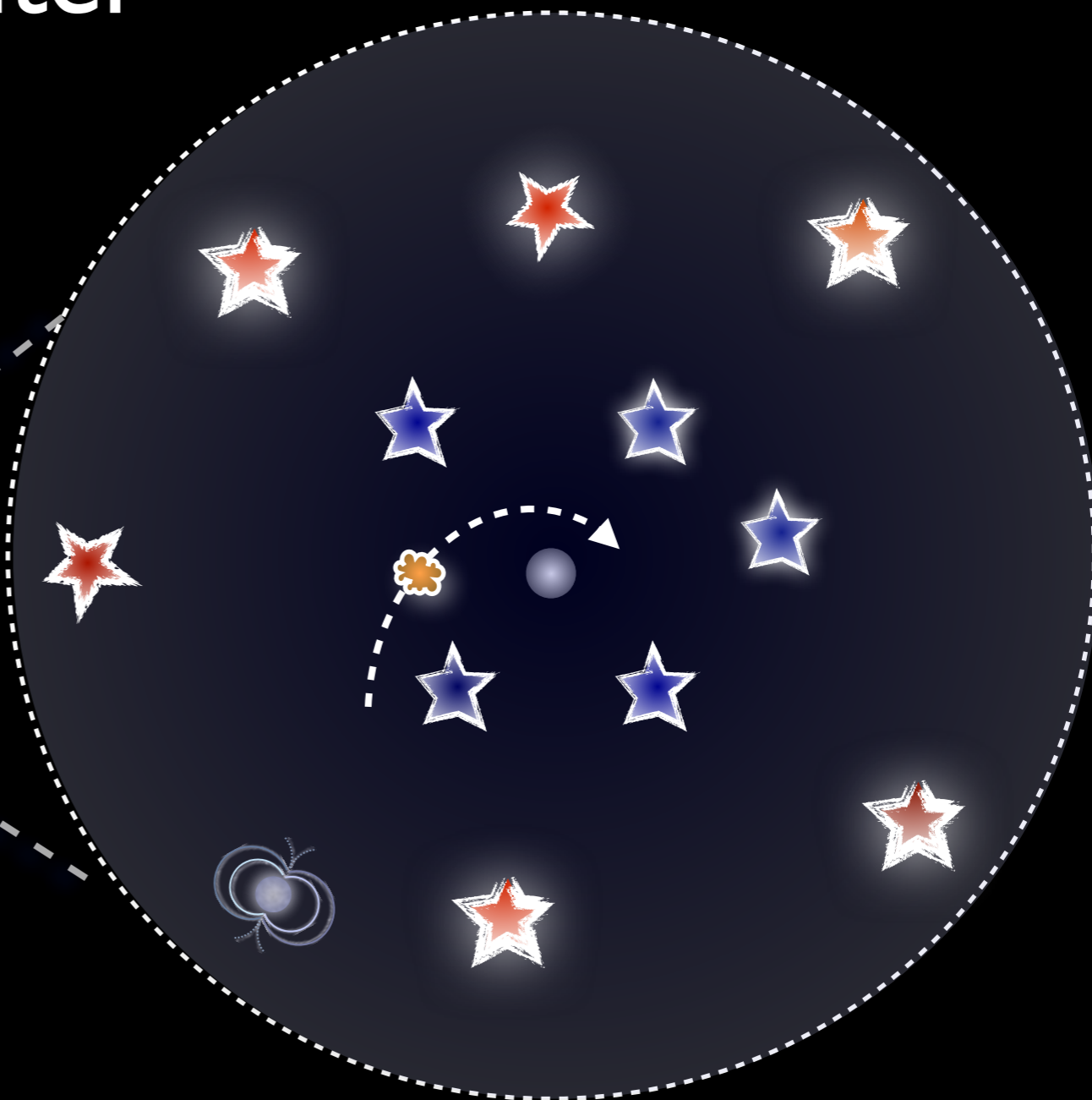
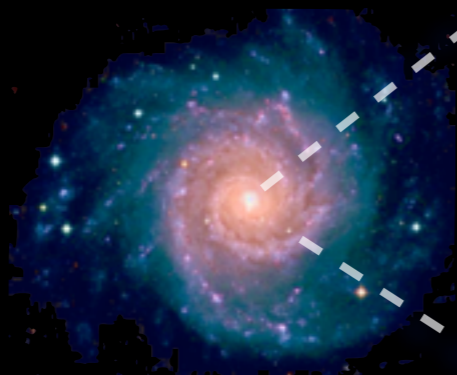


