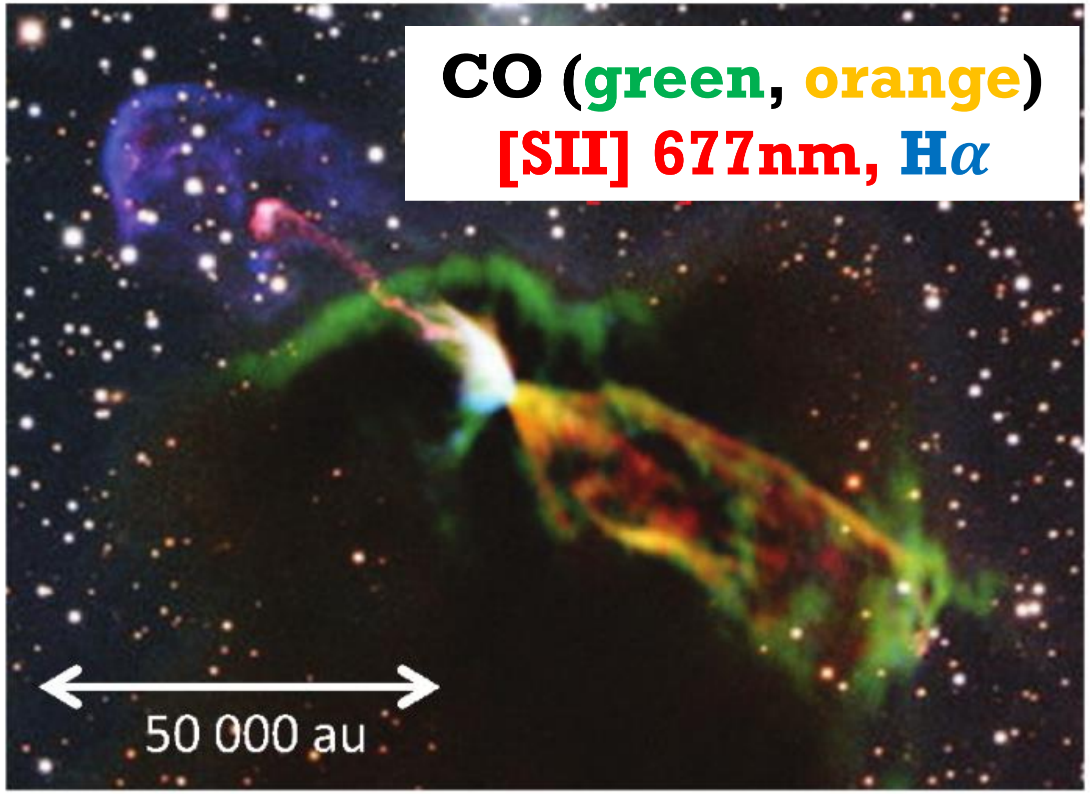
OUTFLOW FEEDBACK ON STAR FORMATION:WIND-DRIVEN OR JET-DRIVEN ?

Mialy RABENANAHARY
PhD Student at the **Observatory of Paris (LERMA)**
Supervisor : **Sylvie CABRIT, Guillaume Pineau des Forets, Zakaria Meliani**

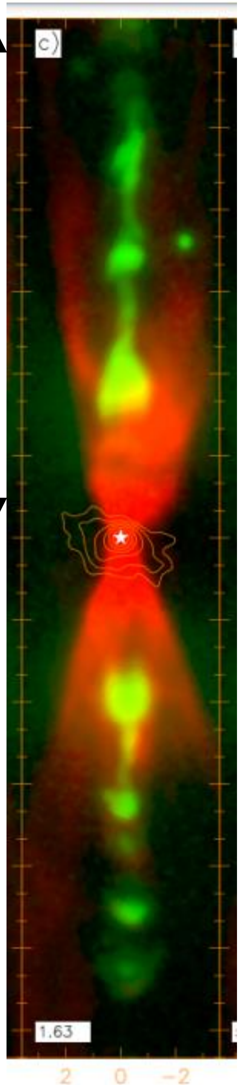
Introduction

HH46/47



(Arce et al. 2013)

~ 8000 AU



HH 212

(Lee et al. 2015)

Jets :

- Highly **collimated** : $\theta_{open} \lesssim few\ degrees$
- **High velocities** : $v_{obs} \geq 100\ km/s$
- **Curved H_2 bows** (episodic outbursts) up to a few parsec

Molecular outflows :

- Much **less collimated** $\alpha_{proj} \simeq 25° - 100°$
- **Slower** : $v_{obs} \simeq 1 - 30\ km/s$
- **« Hubble Laws » cavities** : $v \propto$ distance to the protostar

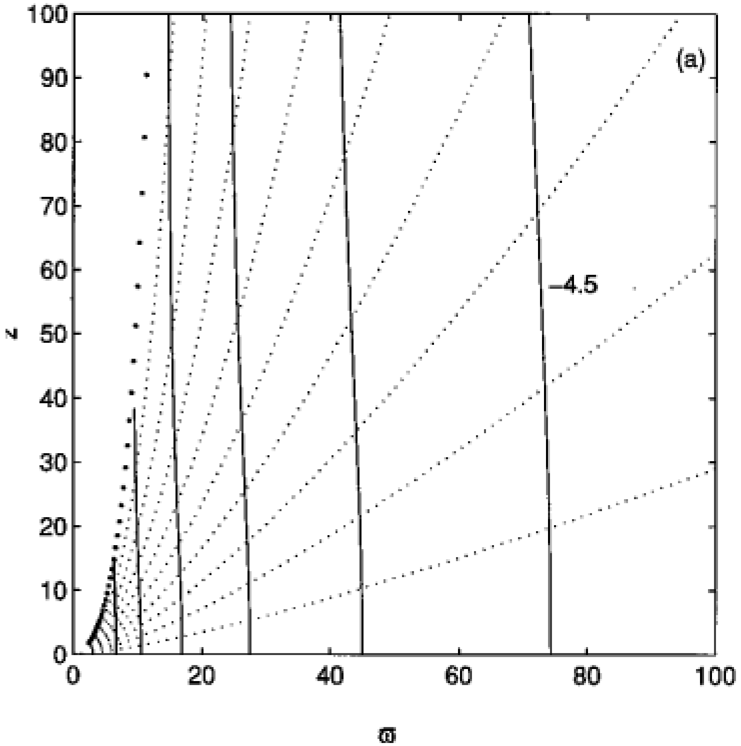
Introduction

- **Feedback on the parent cloud ?**

  1. Depends on the **angular distribution of injected momentum : still a matter of debate**
  2. **Chemical + dynamical feedback** on the cold envelop up to parsec scales
  3. **Disturbance of infall stream + Equatorial envelop impact ?**

