IMPRS

A High-Dispersion Molecular Gas Component in Nearby Galaxies

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Ianjasamanana and Mogotsi

Motivation

Multiphase ISM

Morphology of galaxies

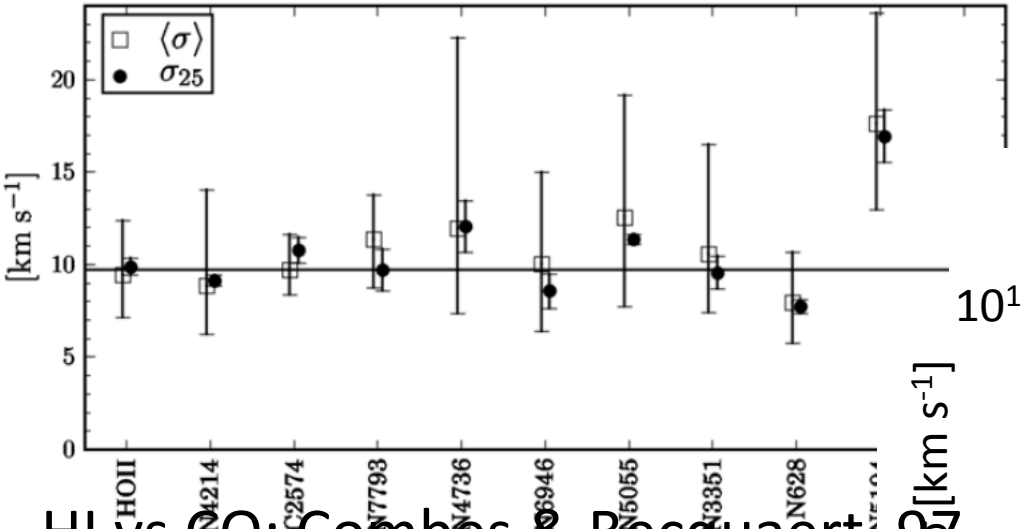
VELOCITY DISPERSIONS

HI: $$\sigma_{HI} = \sqrt{\underbrace{\sigma^2_{CNM,TH} + \sigma^2_{CNM,NTH}}_{\text{CNM}} + \underbrace{\sigma^2_{WNM,TH} + \sigma^2_{WNM,NTH}}_{\text{WNM}}}$$

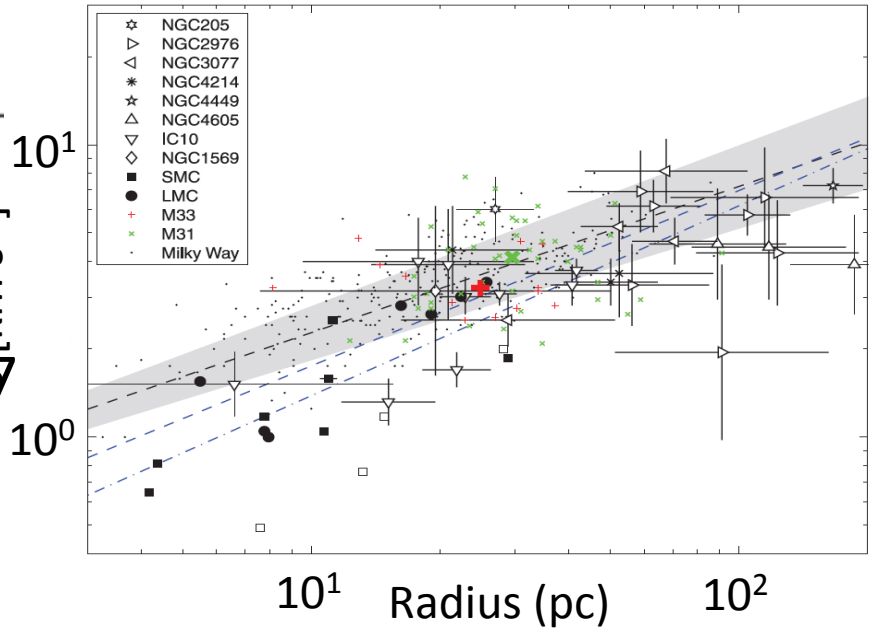
CO: $$\sigma_{CO} = \sqrt{\sigma^2_{TH} + \sigma^2_{NTH}}$$

