Phi(Z) \propto -\alpha_0 + \frac{1}{2}\alpha_1 Z^2 - \frac{1}{4}\alpha_2 Z^4$$

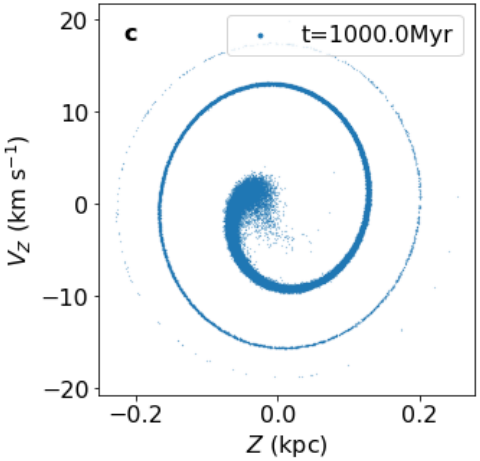


Vertical frequencies depend on: R and Zmax

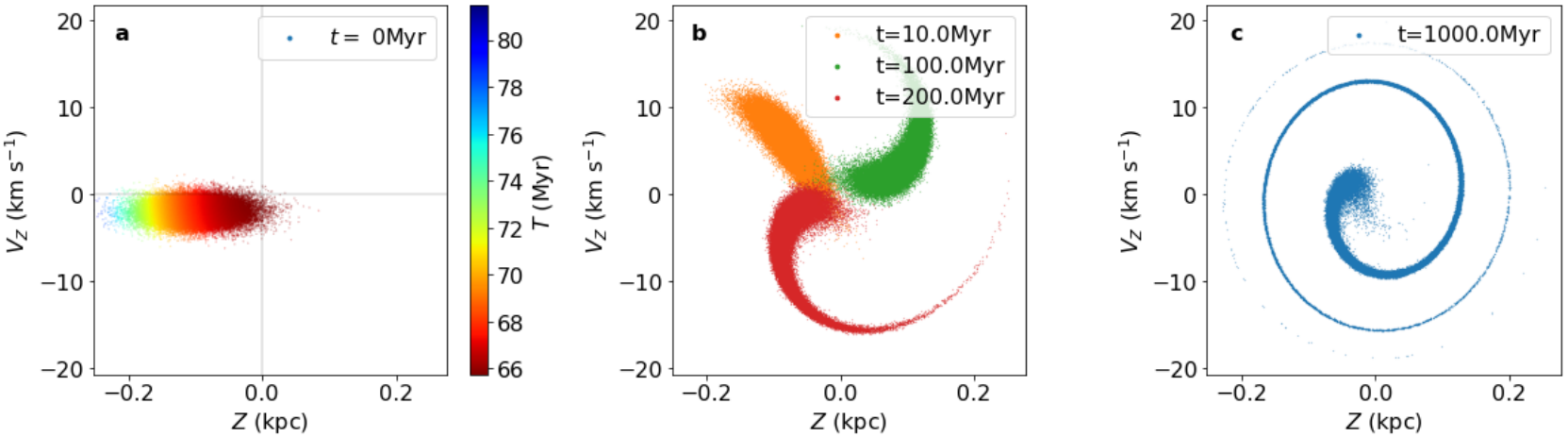
