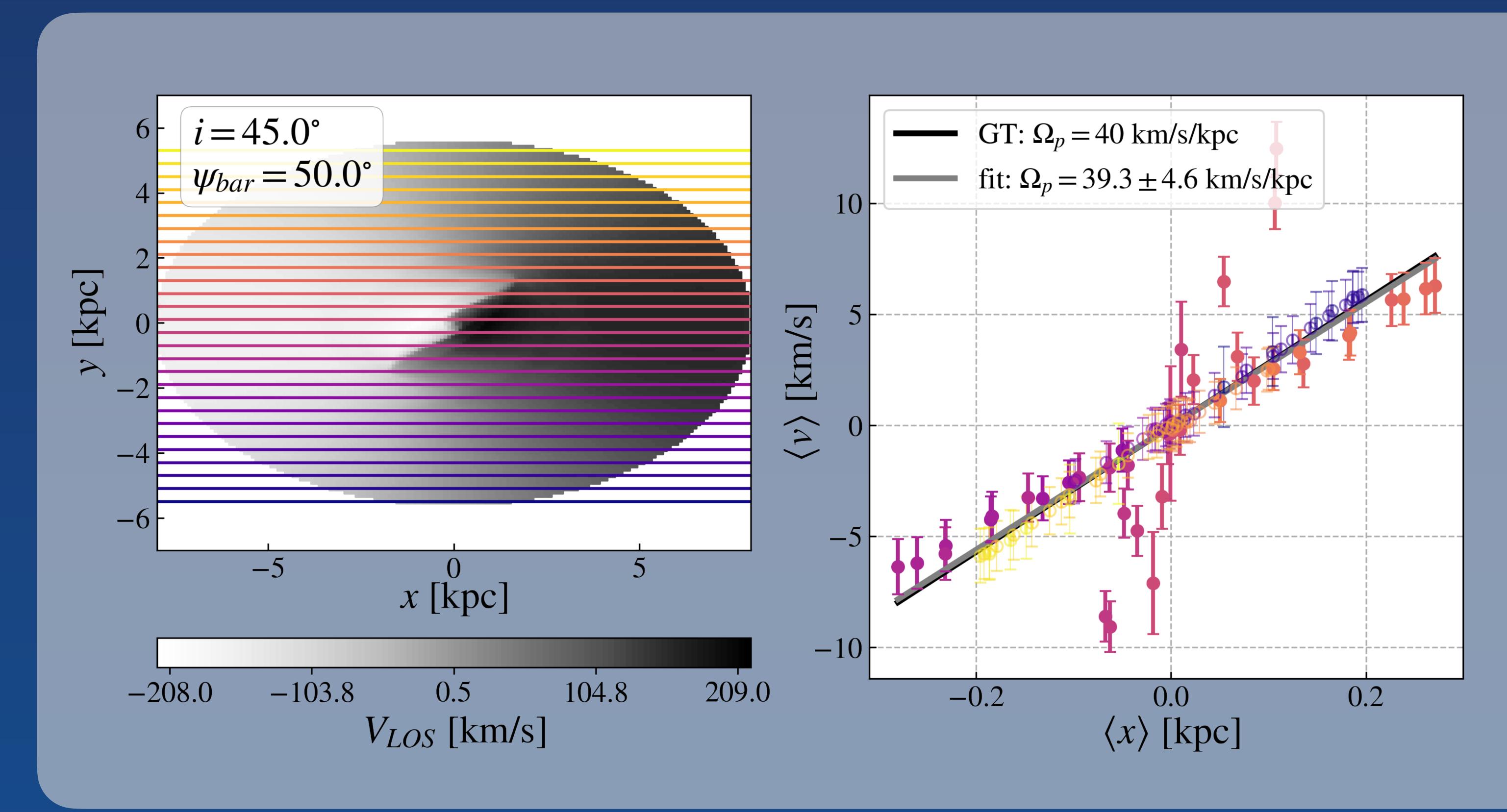
On the Tremaine-Weinberg method:

can we trust gas tracers to measure pattern speeds?