Previous (extragalactic) studies

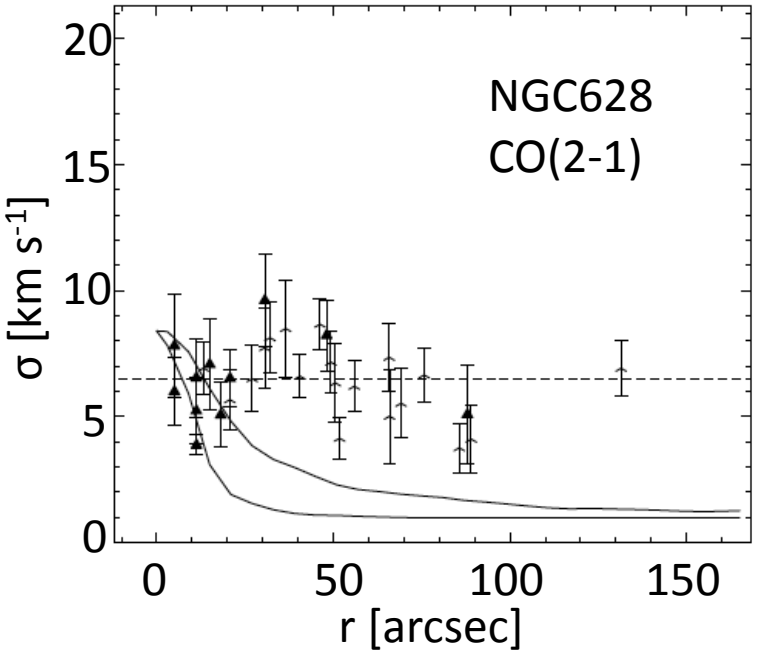
HI: Tamburro et al., 09



CO: Bolatto et al., 08



HI vs CO: Combes & Becquaert, 97



Data: 12 galaxies

THINGS survey

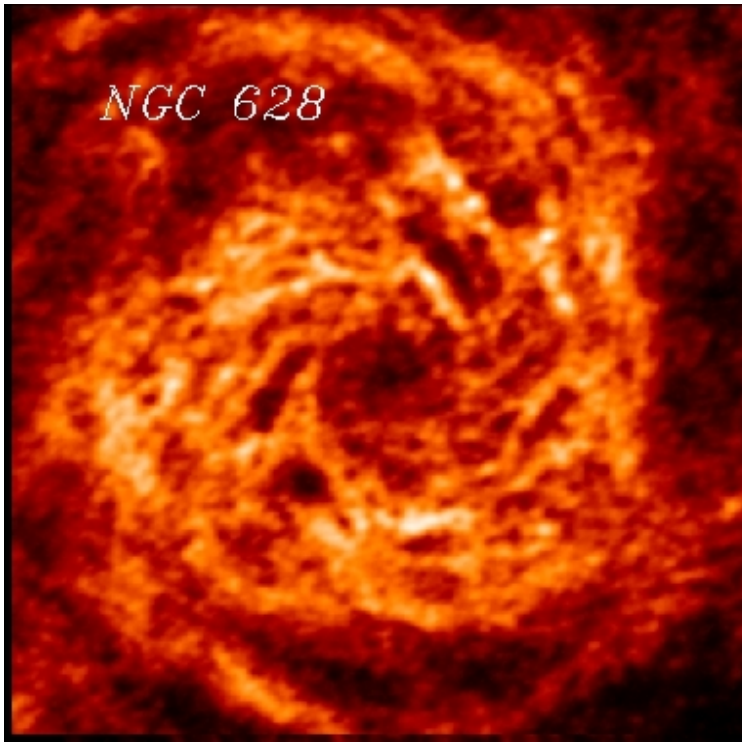
Walter et al., 08

VLA

21 cm line

Linear resolution ~ 0.4 kpc (NA)

