Self-consistent modelling of the Milky Way structure using live potentials[1]

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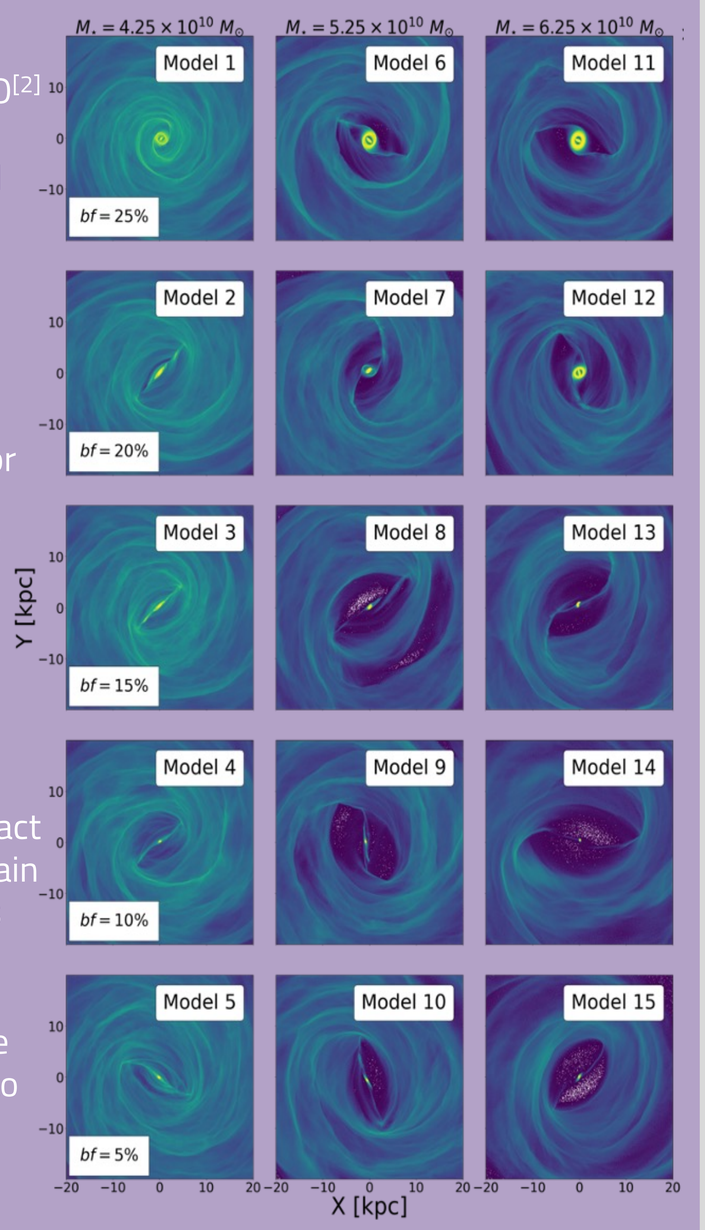
With the goal of investigating the role of the large-scale dynamics of the Galaxy on star formation, we aim to reproduce the structure of the Milky Way self-consistently and create a base model for the inclusion of sophisticated ISM processes such as stellar and SNe feedback, pre-SNe feedback and chemistry

1) Initial Conditions

We use the hydrodynamical AREPO[2] moving-mesh code to perform **15 isothermal simulations** of Milky Way-type galaxies using live stellar and dark matter potentials.