The Tremaine-Weinberg method

the TWM helps measure the pattern speed $\Omega_{\rm P}$ of galaxies calculating $\langle v \rangle$ and $\langle x \rangle$ in slits (horizontal lines on the left panel) using the formula:

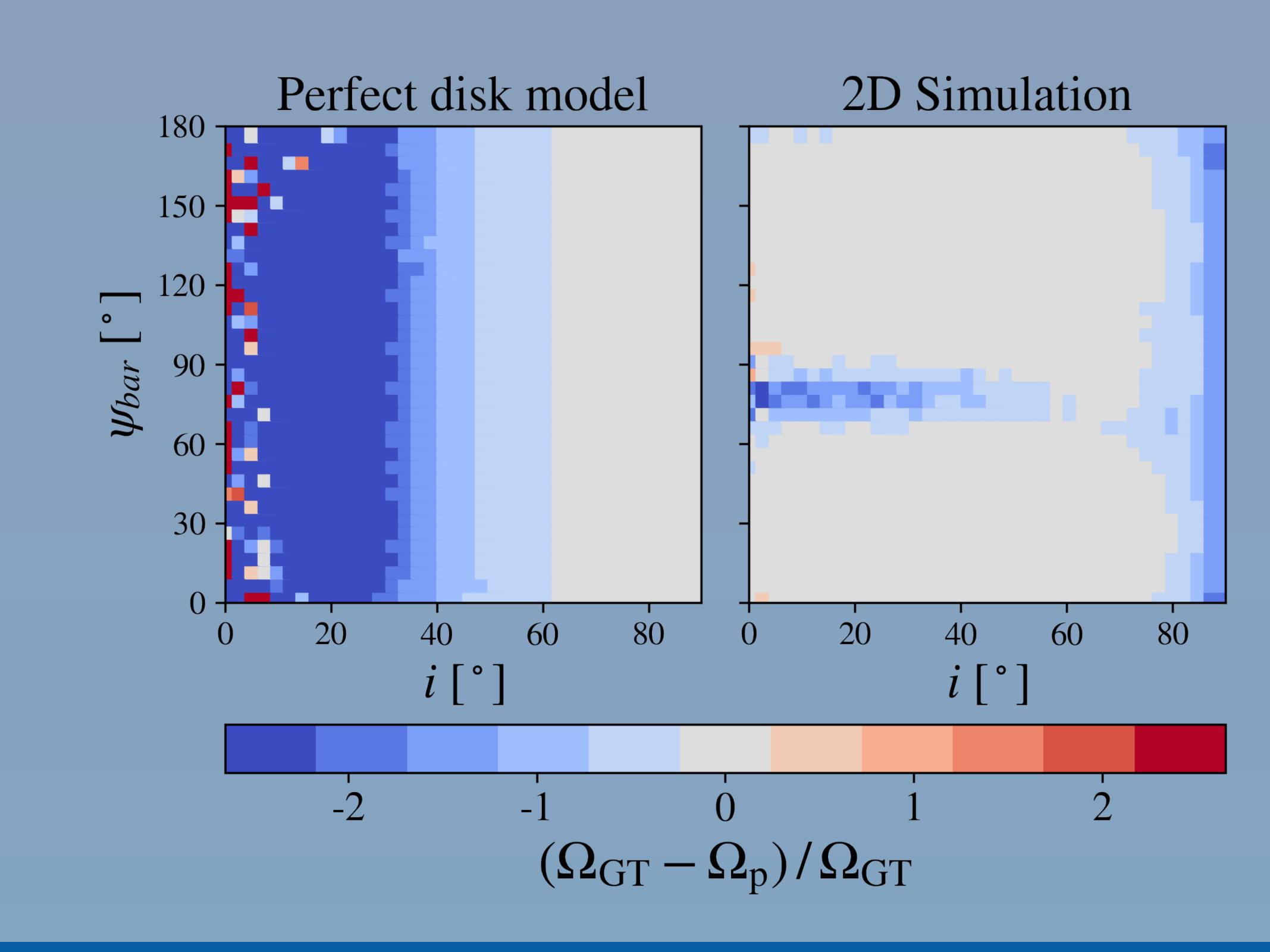
$$\Omega_{\mathsf{P}} \sin(i) = \frac{\int_{-\infty}^{\infty} h(y) \int_{-\infty}^{\infty} v_{\mathsf{LOS}}(x, y) \Sigma(x, y) \, \mathrm{d}x \mathrm{d}y}{\int_{-\infty}^{\infty} h(y) \int_{-\infty}^{\infty} \Sigma(x, y) x \, \mathrm{d}x \mathrm{d}y} = \frac{\langle v \rangle}{\langle x \rangle}$$

 ψ_{bar} is the angle between galaxy major axis and the bar; i is inclination.

