Molecular Gas, Ionized Gas, and Stellar Velocities in E and S0 galaxies

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with: M. Bureau, M. Cappellari

and thanks to: the SAURON/Atlas3D teams

stellar velocities, ionized gas, line ratios etc. from the SAURON papers (e.g. Emsellem, Sarzi, Kuntschner)

CO data from Combes, Young, & Bureau 2007 and Young, Bureau, & Cappellari 2008

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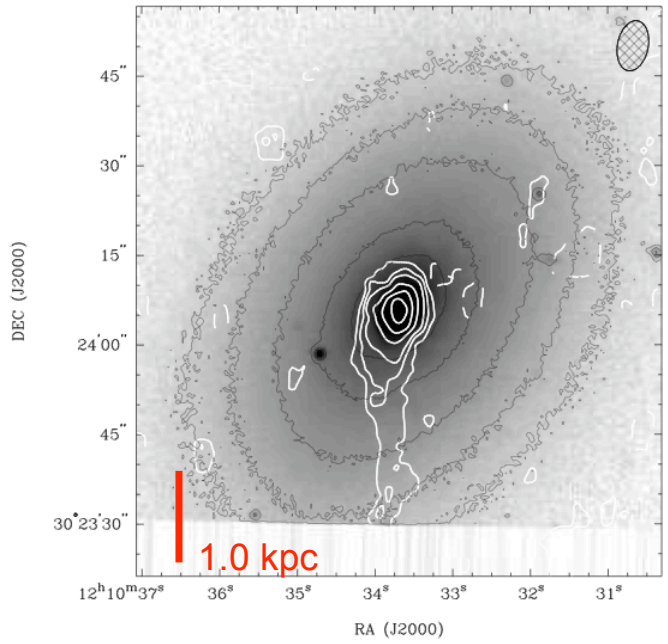
Context: ≥ 20% of nearby elliptical and lenticular galaxies (Atlas3D sample) contain molecular gas.