Spectral resolution 2.6 or 5.2 km/s



HERACLES survey

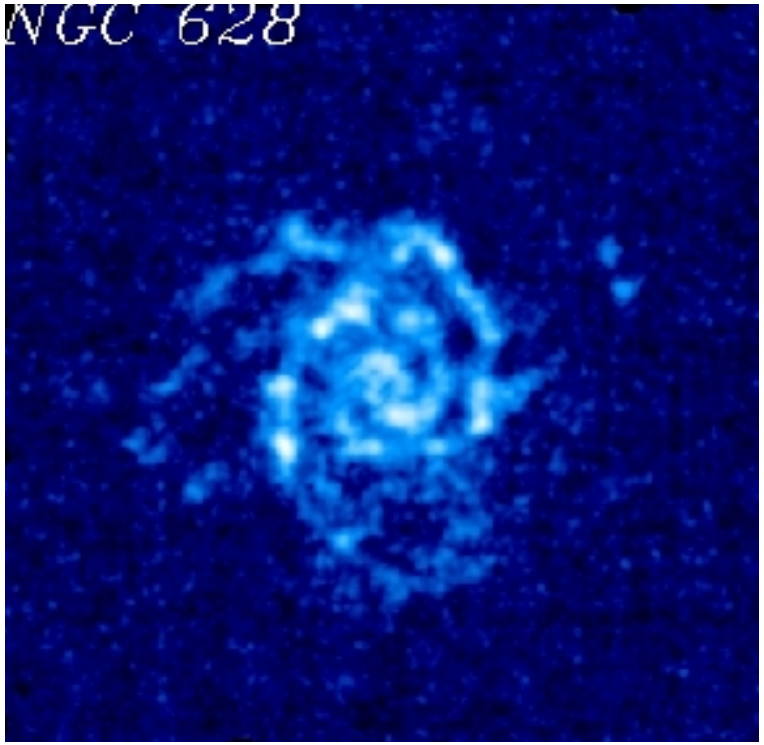
Leroy et al., 09

IRAM 30 m

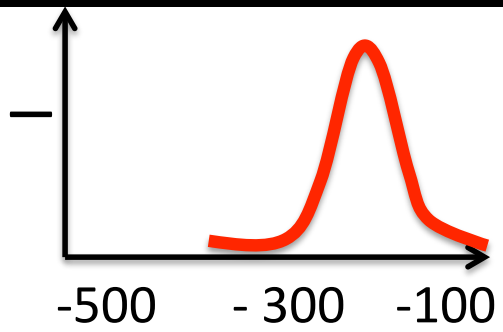
CO: 2-1

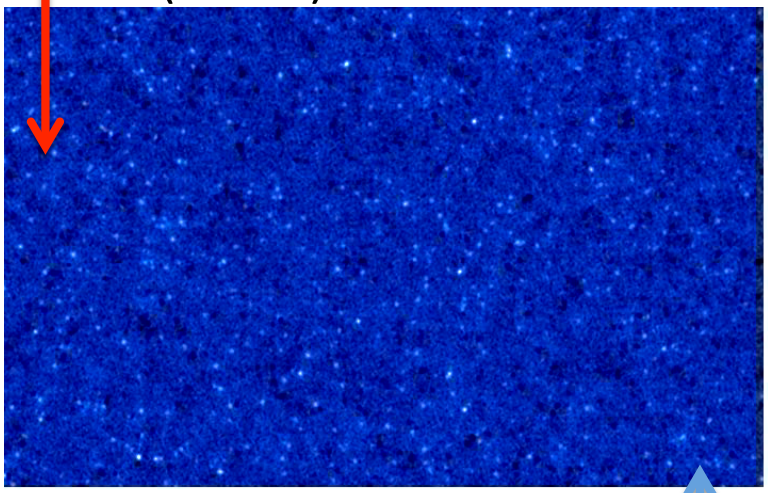
Linear resolution ~ 0.5 kpc

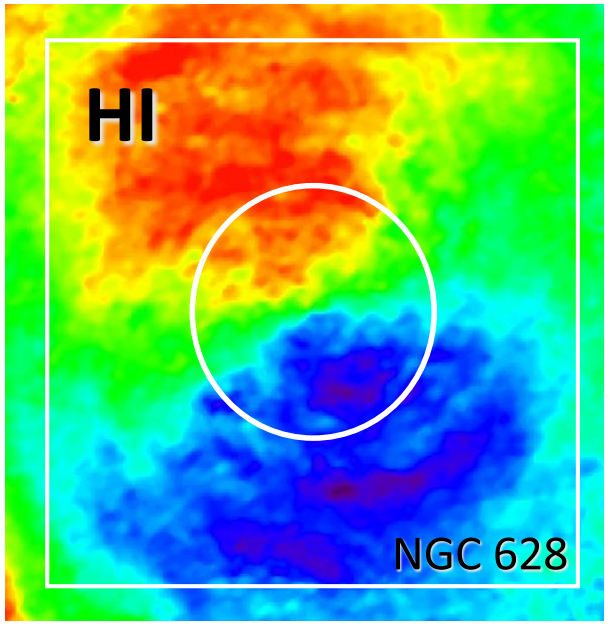
Spectral resolution 2.6 km/s

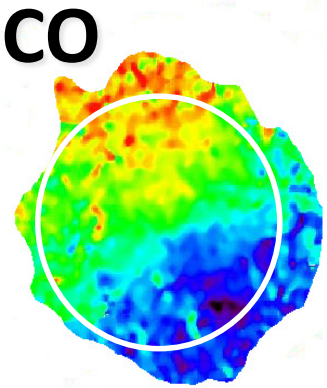


