Stellar angular momentum
can be controlled from
cosmological initial conditions

arXiv: 2206.11913

Rationale
Disk formation:
angular momentum (AM) drives formation of disk & morphology

Intrinsic alignment:
spins of neighbouring galaxies are correlated

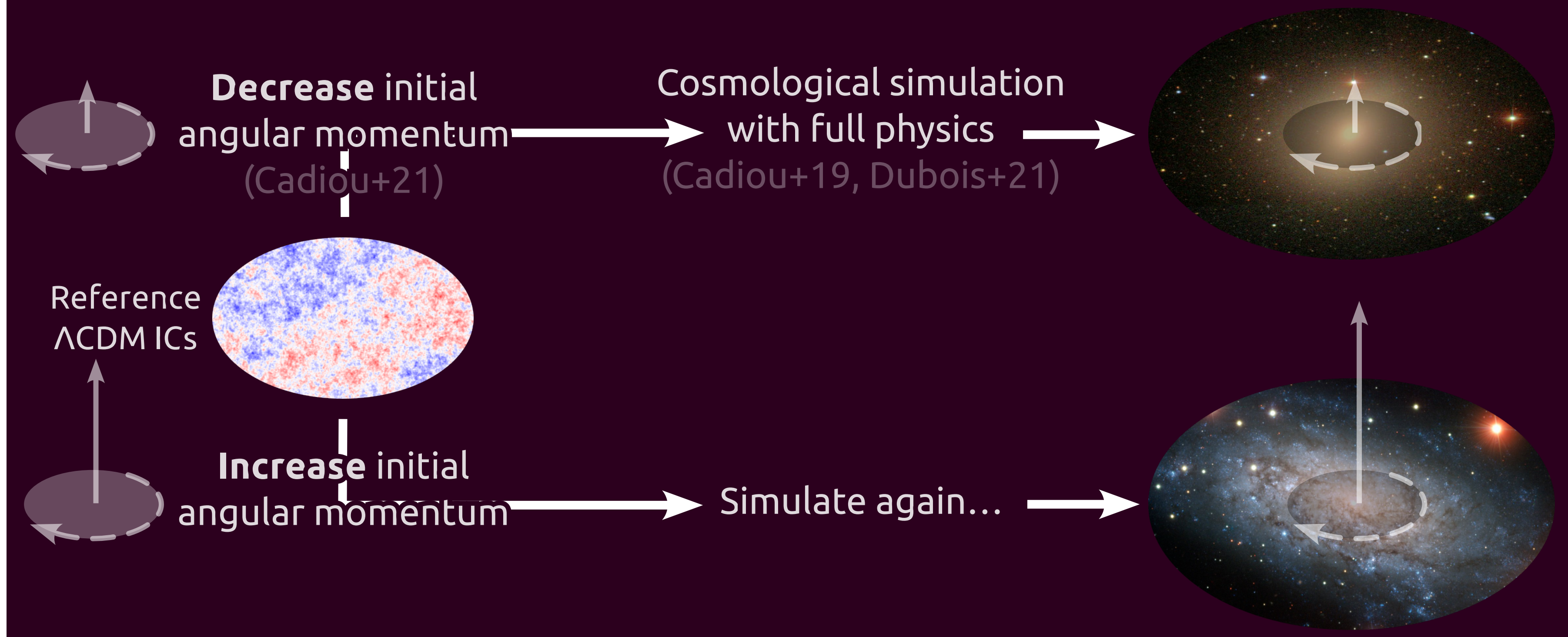
Origin of stellar AM:
(1) Gas+DM AM generated via torques with large-scale structure in early Universe
(2) AM accreted via smooth accretion & mergers (possibly non-conservative)
(3) Gas AM ⇒ stellar AM *via* star formation (segregation of gas)
(4) Excess gas AM expelled *via* feedback

⇒ need to understand origin of stellar angular momentum for galaxy formation & ahead of weak lensing surveys (*Euclid*, Rubin-LSST)

Question
Do stars retain memory of the AM generated by cosmological environment?