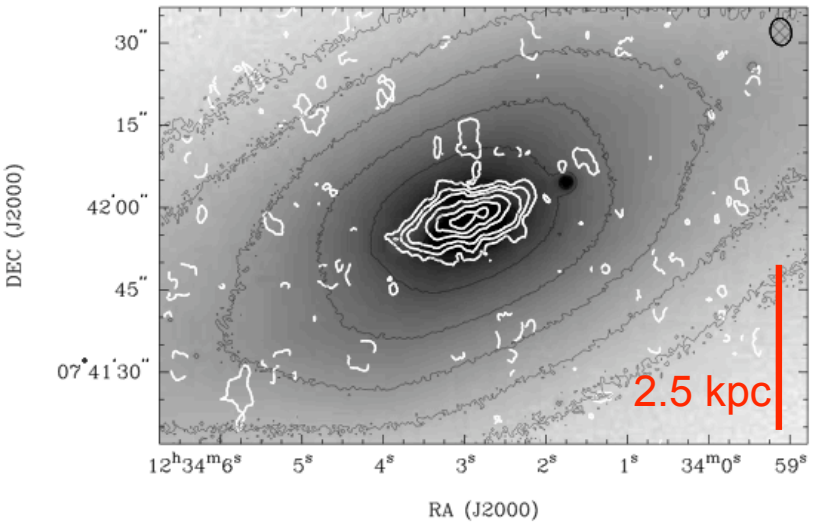
$M(H_2)= 10^7$ to 10^9 $M_\odot$

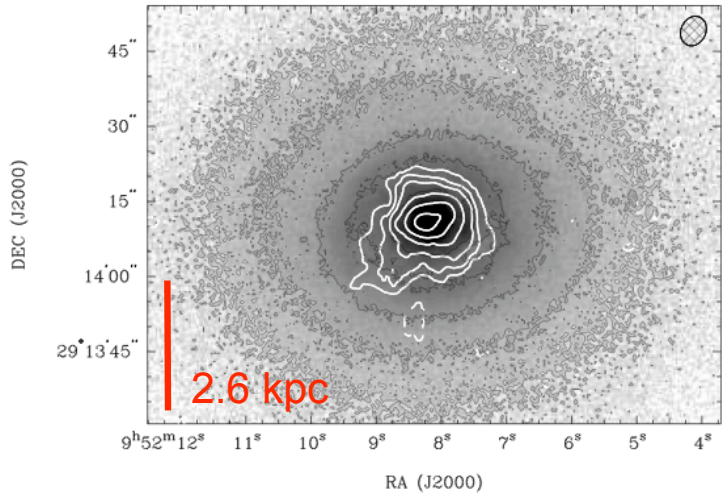
Big Question: How do galaxies move from (gas-rich) blue cloud to (gas-poor) red sequence & what happens to them after they get there?

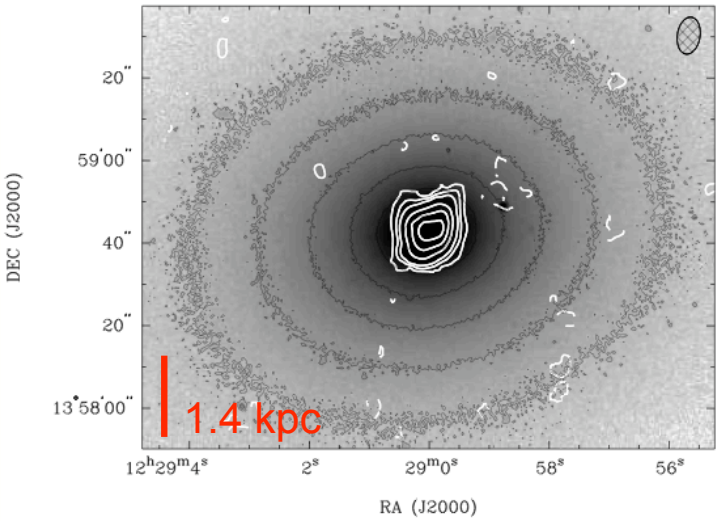
Objectives: use the relationships between stellar, ionized gas, and cold gas distribution and kinematics to read the origin and the future of the cold gas