Model: Time evolution



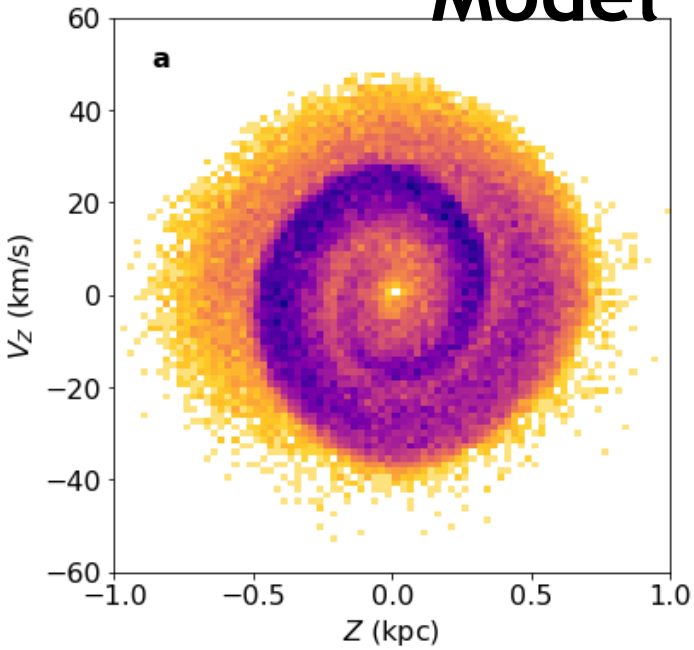




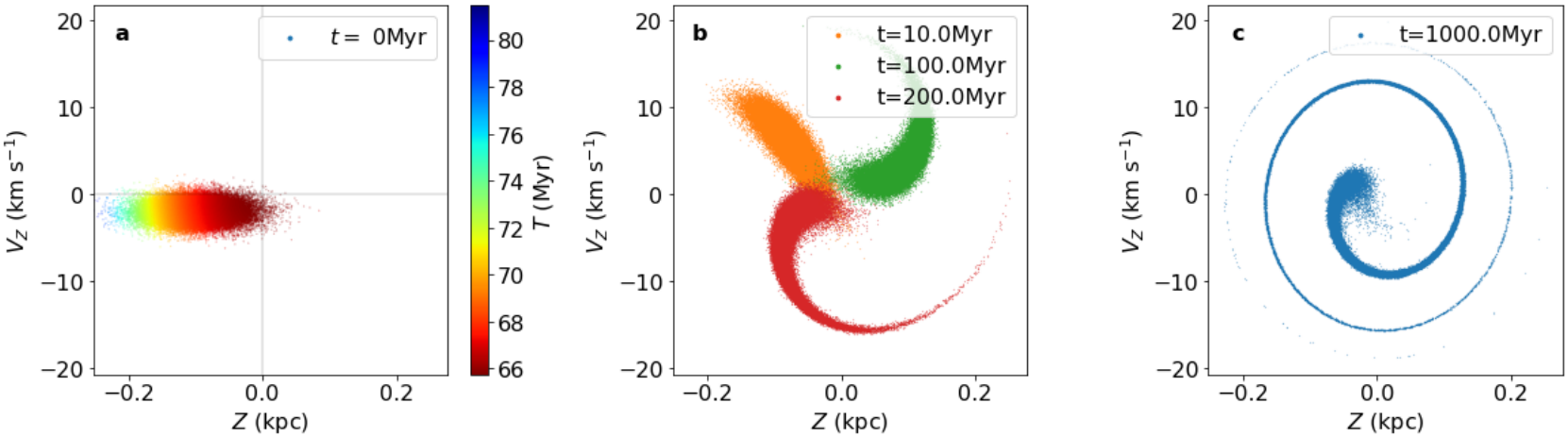
Model: Time evolution



Model

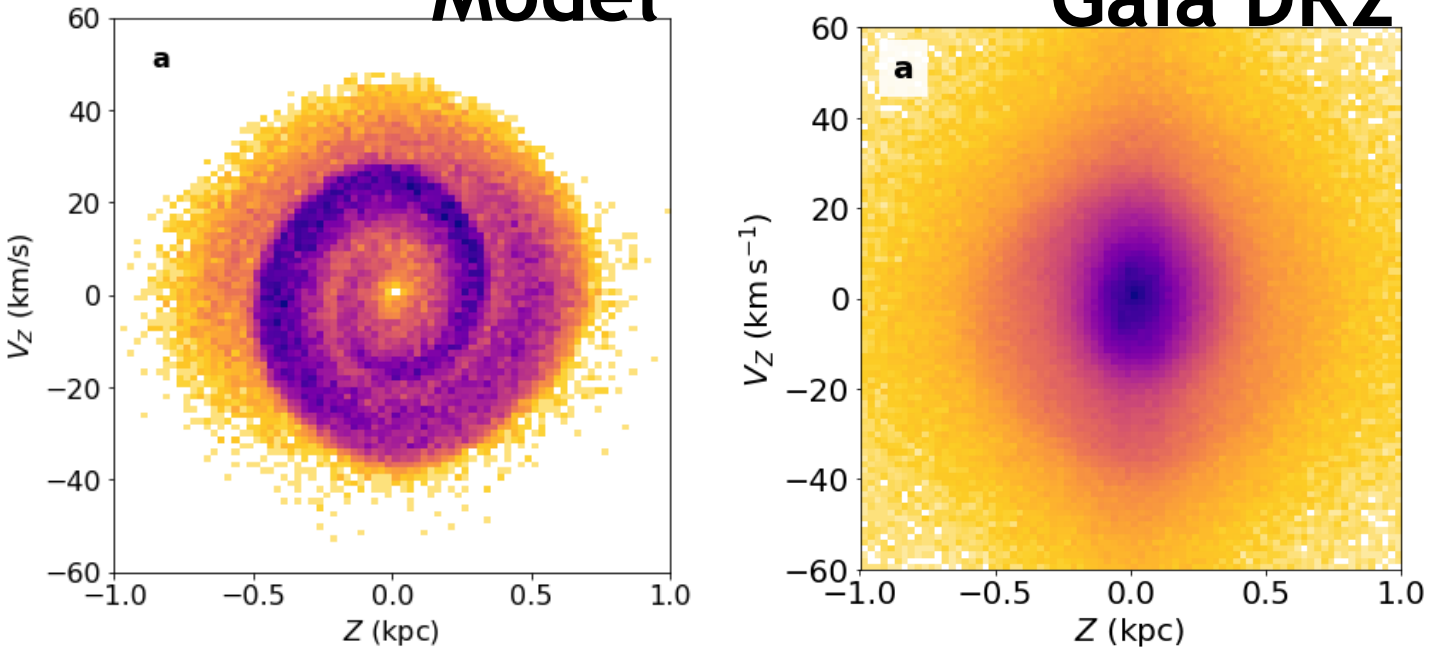