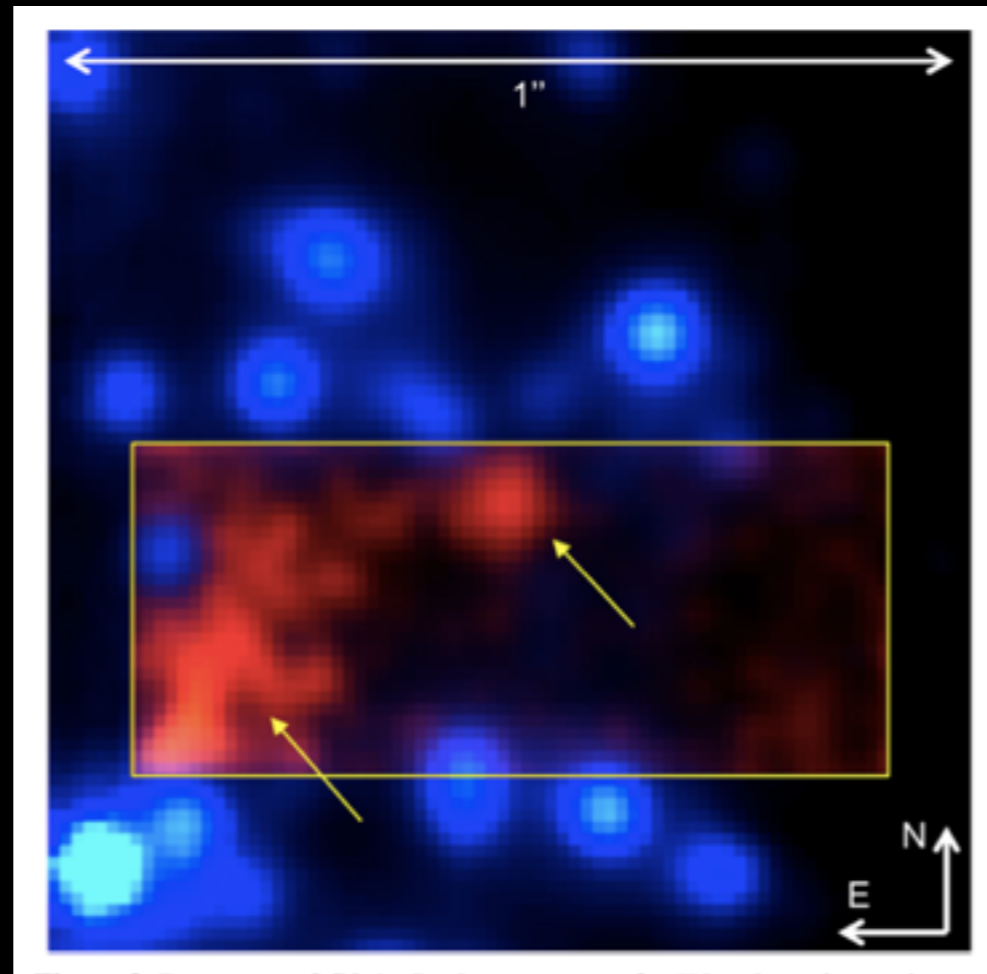
The Disruption of Magnetized Gas Clouds in the Galactic Center