Methodology: Shifting

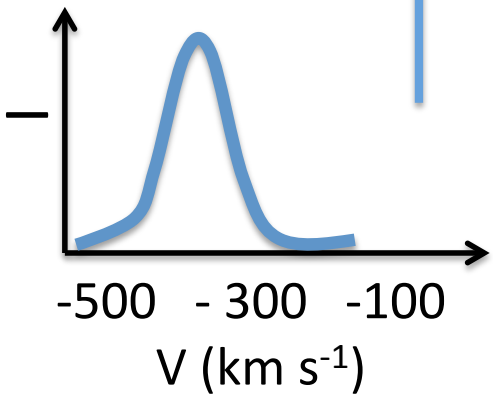


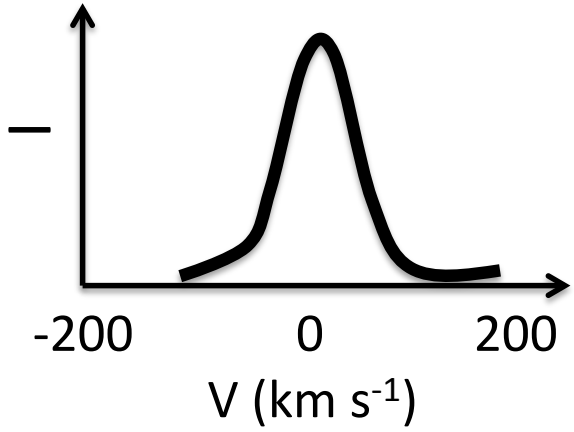






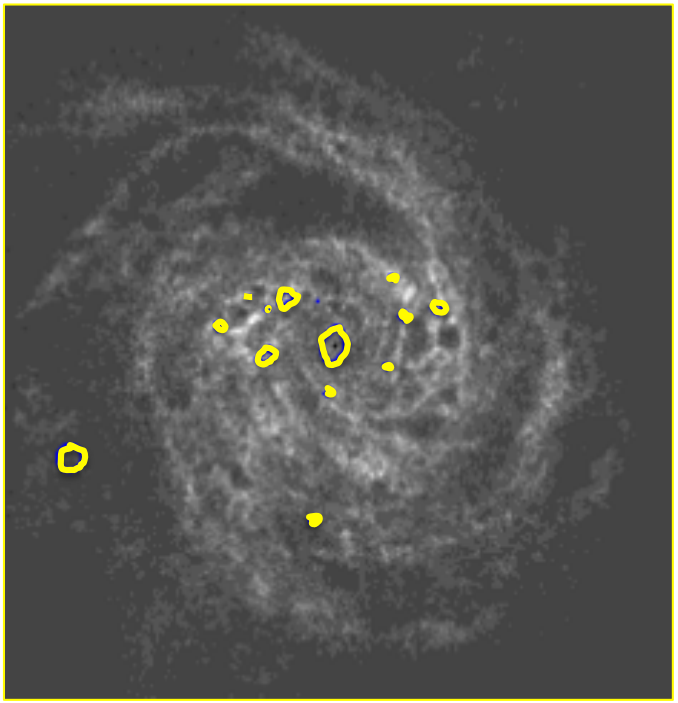
NGC 6946 HI velocity cube

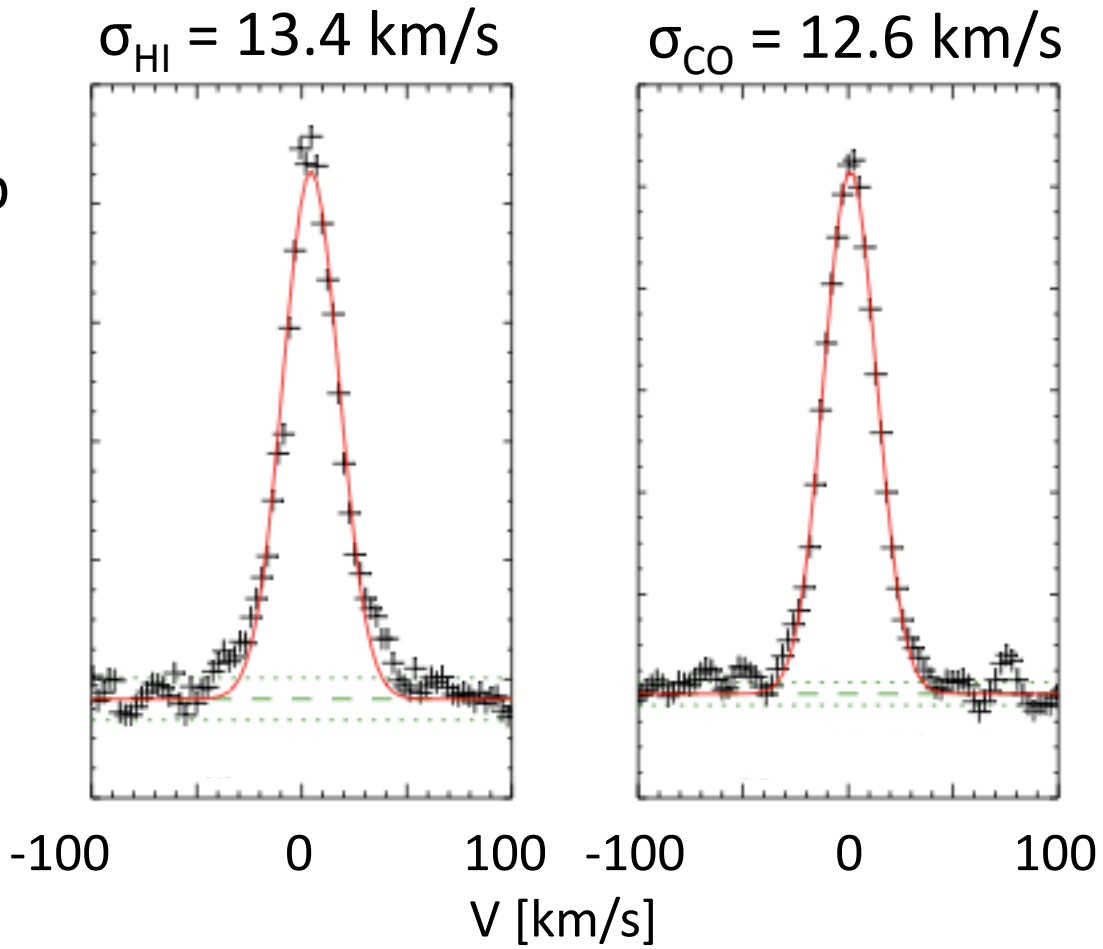




Methodology: Stacking and Measuring Velocity Dispersions

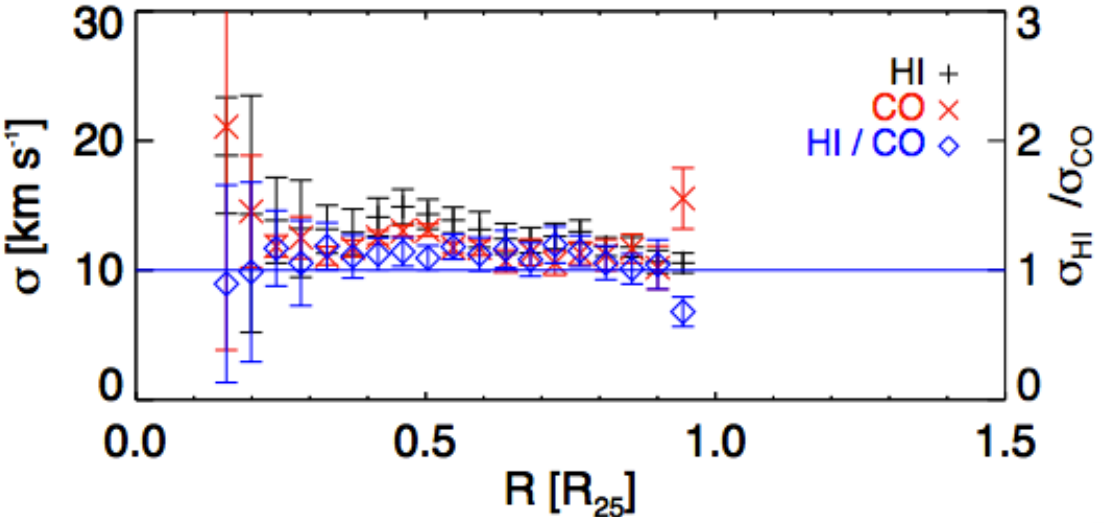