Model: Time evolution

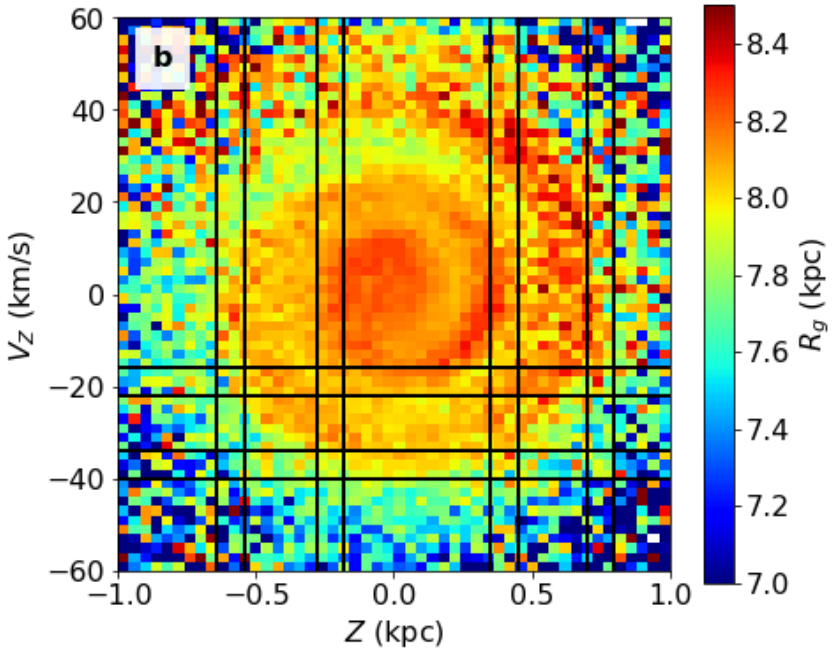


Model

Gaia DR2

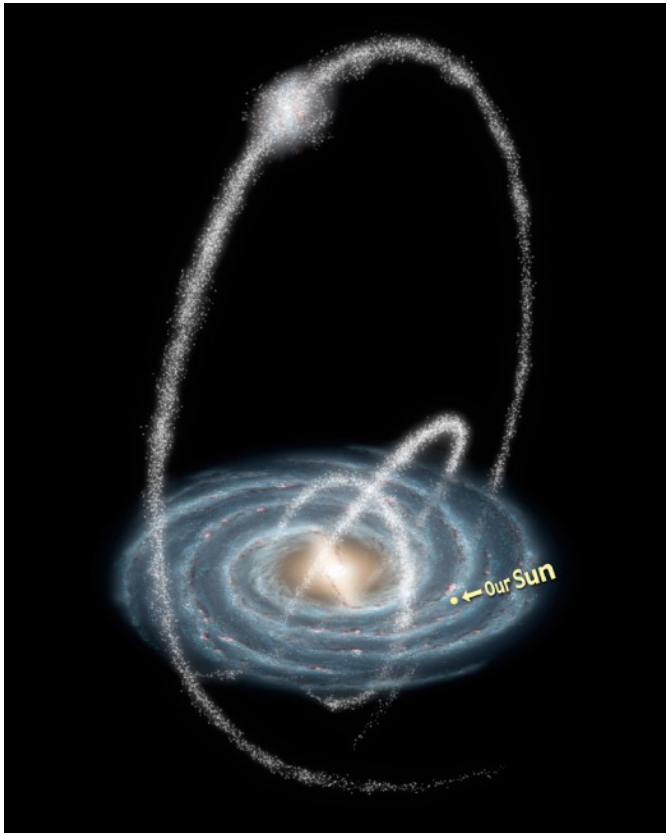


Time of perturbation



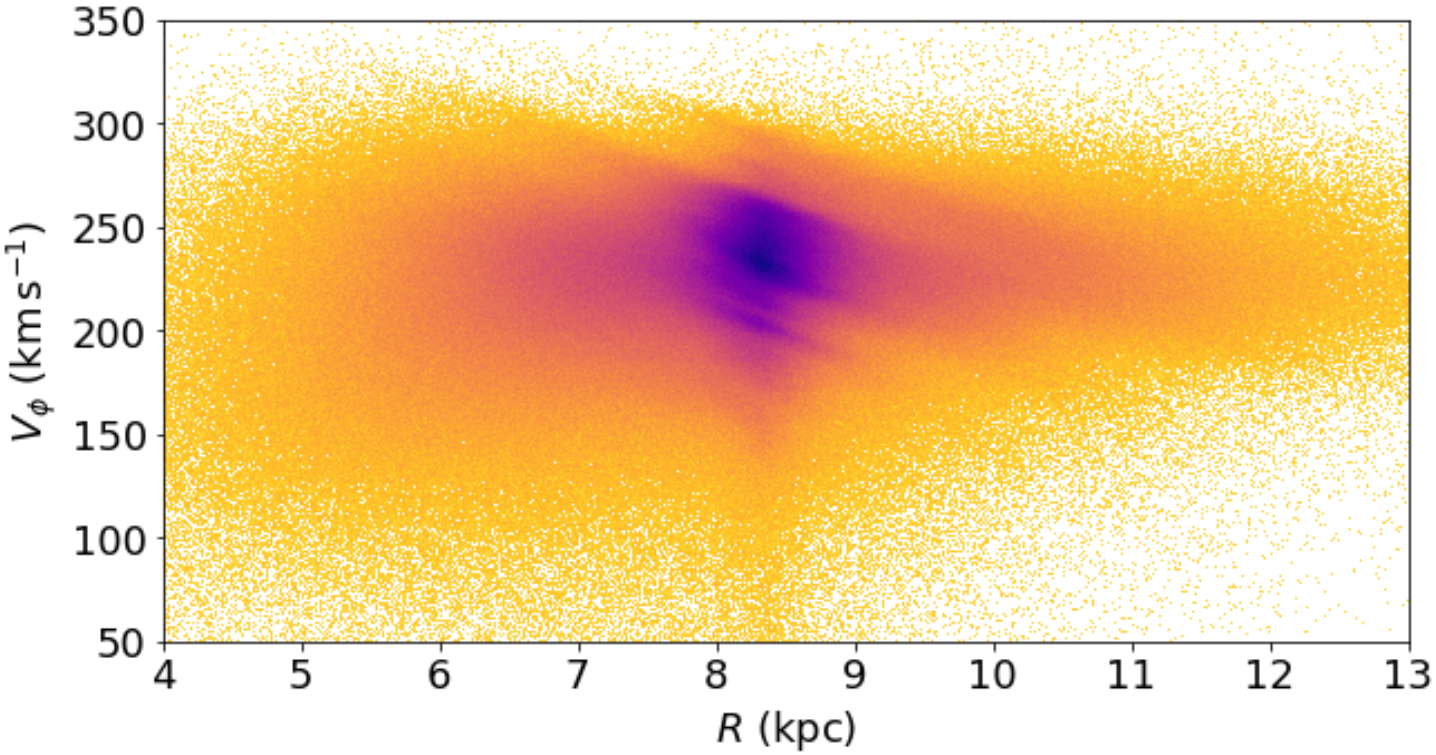
$$t = \frac{2\pi}{\nu_2 - \nu_1}$$

- 500 Myr [300,900] Myr
- Sagittarius dwarf pericenter



Horizontal phase space

Gaia DR2



Models

Phase mixing in horizontal direction

Galaxy with a bar