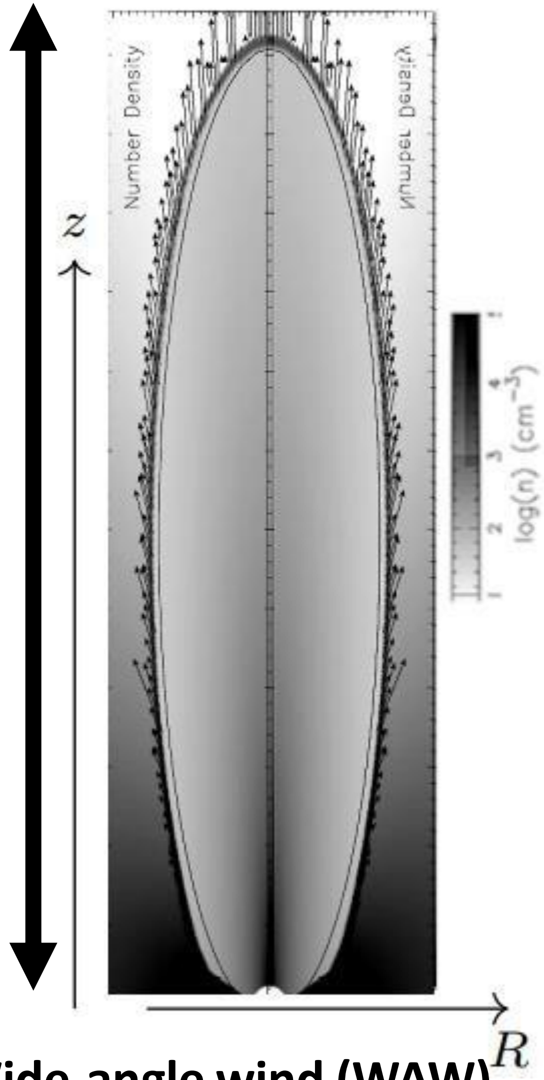
  ➔ **Impact on giant cloud evolution + star formation conditions & efficiency**

Introduction



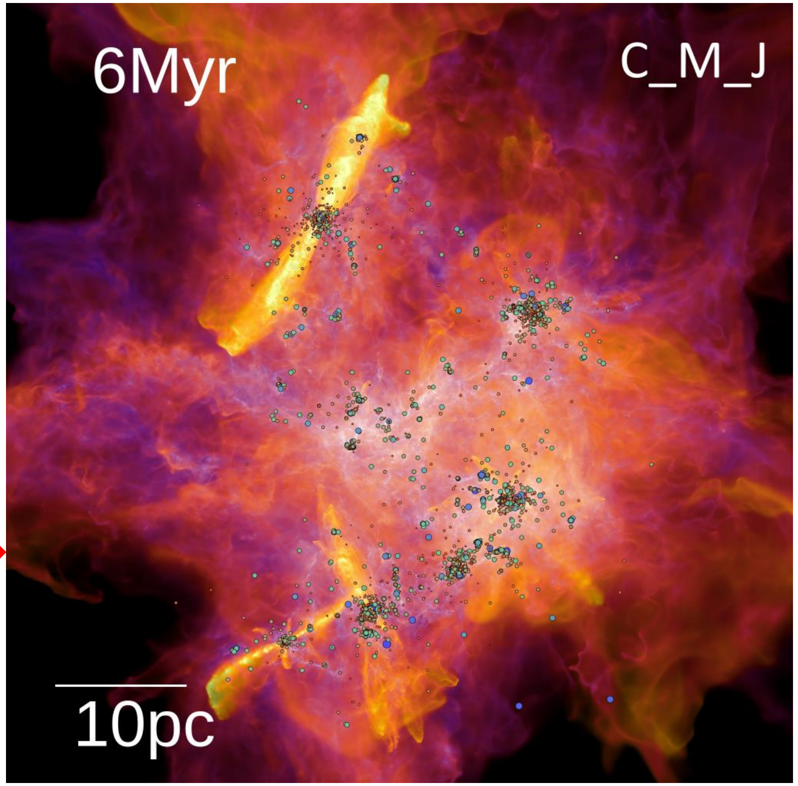
(Shu et al. 1995)

~8000 AU



Wide-angle wind (WAW)

(Lee et al. 2001)