NGC 6946 0th-moment map and Σ_{SFR} bin overlay





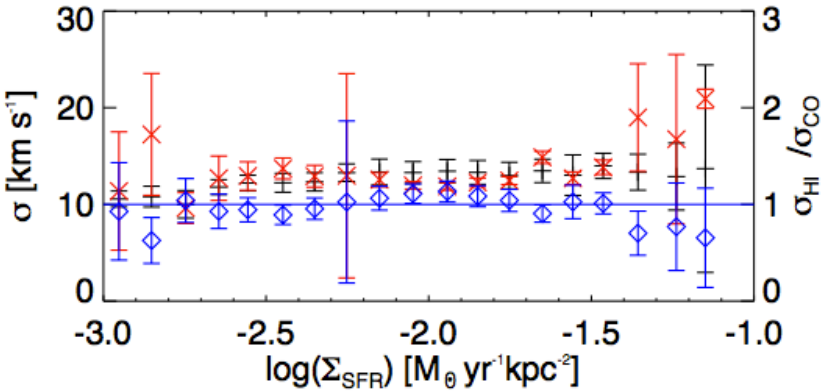
Caldu-Primo et al, submit.

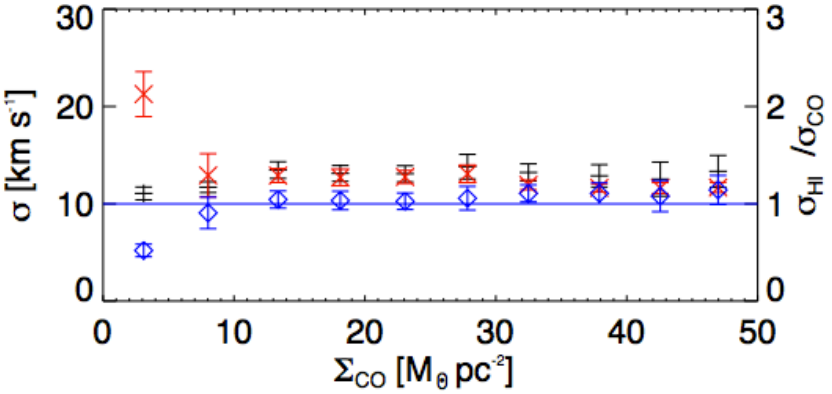
Methodology: Stacking and Measuring Velocity Dispersions

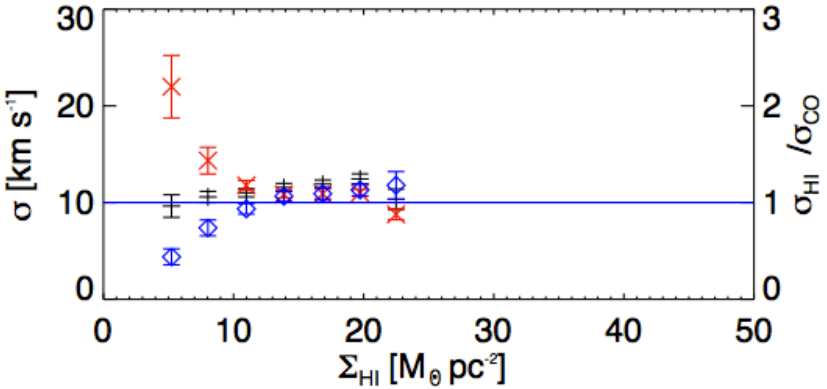


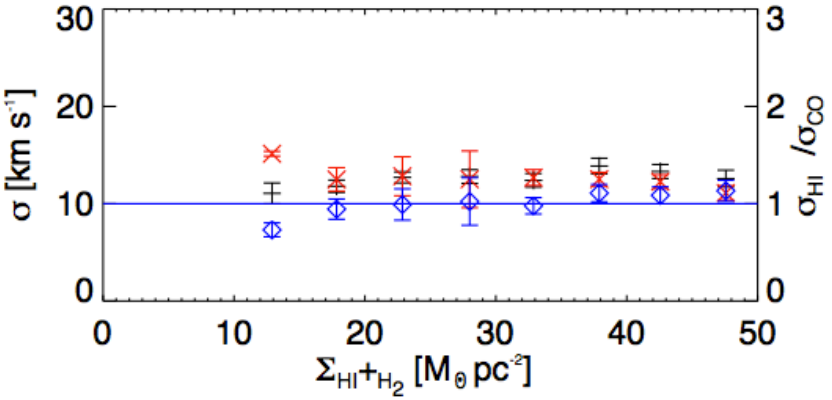
NGC 6946

Caldu-Primo et al, submit.