Four CO-rich fast rotators



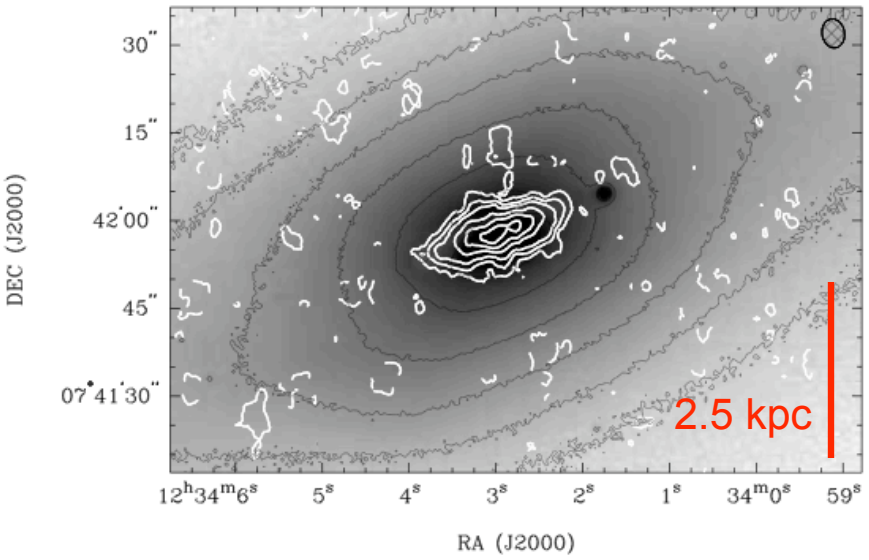




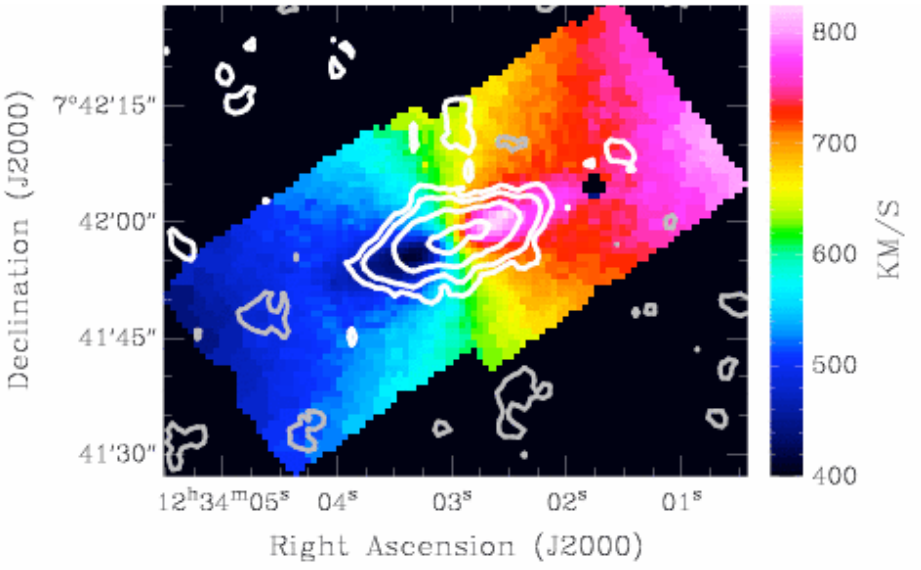


- In 1 of the 4, CO is counterrotating (vs stars).
- CO comes from both internal and external sources?

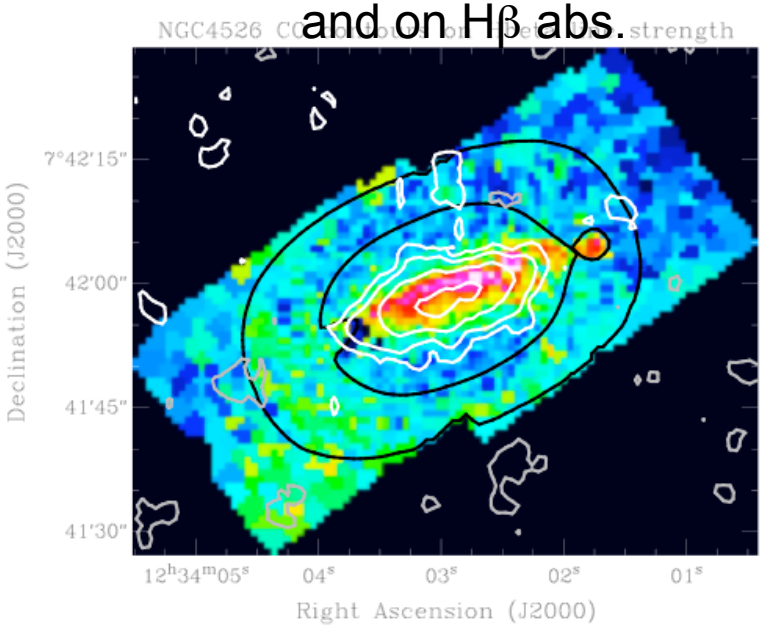
More details: NGC 4526, with CO at 5” ~ 400 pc resolution