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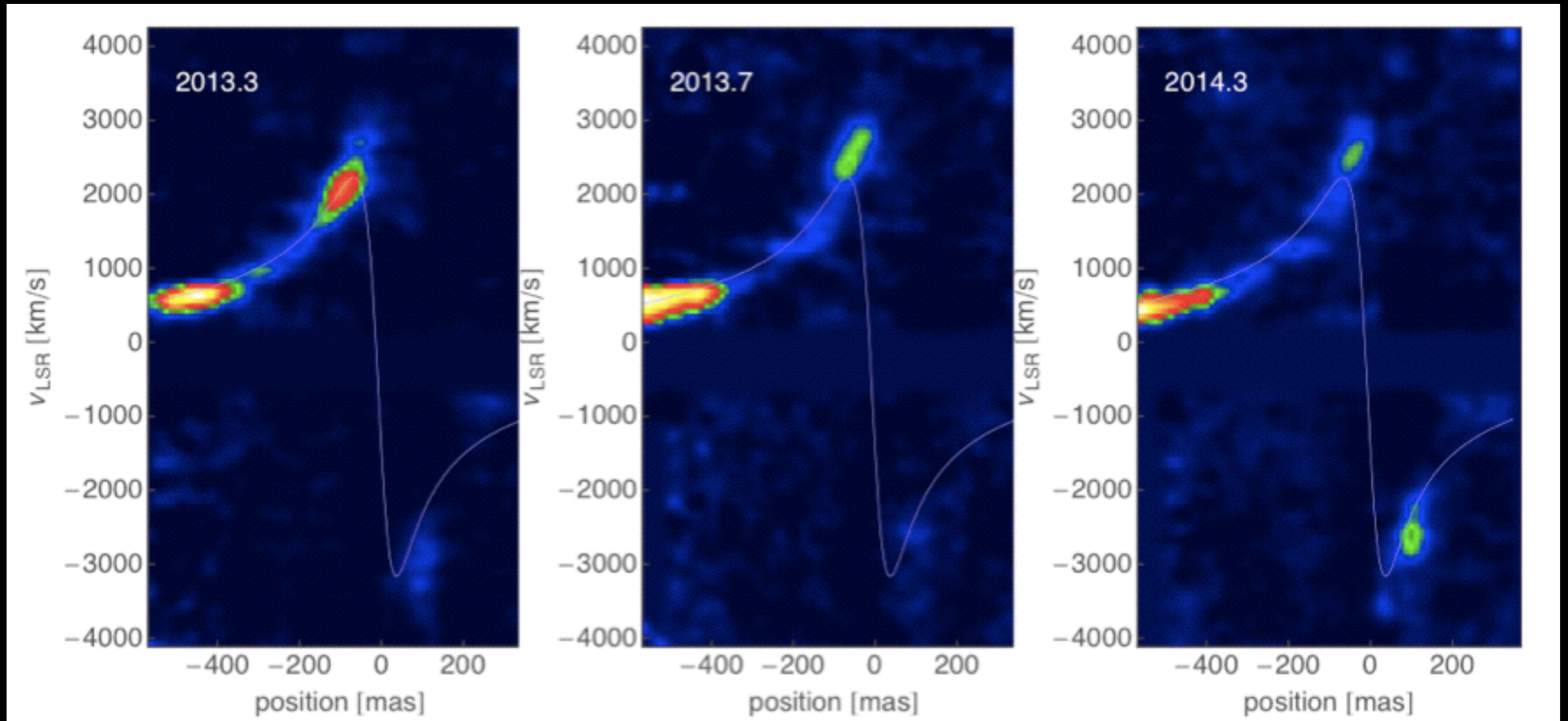
G2 gas cloud



$$\begin{aligned}m &\sim 3M_{\oplus} \\e &\sim 0.98 \\P &\sim 300 \text{ Yr} \\r_p &\sim 0.001 \text{ pc} \\r &\sim 100 \text{ AU}\end{aligned}$$

Gillessen et al (2013)