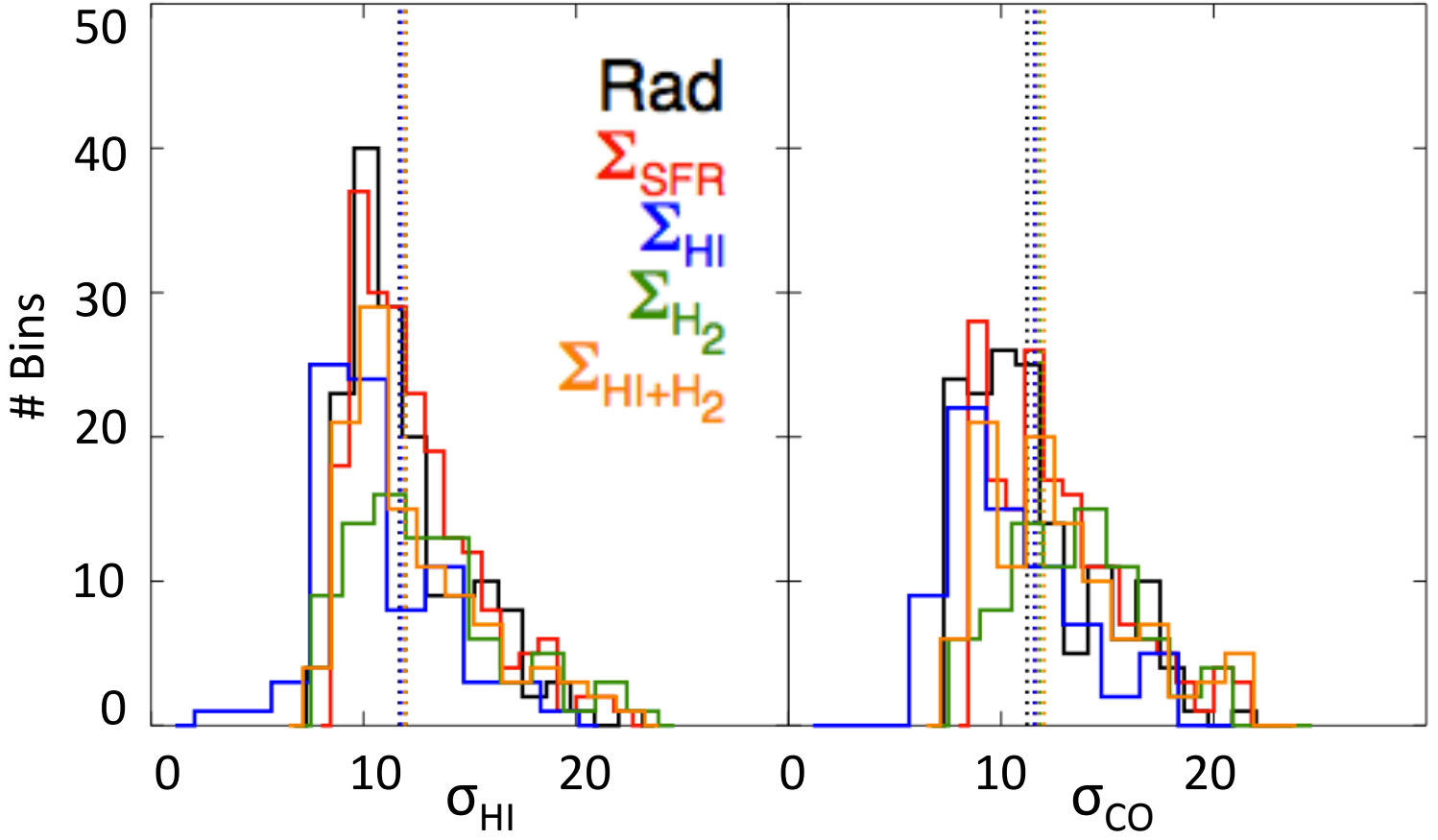






Results

12 Galaxies



σ_{HI} : 7 – 21 km/s

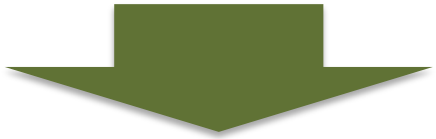
σ_{CO} : 6.7 – 23 km/s

$\langle\sigma_{HI}\rangle$ = 12.7 ± 3.1 km/s

$\langle\sigma_{CO}\rangle$ = 12.8 ± 3.9 km/s

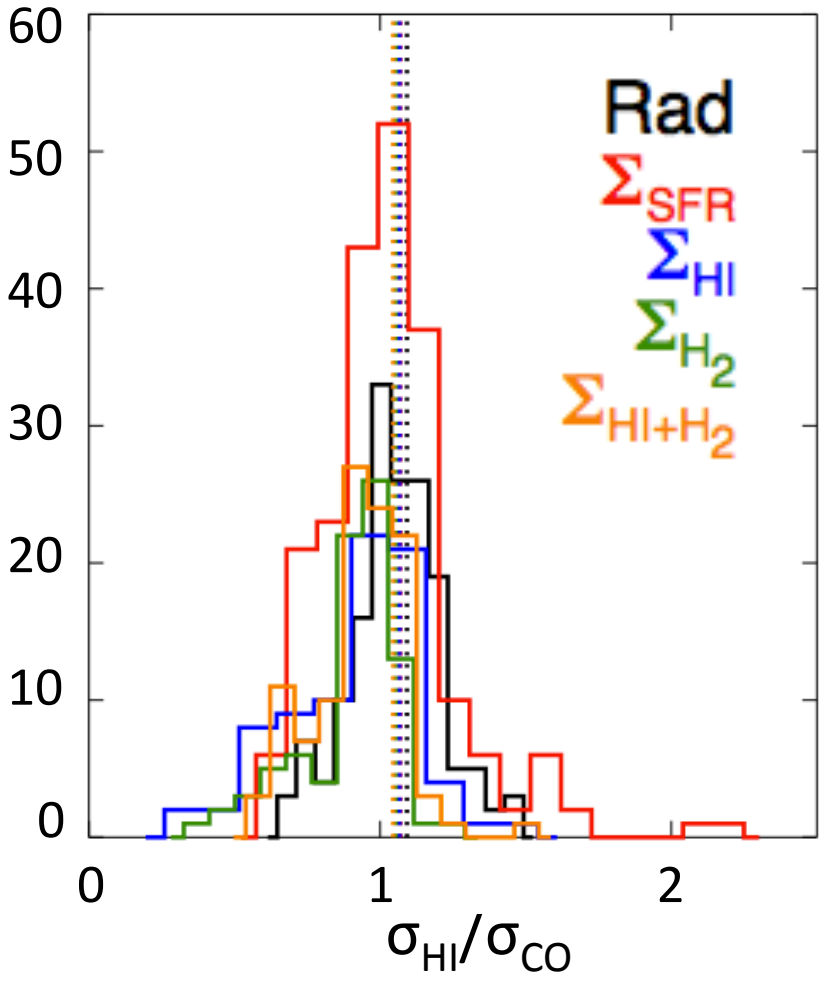
Results

HI	CO