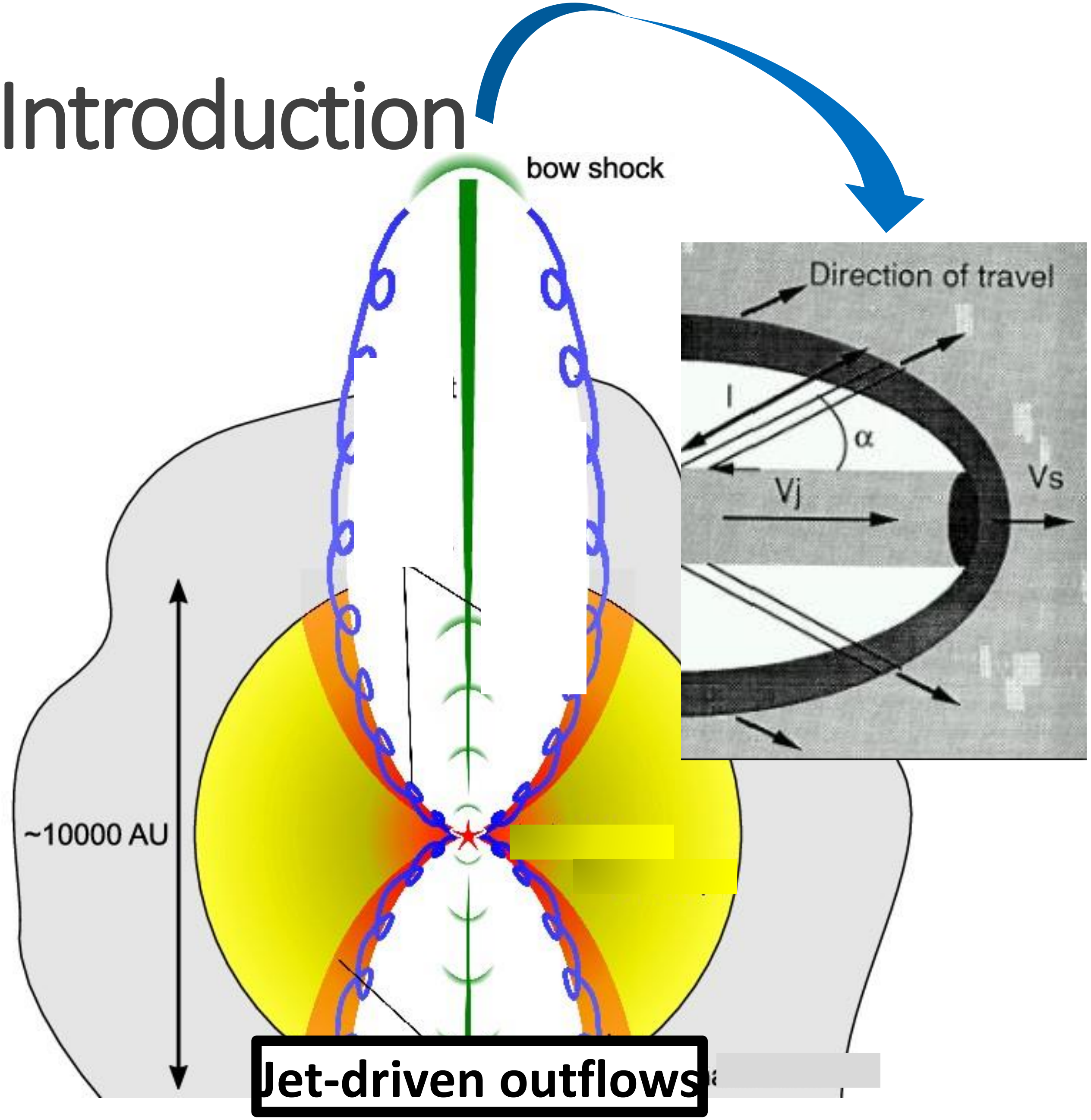


Cloud-scale outflows feedback

(Guszejnov et al. 2021)

➔ Outflows reduce protostar formation (by a factor 2-3)

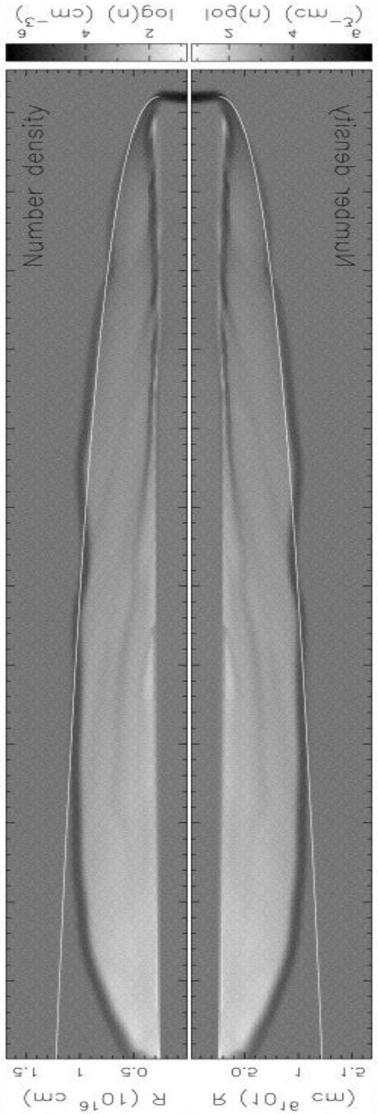
Introduction



Jet-driven outflows

(Dishoeck et al. 2011)

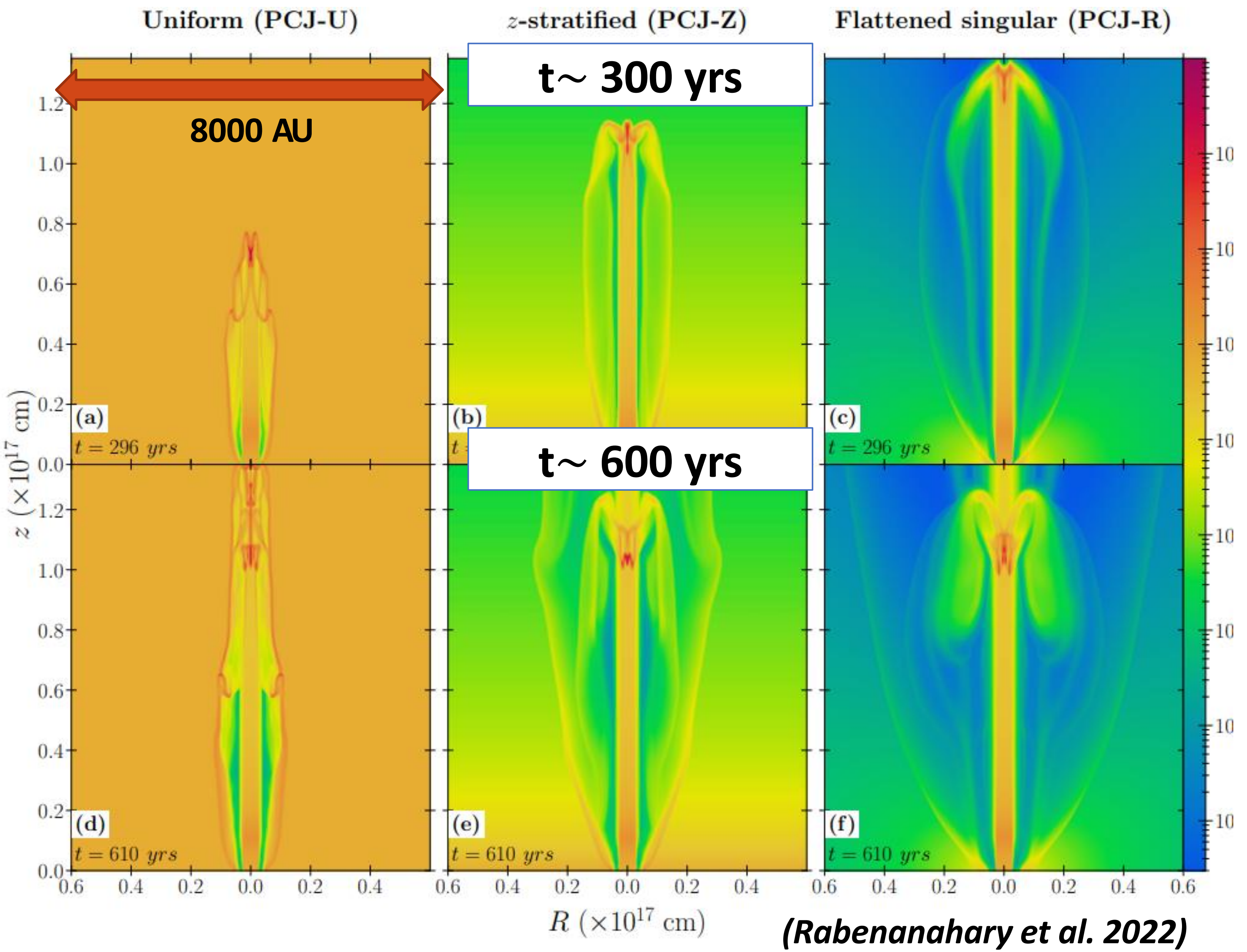
Uniform envelop : predicts too narrow outflows