Tidal shearing of gas by black hole



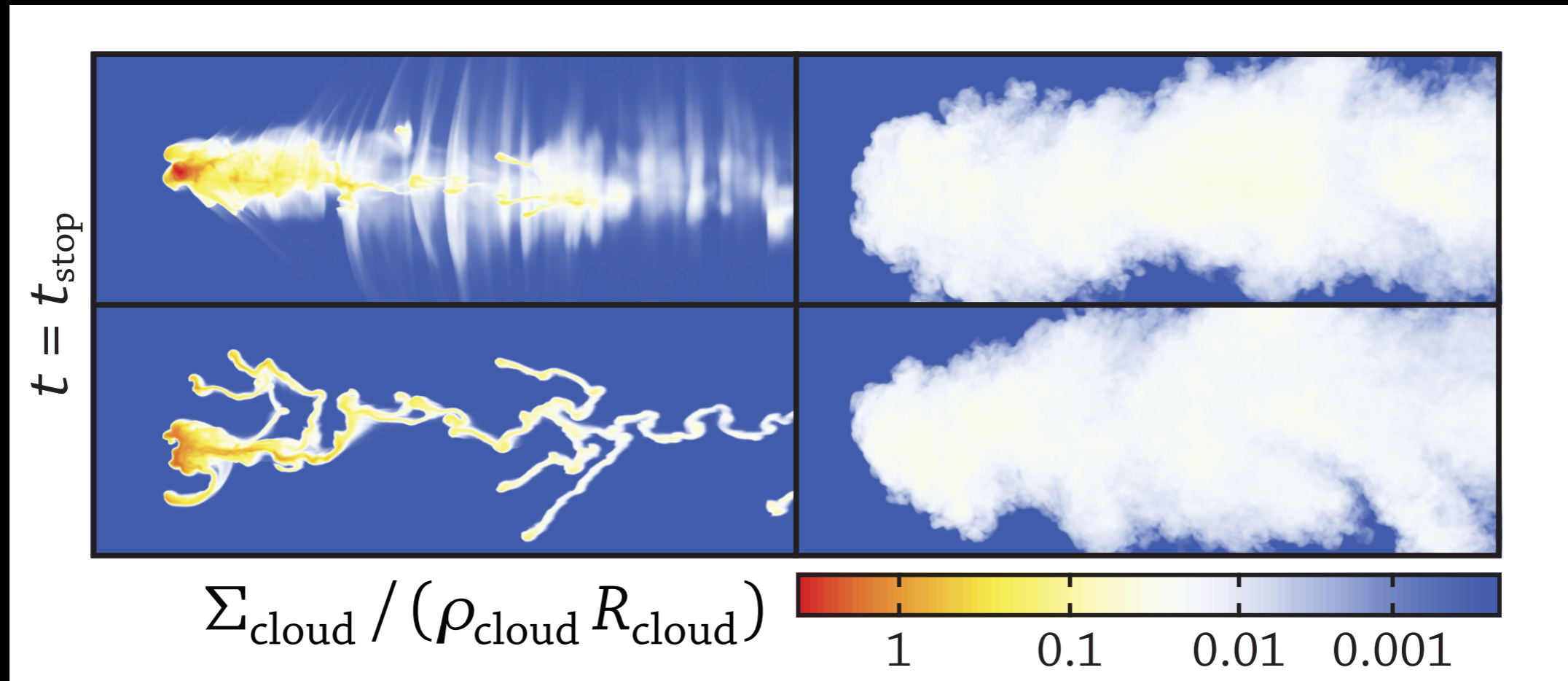
Pfuhl et al (2014)

Predictions from hydrodynamics if G2 is gas cloud

1. Cloud disrupts on timescale \ll orbital period & mixes with plasma
2. Insignificant drag force at periapse - no deviation of orbit from Keplerian