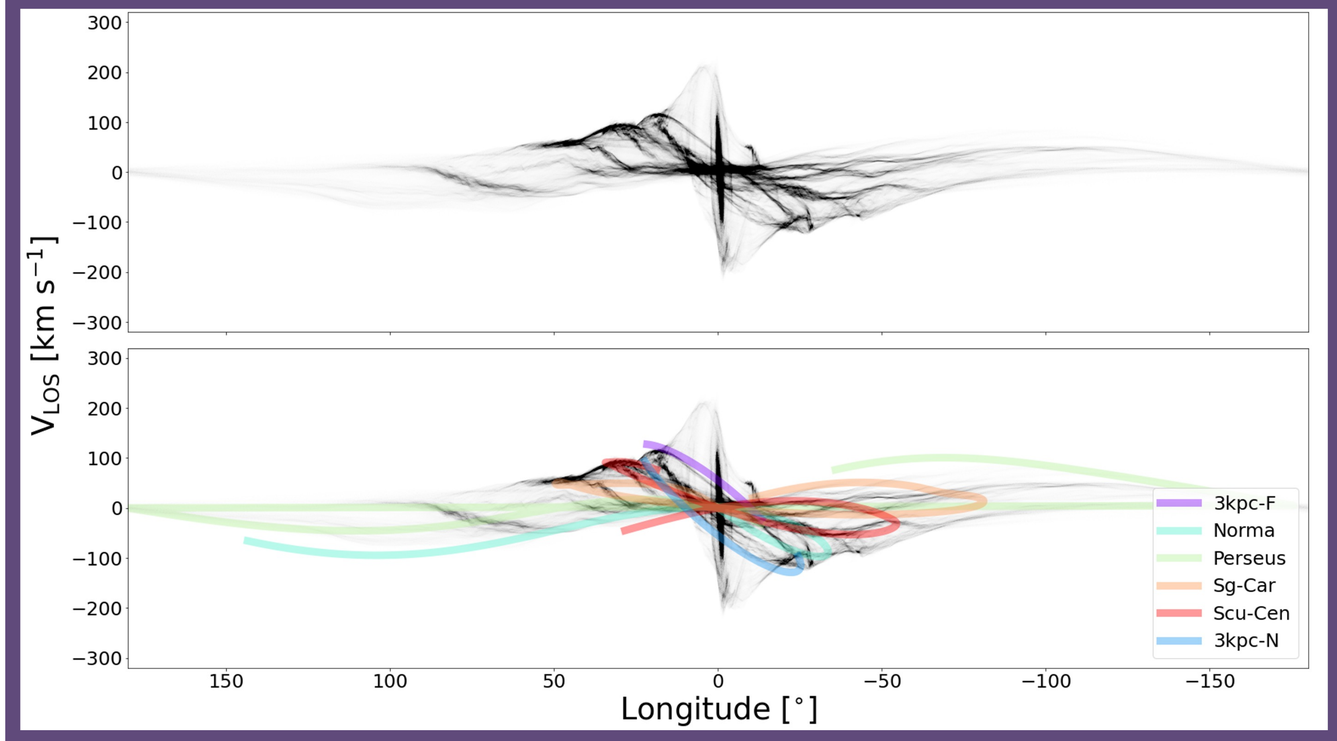
The initial conditions for the different models were generating using the MAKENEWDISK [3] code

We produce longitude-velocity (l-v) plots of the gas to extract the skeletons of the main features (arms, bar), as well as the contours defining the terminal velocities, and compare with observations [4,5] to obtain a best-fitting