(Lee et al. 2001)

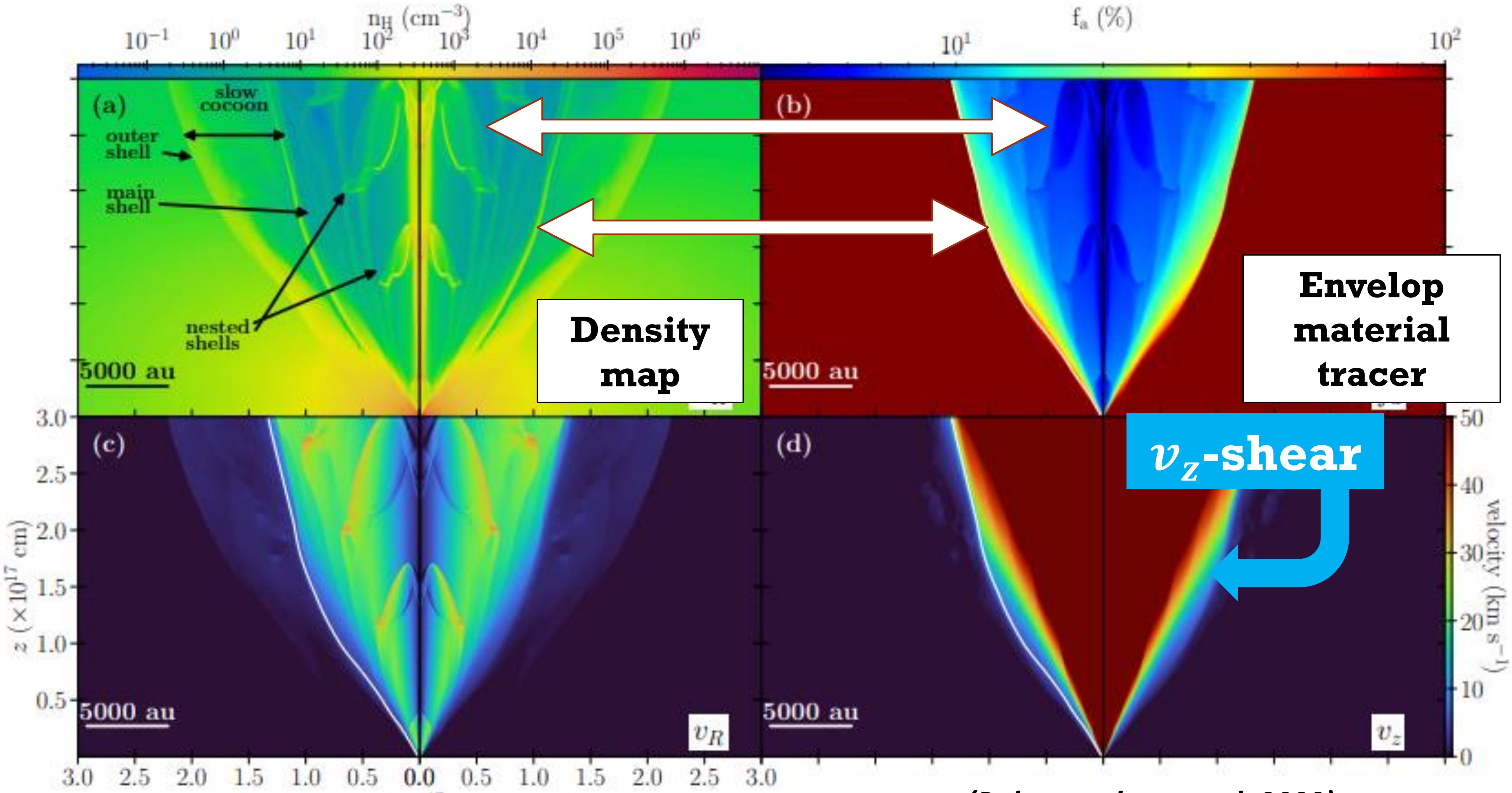
~8000 AU

Core Stratification



(Rabenanahary et al. 2022)