MHD

Hydro

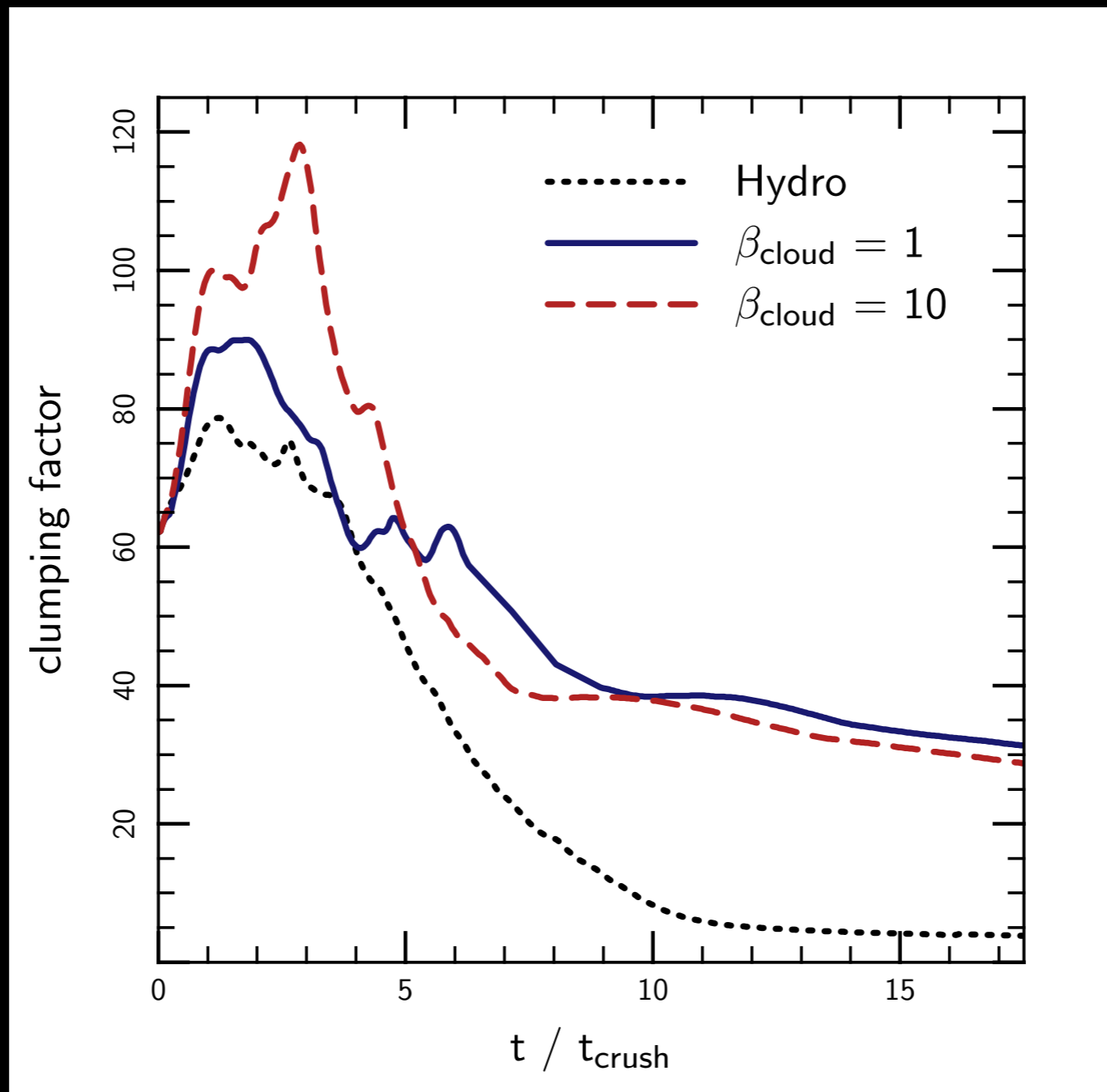


Cloud: tangled magnetic field
Wind: straight lines

McCourt et al (2014)