CNM and WNM	Predominantly in GMCs
$\sigma_{HI,\,th}$ (8000 K) ≈ 8 km/s	$\sigma_{CO,\,th}$ (10K) ≈ 1 km/s
	$\sigma_{CO,\,mol.\,cloud}$ ≈ 2-5 km/s



We measure for both ~ 12 km/s

Results



?

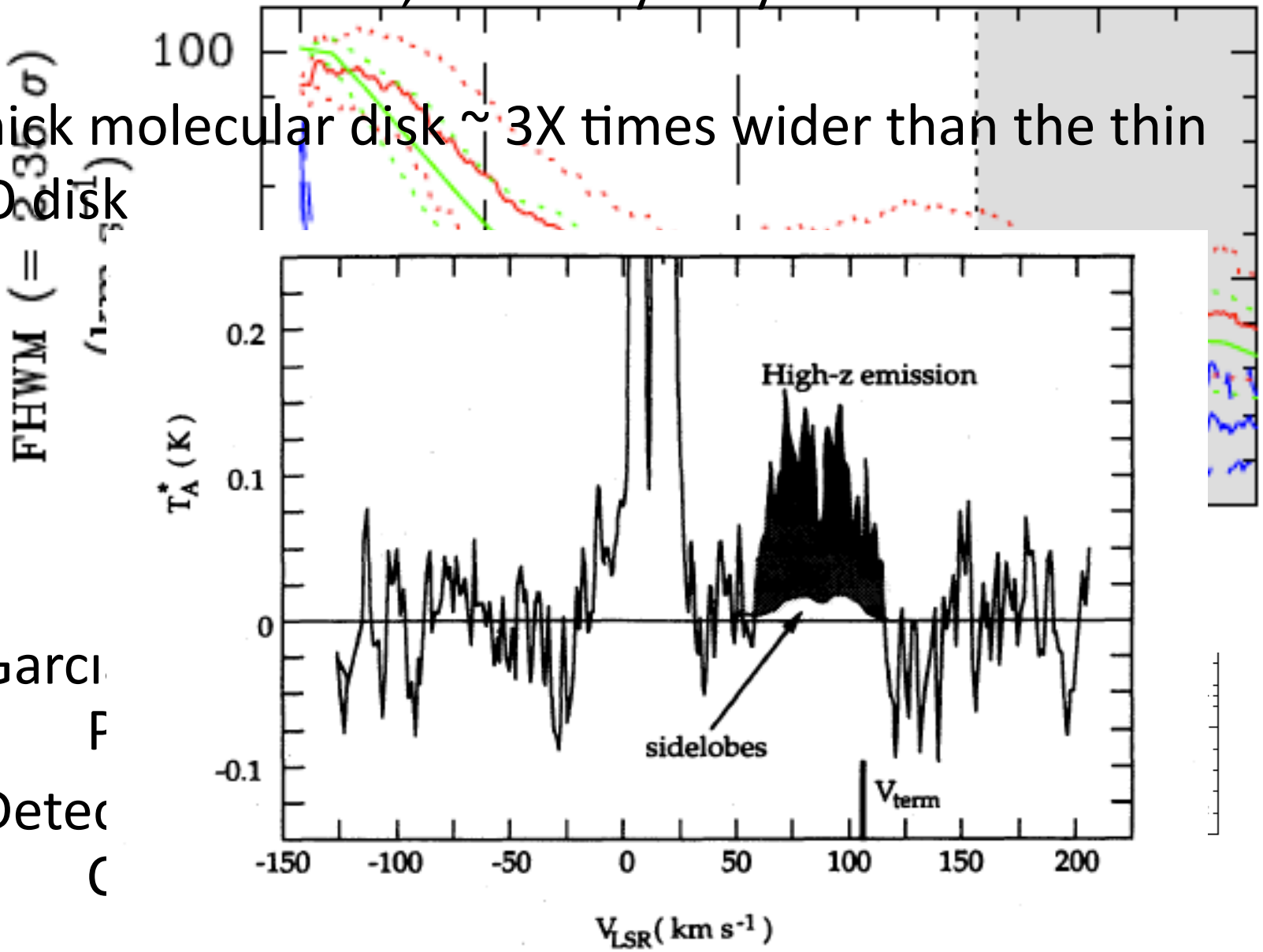
Existence of a high-dispersion molecular component in our sample of galaxies