t~ 10^4 yrs : in the long term

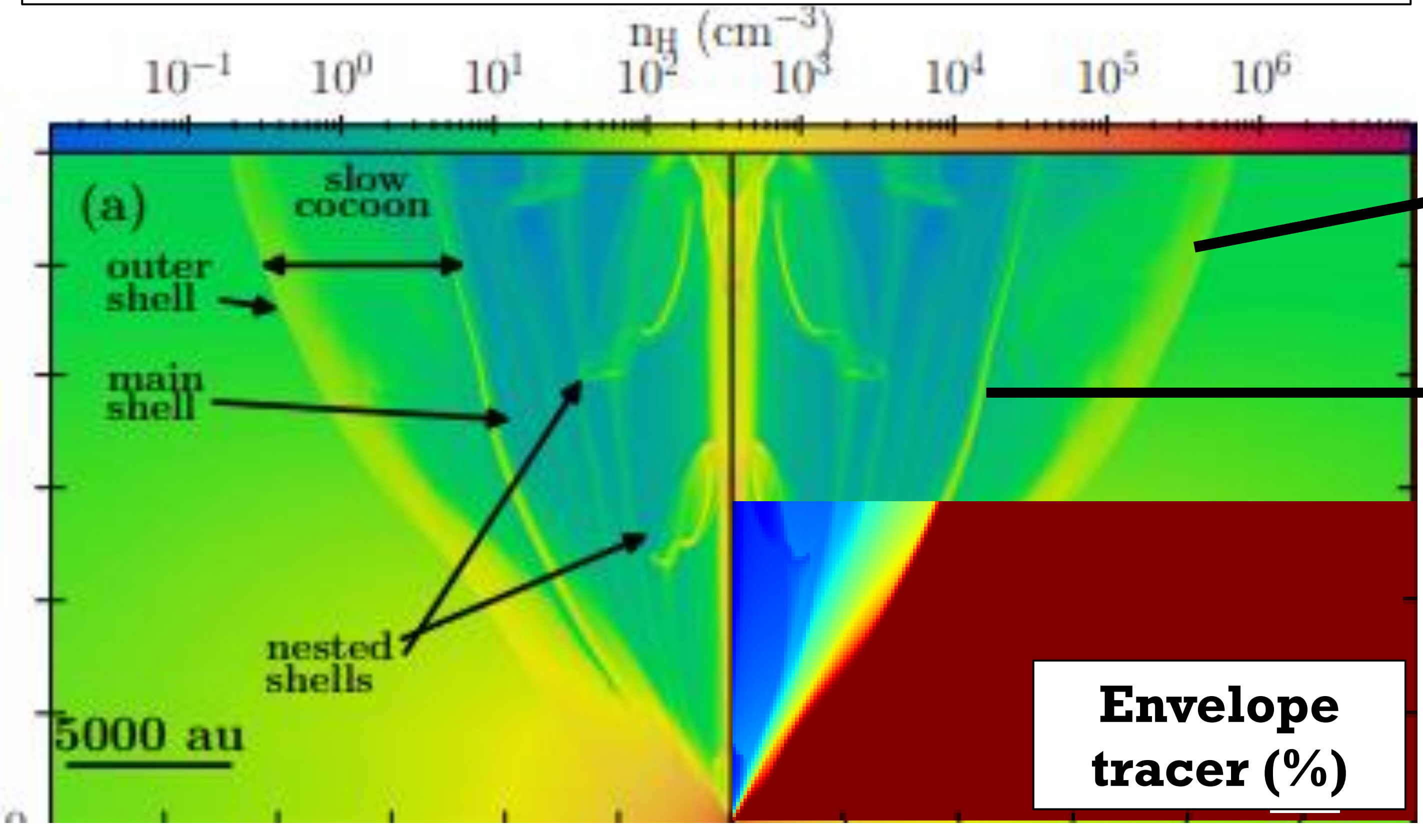


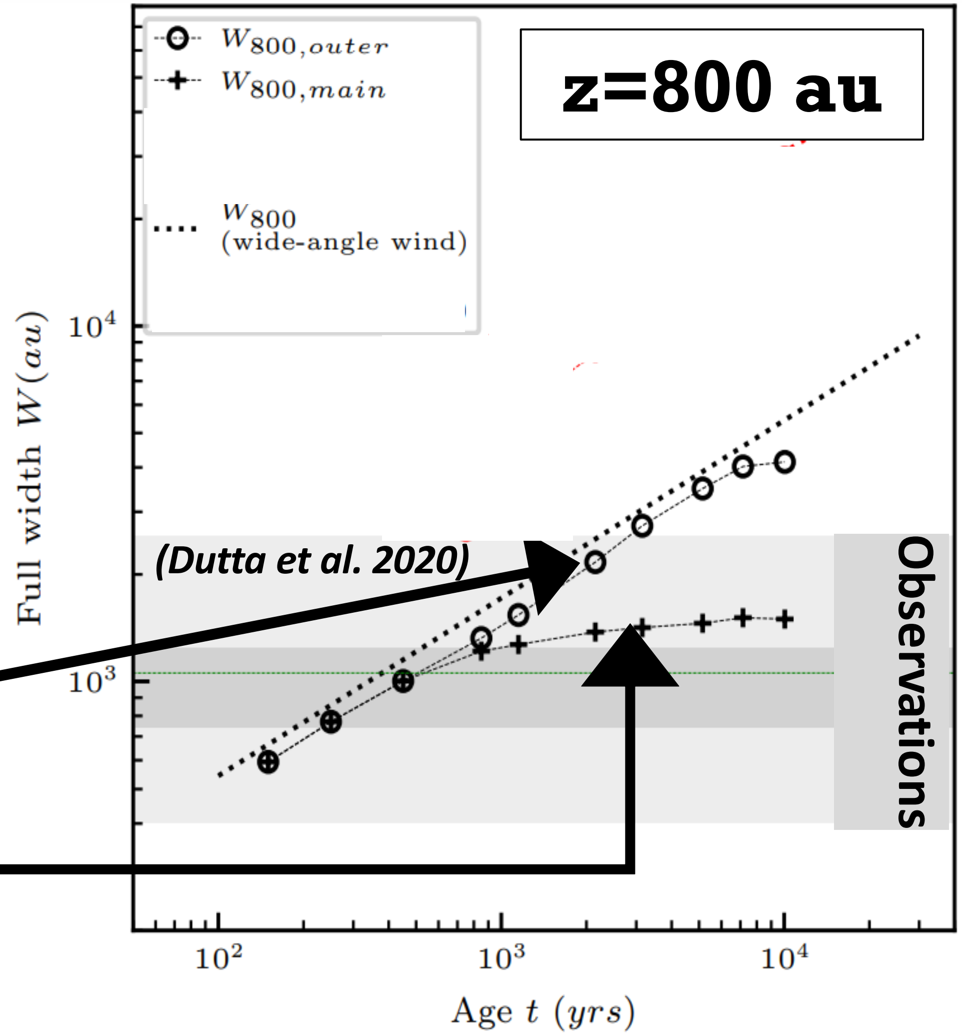
(Rabenanahary et al. 2022)

t∼ 10^4 yrs : in the long term

MAIN RESULT :