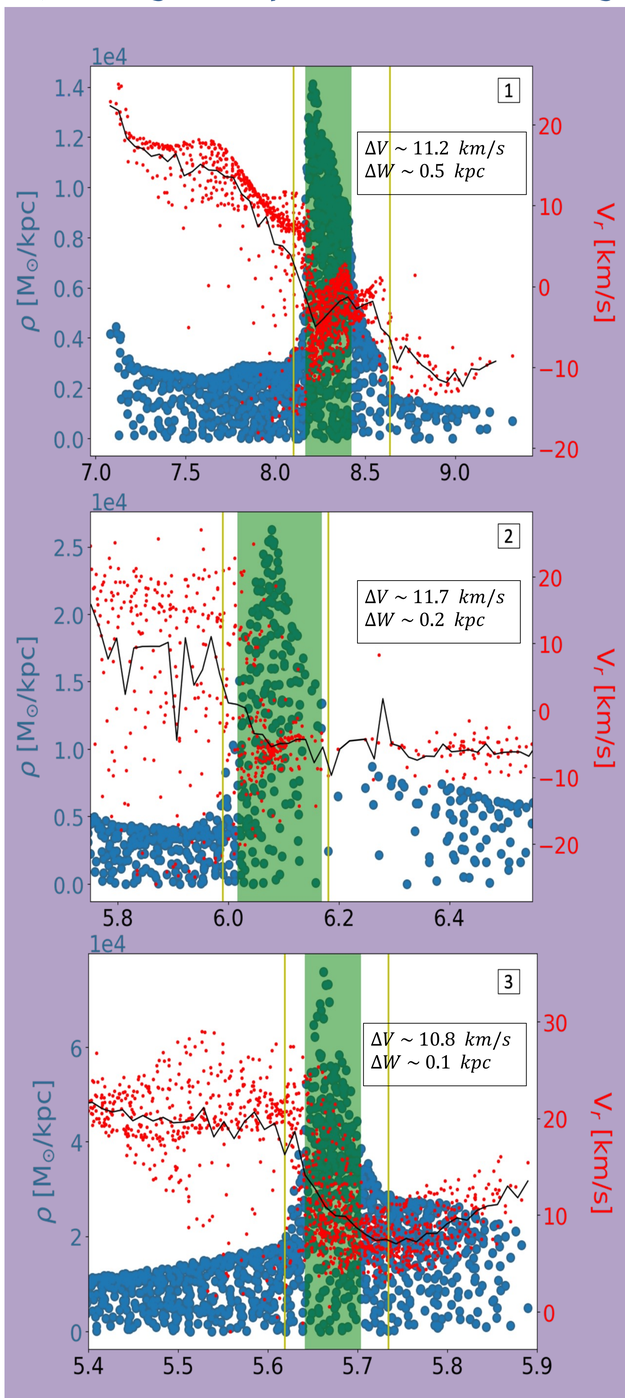


2) Best model

We find that our **Model 3 at a time ~2.4 Gyrs** presents the closest fit to the observations [4,5] . Here we show its l-v map (top) and include Taylor and Cordes spiral tracks[6] for comparison



3) Through the spiral arms – streaming motions



We examine how the density of the gas and the radial velocity changes along the cross-section of three spiral arms, at various distances from the Galactic Centre

We can see that the typical **change in radial velocity** (ΔV) crossing a spiral arm is almost constant for all three cases and it is around ~ 11 km/s

However, the **width** (ΔW) of these three different arms increases with distance from the Galactic Centre

This is a small selection from the top-view of the radial velocity and future projects will include a systematic study through different parts of the same spiral arm