$\sigma_{HI} / \sigma_{CO} = 1.0 \pm 0.2$

Previous results pointing in this direction

Dame & Thaddeus, 94: Milky Way

Thick molecular disk ~ 3X times wider than the thin of CO disk



Garci

F

Detec

C

k

Take home message

At ~ 500 pc resolution:

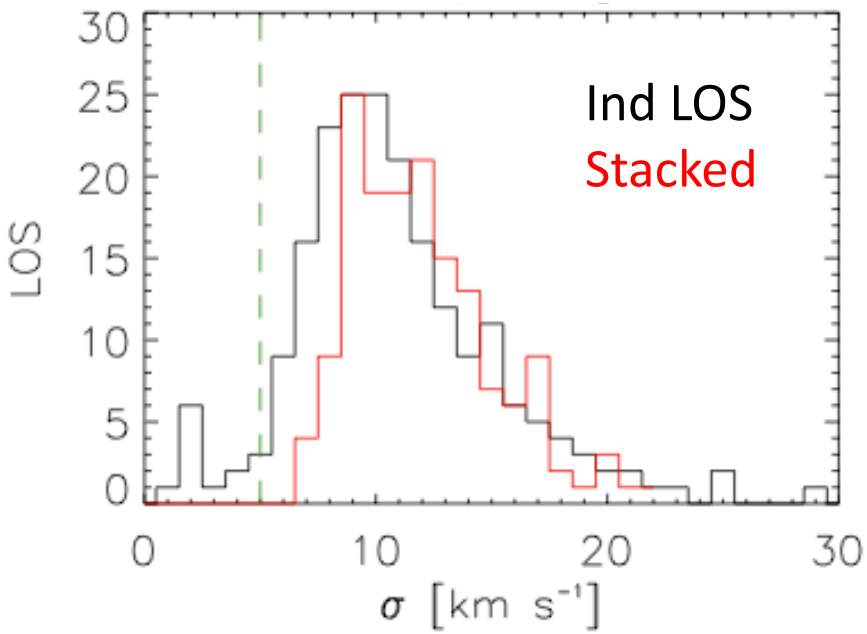
	HI	CO
σ (km/s)	12.7 ± 3.1	12.8 ± 3.9

σ_{HI}/σ_{CO}: 1.0 ± 0.2

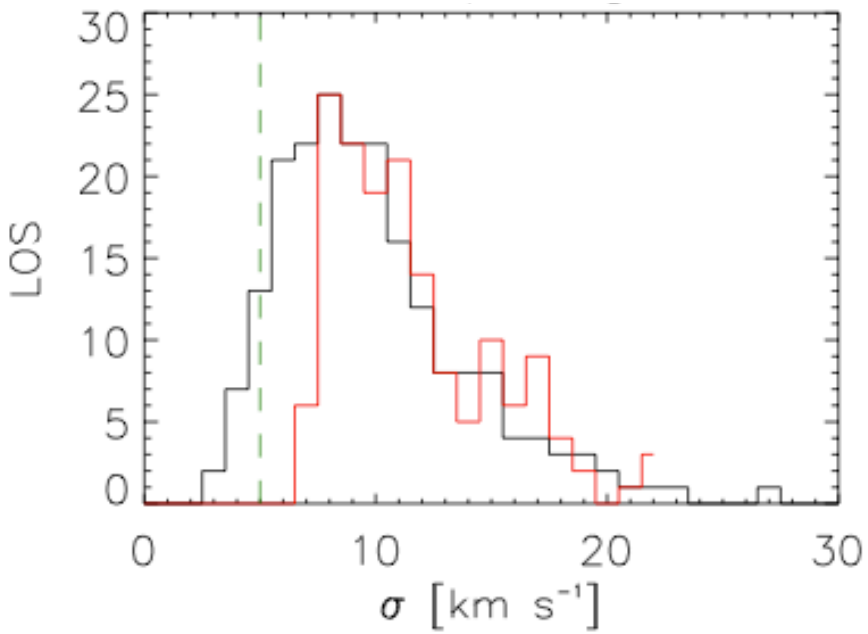
Existence of a high-dispersion molecular gas component?

Compared when fitting individual LOS for 10 galaxies

HI



CO



Individual LOS < HI/CO> = 1.1

Stacked spectra <H/CO> =1.0