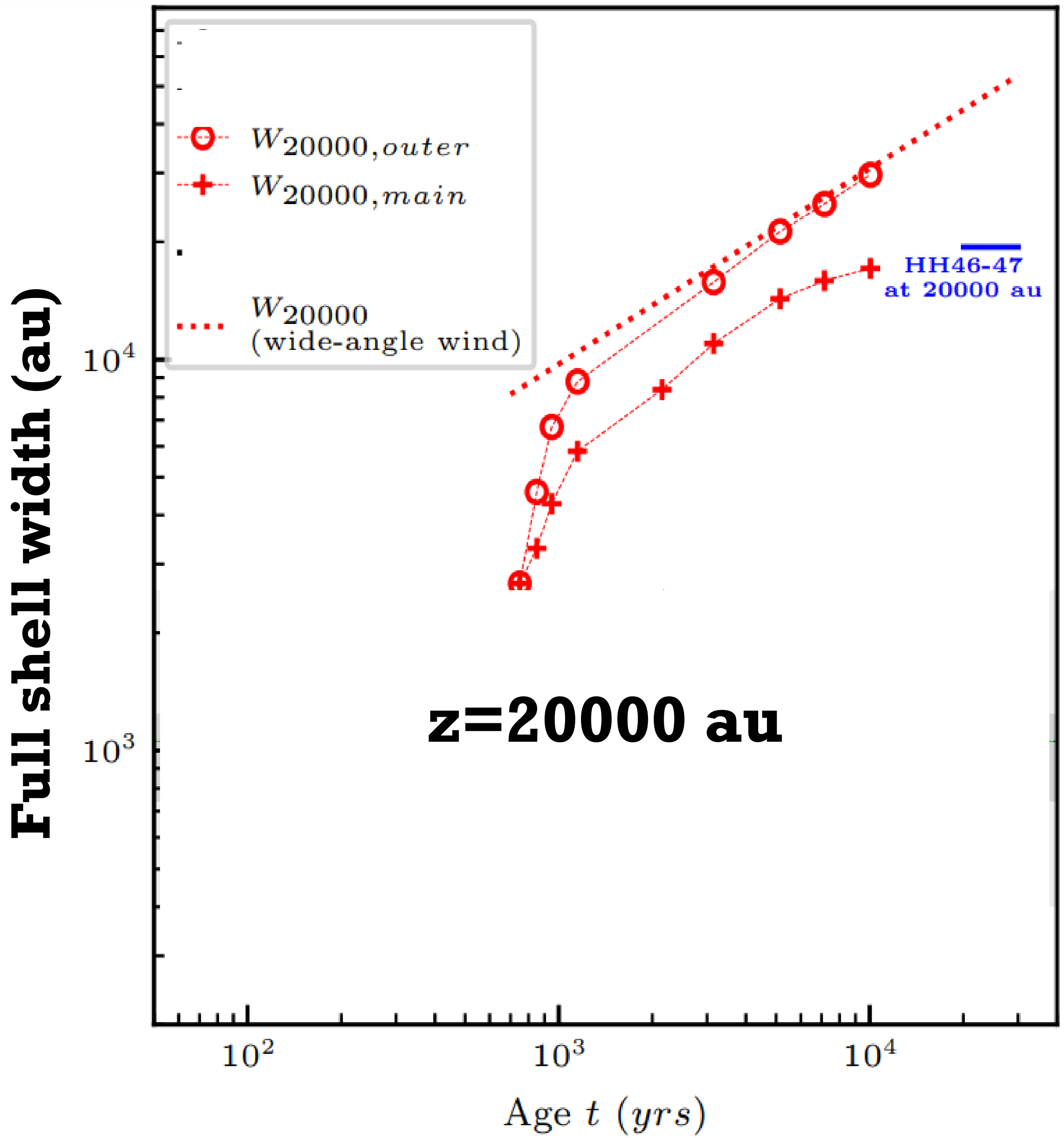
- **Deceleration** of the **main shock,** separating **jet-envelope material** and **where bow-shock wings pile-up** (≠ WAW driven shells)

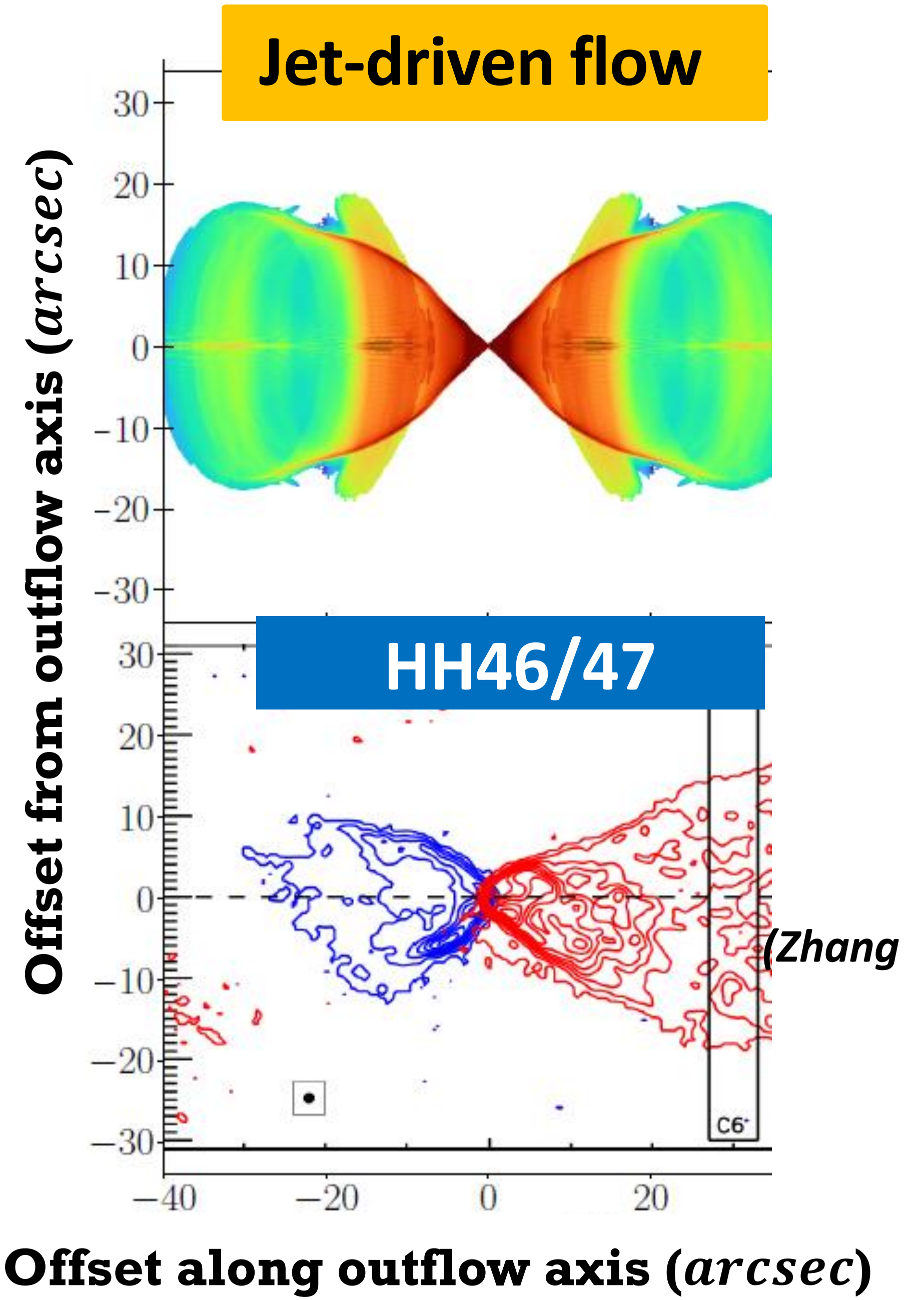




(Rabenanahary et al. 2022)