Method
- hydrodynamical simulation
- 3 galaxies $M_\star = 10^{11}$ $M_\odot$ at $z = 2$
- modify **initial conditions** of each to change AM generated by torques of environment (×0.66, ×0.8, ×1.2, ×1.5, 15 sims in total)
- measure AM at $z = 2$

Results
Increase of torques in **initial conditions**
⇒ **increase** of AM at $z = 2$
Change of AM:
- conveyed by changes in **orbit of mergers**
- Impact galaxy **morphology**: **bulge** fraction, effective **radius**, v/σ



We modify initial AM at $z = 200$ measure galaxy properties at $z = 2$

We find that more AM in… … causes more ★ AM out ⇒ more disk & less bulge

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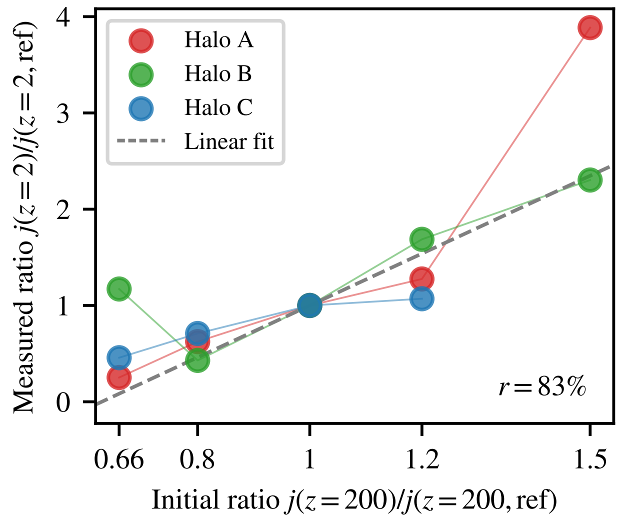
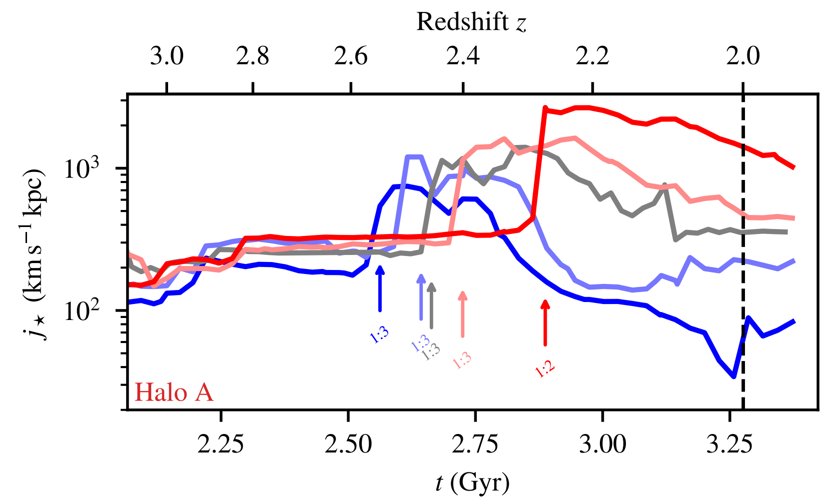
Any questions? Contact me!
(scan or click)

Read the paper

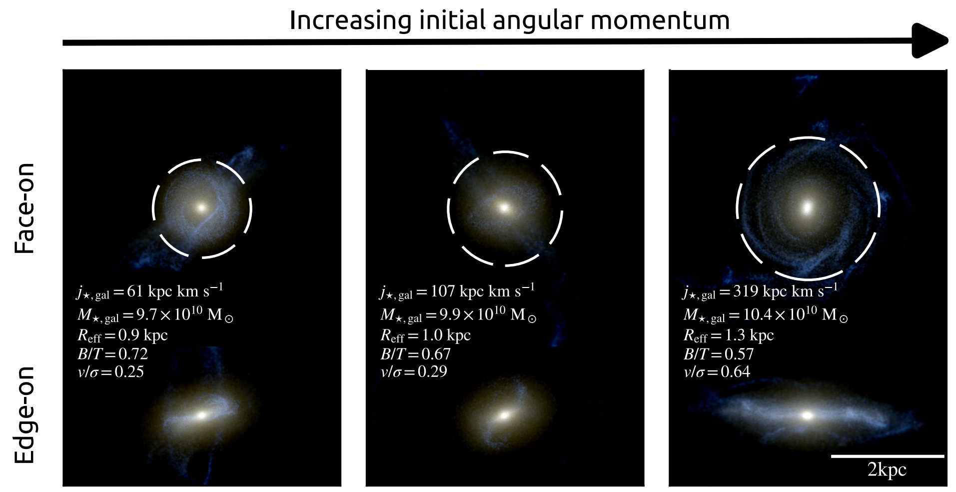
Increasing initial AM *via* torques with large-scale environment from the initial conditions causes an increase in stellar angular momentum at z = 2



Stellar AM can be increased by delaying infall time & changing orbital parameters of major mergers. We do this in deterministic way!



Increasing AM of individual galaxy keeps stellar mass fixed but causes the galaxy to have smaller bulge, more rotation, larger effective radius



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