Internal tangled B-field of cloud

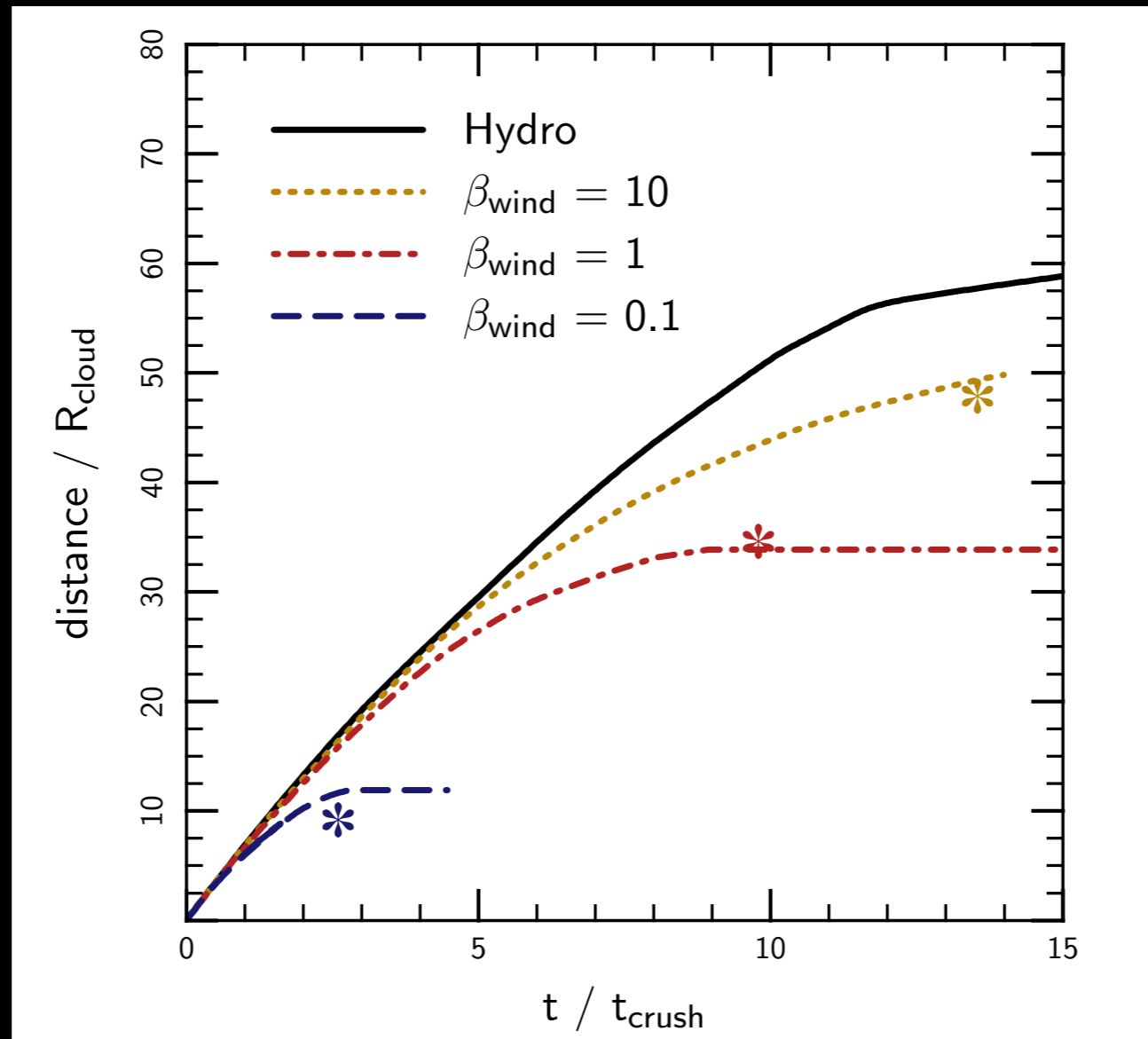
$$c = \frac{\sqrt{\langle \rho^2 \rangle}}{\langle \rho \rangle}$$



McCourt et al
(2014)

$$t_{\text{cc}} = \left(\frac{\rho_{\text{cloud}}^{1/2}}{\rho_{\text{wind}}} \right) \frac{R_{\text{cloud}}}{v_{\text{wind}}}$$

External B-field in wind



McCourt et al
(2014)

$$\mathbf{F}_{\text{drag}} \sim \rho_{\text{wind}} \mathbf{v}_{\text{wind}}^2 r_{\text{cloud}}^2 \times \left(1 + \frac{v_{\text{A}}^2}{v_{\text{wind}}^2} \right)$$