$t \sim 10^4$ yrs : Comparing to HH46/47

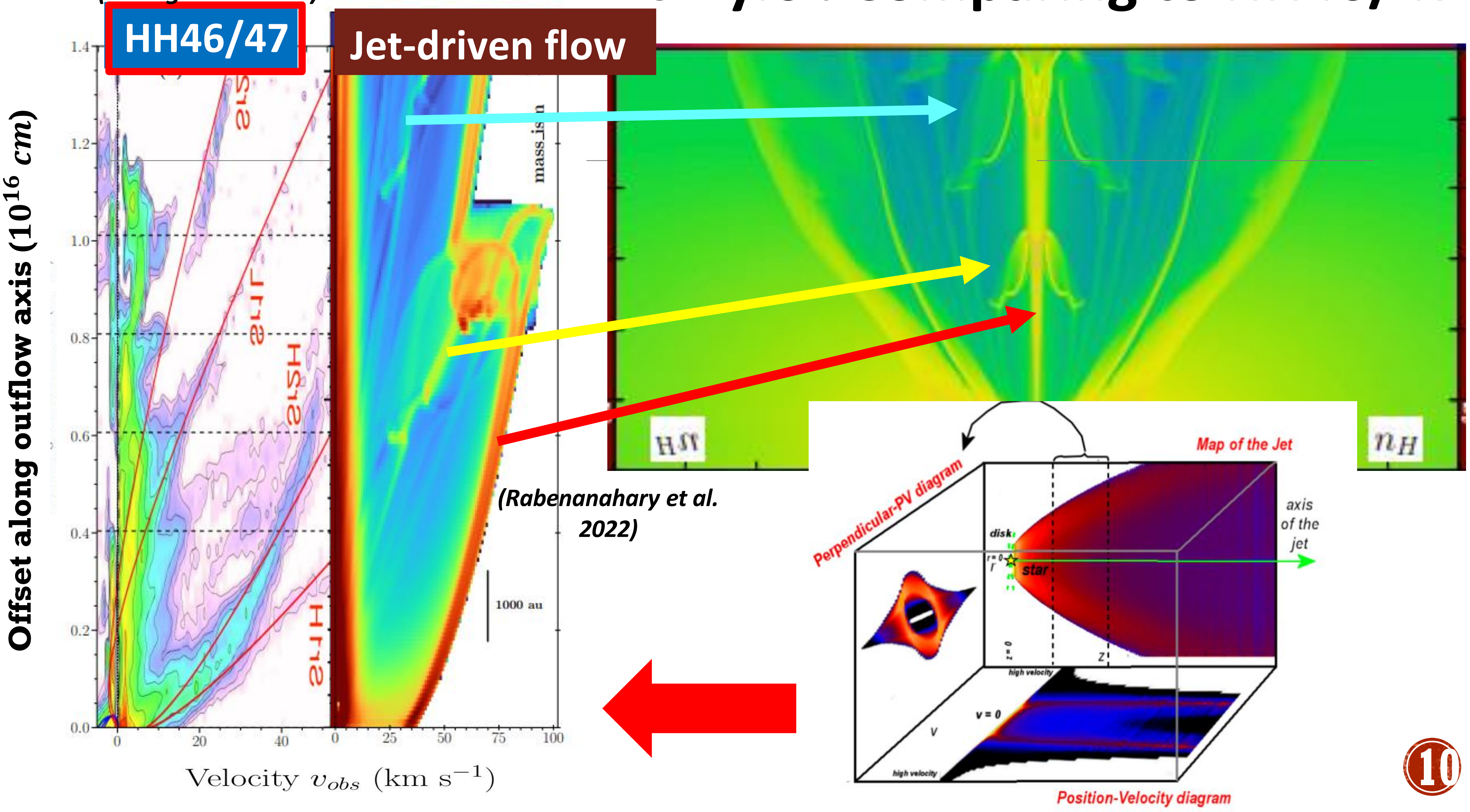




(Zhang et al. 2016)