CO on stellar velocities

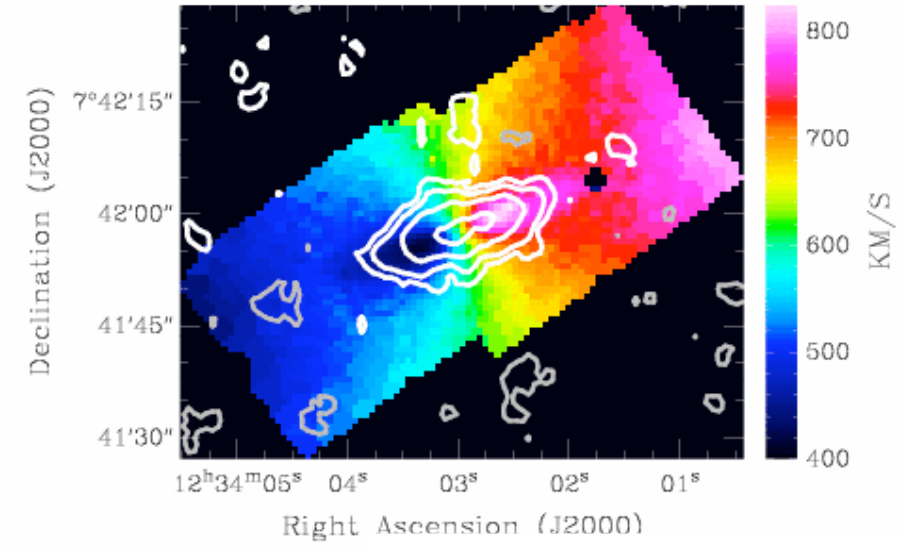


and on Hβ abs.

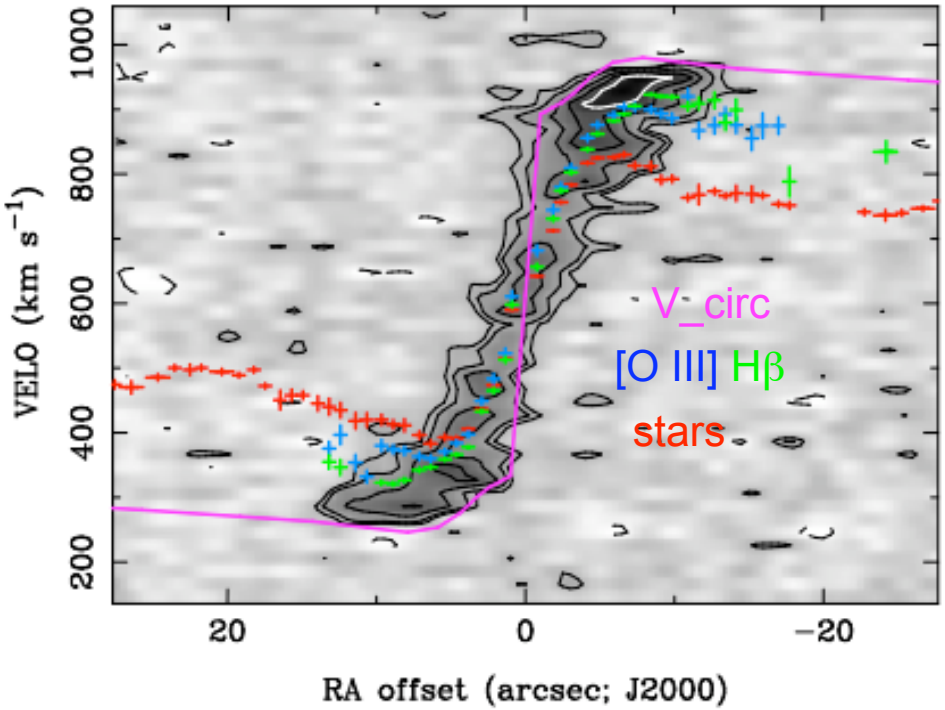


A dynamically cold stellar disk is growing out of the molecular disk.