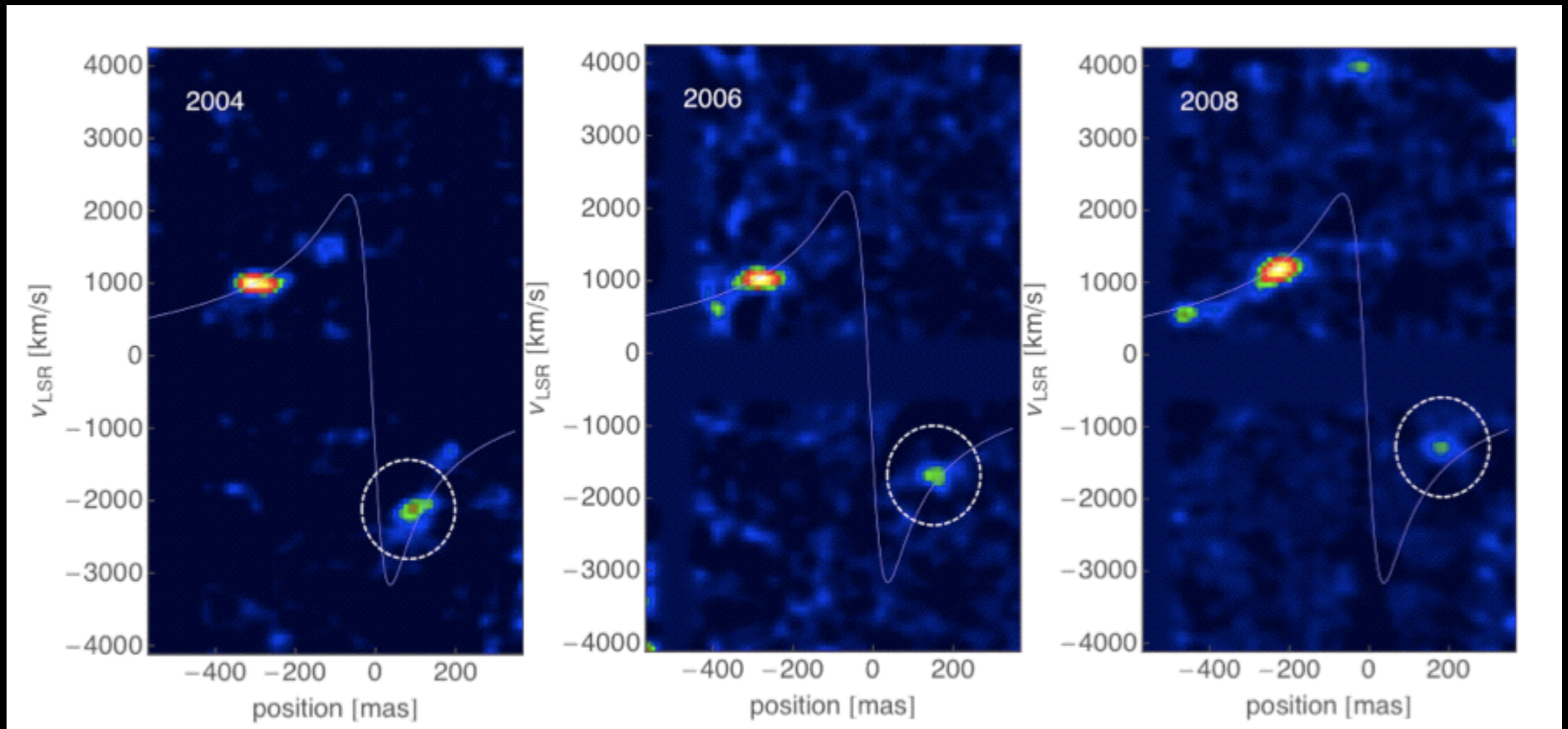
Results from 3D MHD

Magnetized gas clouds:

- 1. break-up but do not mix entirely into plasma.**
- 2. experience a greater drag force than hydrodynamics predicts.**

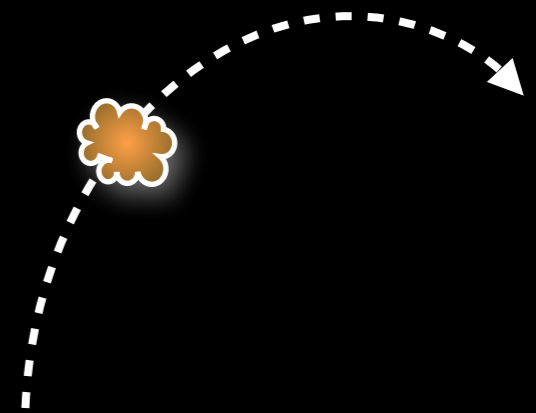
$$\mathbf{F}_{\text{drag}} \sim \rho_{\text{wind}} \mathbf{v}_{\text{wind}}^2 r_{\text{cloud}}^2 \times \left(1 + \frac{v_{\text{A}}^2}{v_{\text{wind}}^2} \right)$$

(Re-)discovery of G1



	semi-major axis	eccentricity	pericenter time	inclination	pos. angle asc. node	long. pericenter
G2	$1.05 \pm 0.25''$	0.976 ± 0.007	2006.25 ± 0.05	$11^\circ \pm 2^\circ$	$82 \pm 1^\circ$	$07 \pm 2^\circ$
G1	$0.36 \pm 0.16''$	0.860 ± 0.050	2001.57 ± 0.40	$108 \pm 2^\circ$	$69 \pm 5^\circ$	$109 \pm 8^\circ$

Future work



1. **Lifetime of gas clouds in the Galactic center**
2. **Size of ‘cloudlets’/knots**
3. **Constraints on density & temperature of accretion flow**