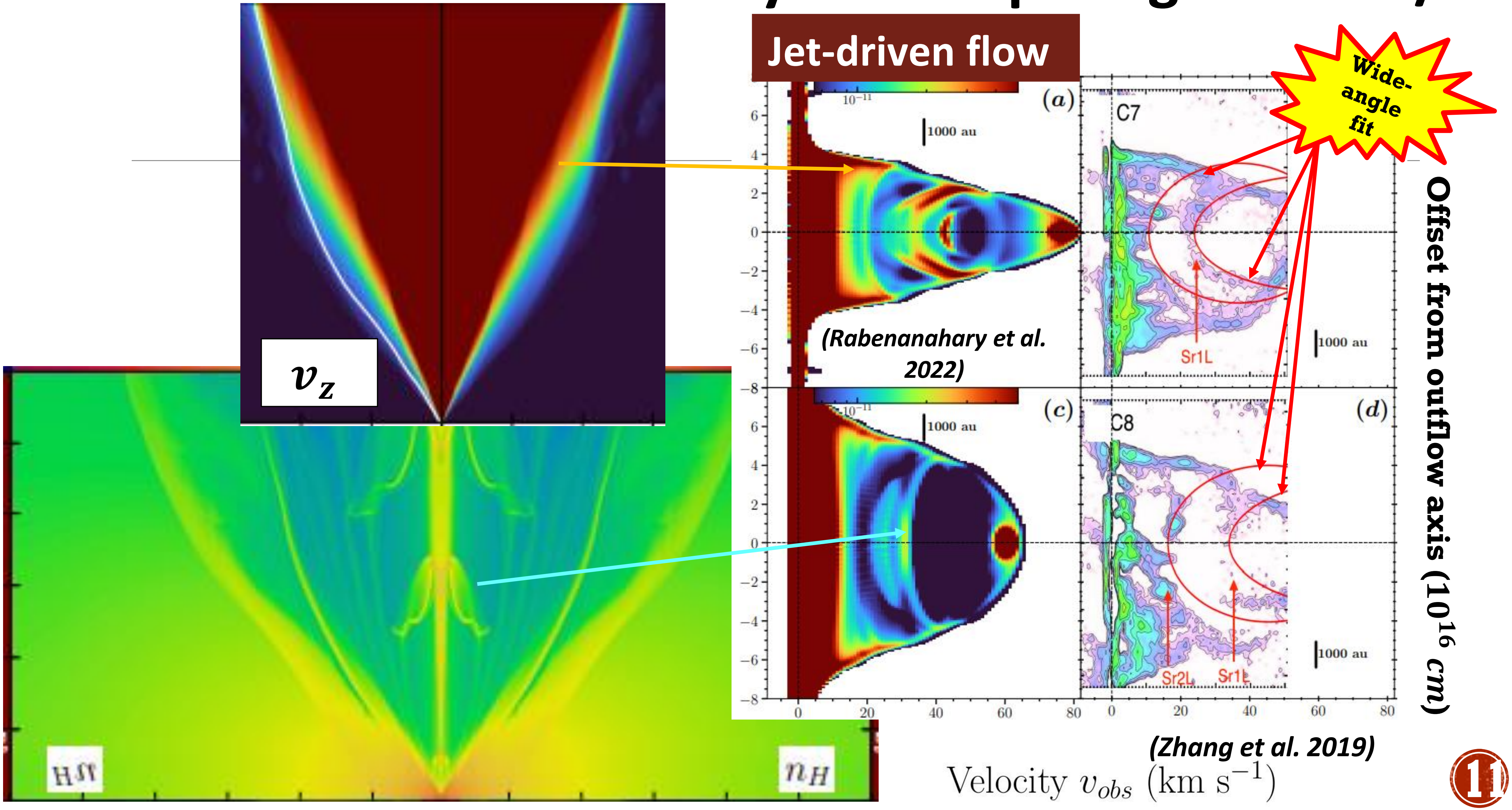
t~ 10^4 yrs : Comparing to HH46/47

(Zhang et al. 2019)



(Rabenanahary et al. 2022)

t~ 10^4 yrs : Comparing to HH46/47



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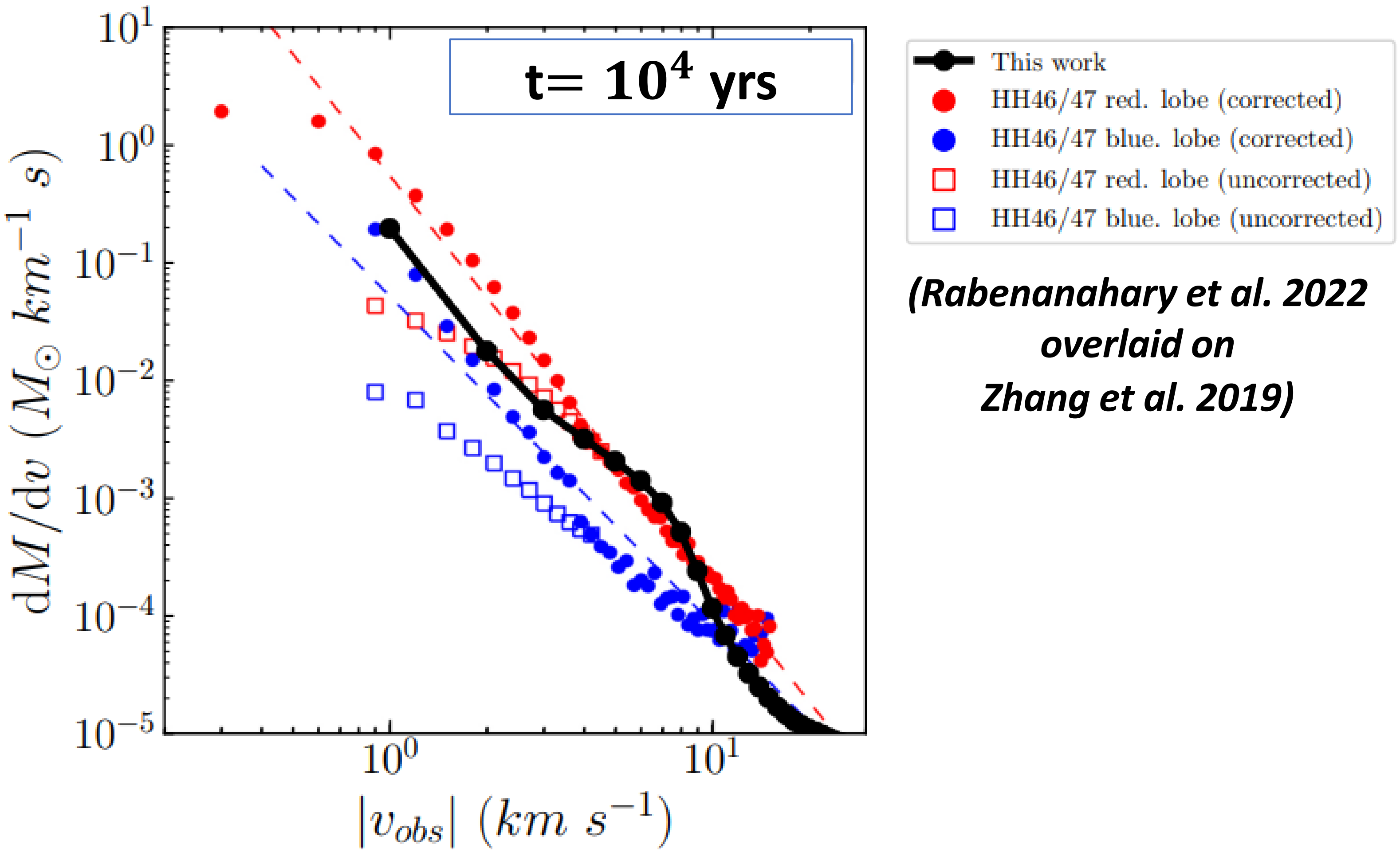

(Rabenanahary et al. 2022 overlaid on Zhang et al. 2019)

CONCLUSION

- For the first time, **realistic jet driven shells predicitions** by including :
  1. **Stratified core**
  2. **Long simulation ages**

- works **better than Wide-Angle Wind** model (WAW)

- **Conditions of shocks** different from WAW **: tests for H_2 lines** with JWST

- **Feedback different from WAW : narrower outflows**
  - ➔ Dig **narrower cavity holes** on pc scales
  - ➔ Less impact on **equatorial infall**

More details in : Rabenanahary et al. 2022

Thank you for your attention !