But we can do more with the details of the gas and stellar velocities…

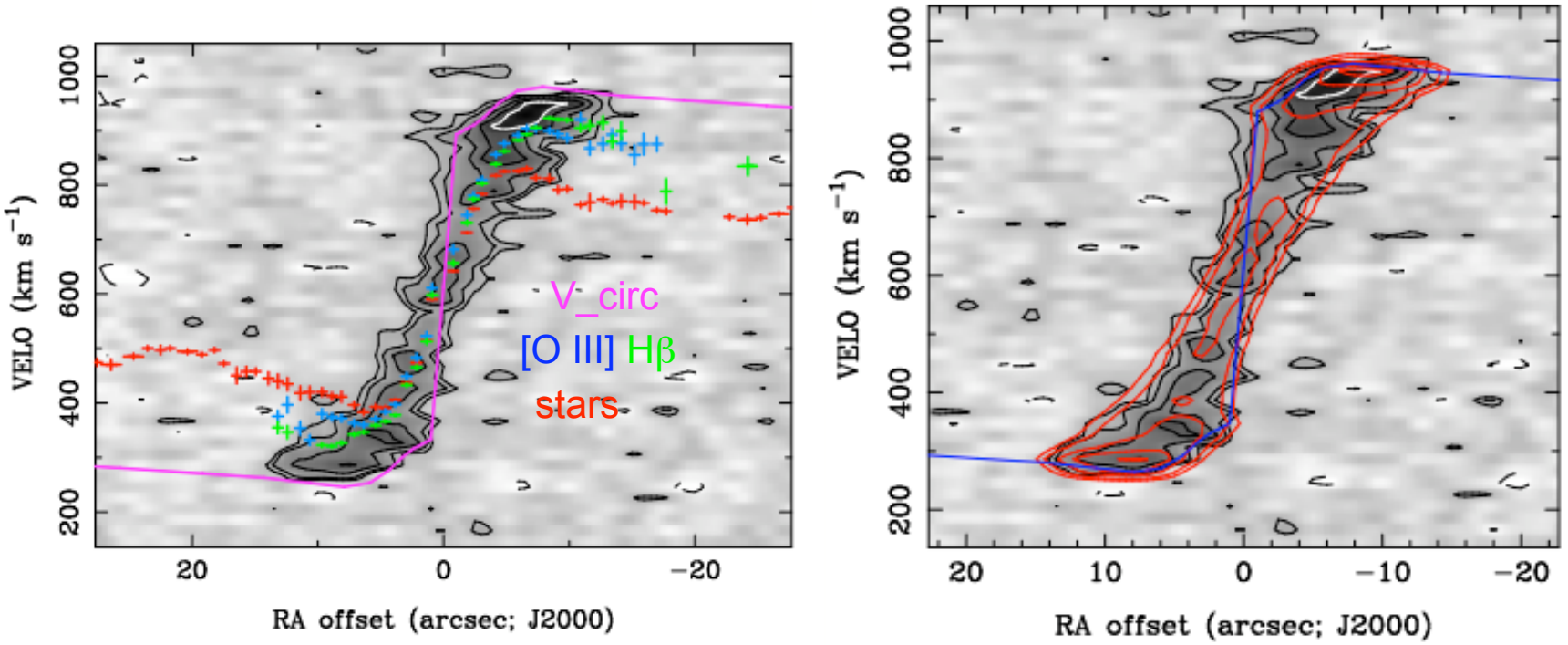


- CO and ionized gas disks are similar in size to the recent star formation (Hβ absorption)
- the dynamically cold stellar disk has a *larger spatial extent* than the CO disk
- molecular disk is now smaller than it was ~ Gyr ago?



- Jeans/Schwarzschild modeling of stellar kinematics (Cappellari et al 2006) gives M/L and a circular velocity curve
- CO kinematics match the inferred circular velocity (tilted ring model)
- excellent, independent confirmation of the stellar dynamical modeling

observed and modeled PV



Larger samples are forthcoming (PdB, CARMA)!