Applying the TWM to 2D simulations

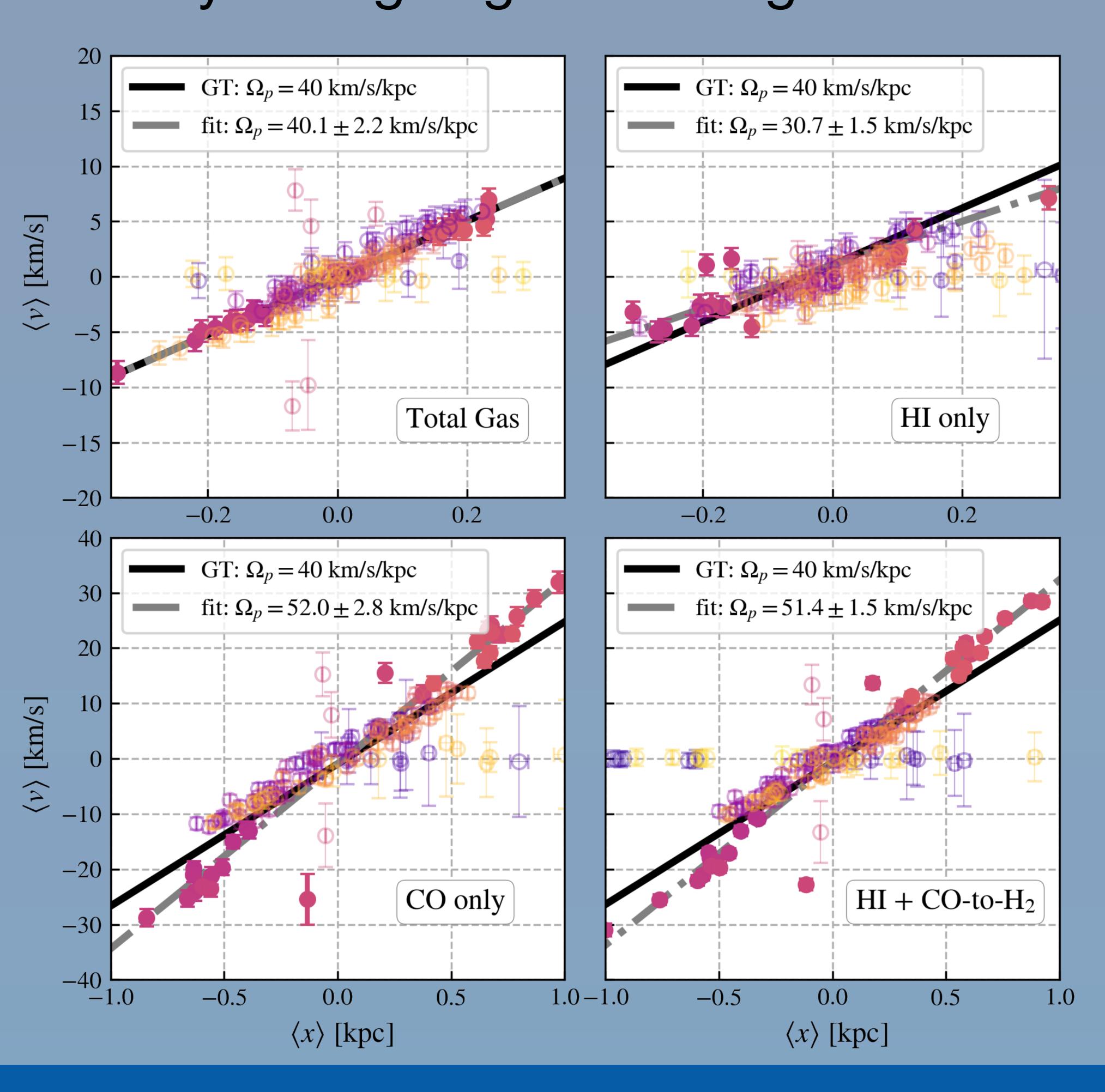
Applying method to simple 2D simulation (right panel) allows us to study $\psi_{\rm bar}$ limitations.

Also, we applied the TWM to galaxy disk without any pattern and still got signal (left panel). It gives us the inclination limits.



Applying the TWM to 3D simulations

For different gas tracers we can measure different pattern speeds, and only total gas gives the right answer.



not really

15:19 ///

Olga Borodina Thomas Williams Mattia Sormani Sharon Meidt

Eva Schinnerer

Takeaways:

- 1. i < 45
- 2. $5^{\circ} < |\psi_{\text{bar}}| < 30^{\circ}$
- 3. try to avoid gas tracers



check out more details and interactive plots!

arXiv:2306.17780