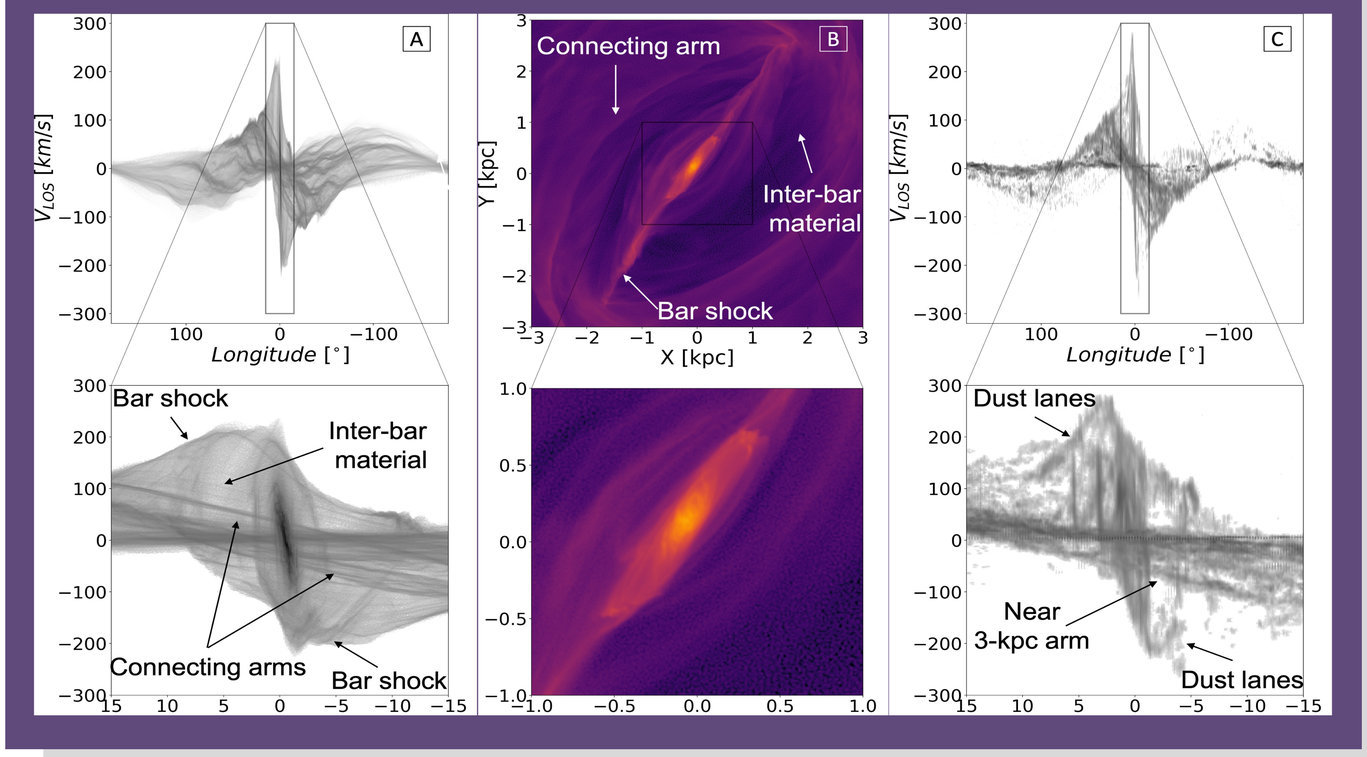
4) The Galactic Centre

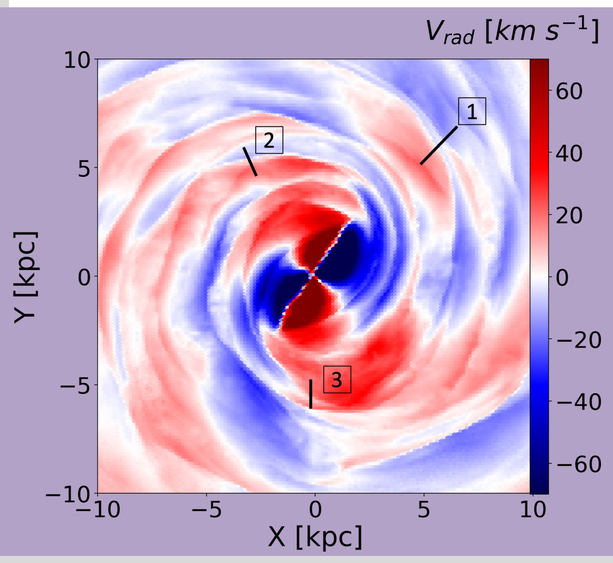
Our best model **reproduces most of the observable features** of the Galactic Centre The below figure shows our Model 3 top-down and l-v maps on panels A and B, and the ^{12}CO emission l-v map[4] on panel C. The found bar features are:

- Bar pattern speed: – **35.9 ±6.3** [Observed: 30-70 km/s/kpc]

- Bar length: – **6.1 ±0.4** [Observed: 4-7.8 kpc]

- Bar orientation: – **32.5 ±1.9** [Observed: 20°-45 °]





References

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Acknowledgements

Calculations were performed using the supercomputing facilities at Cardiff University operated by Advanced Research Computing at Cardiff (ARCCA) on behalf of the Cardiff Supercomputing Facility and the HPC Wales and Supercomputing Wales (SCW) projects. EDC and ADC acknowledge the support from the Royal Society University Research Fellowship (URF/R1/191609. This work has been done as part of the Following the Flow of Gas in Galaxies (FFOGG) project, and the best model will be made available in the FFOGG project website (http://ffogg.github.io)