

# **Ionized gas kinematics of void galaxies**

**Evgeniya Egorova**

***Sternberg Astronomical Institute  
of Lomonosov Moscow State University***

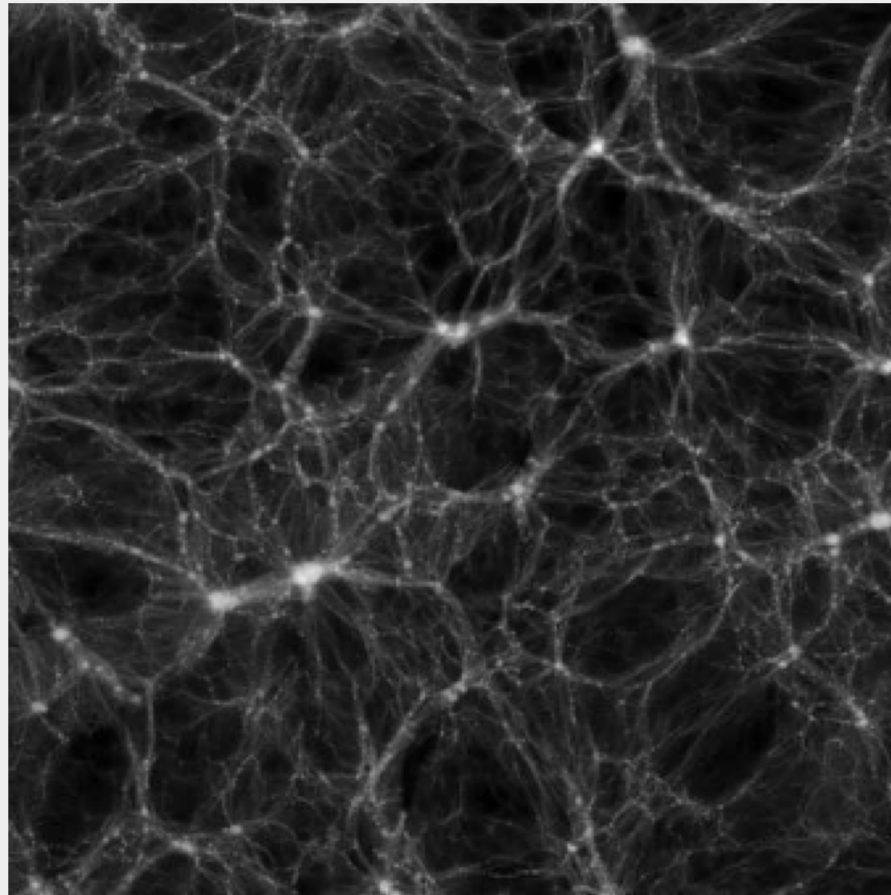
***Co-authors: Alexei Moiseev, Oleg Egorov***



# ***Galaxies in voids***

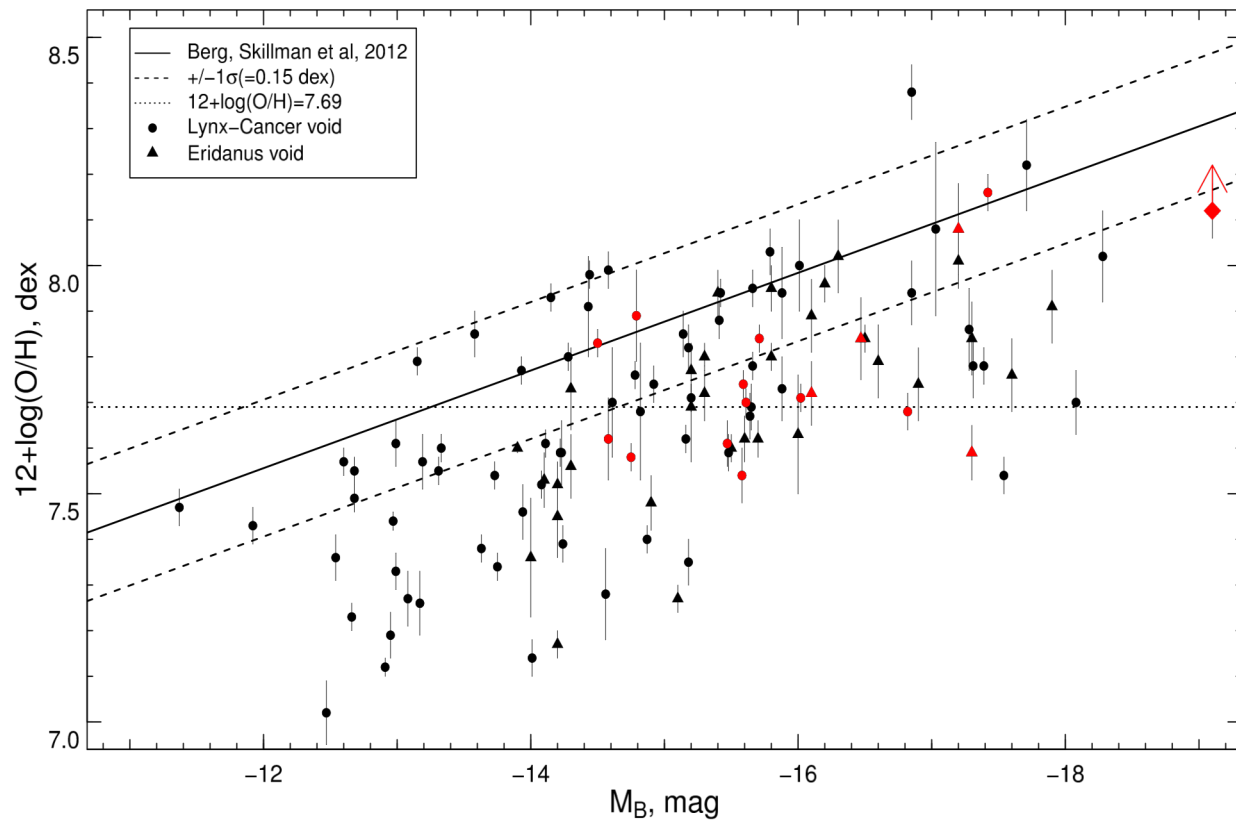
Study of interactions, mergers, accretion in void galaxies

Low density environment → low rate of interactions between galaxies  
→ it's easier to disentangle between different processes



Aragon-Calvo & Szalay (2013)

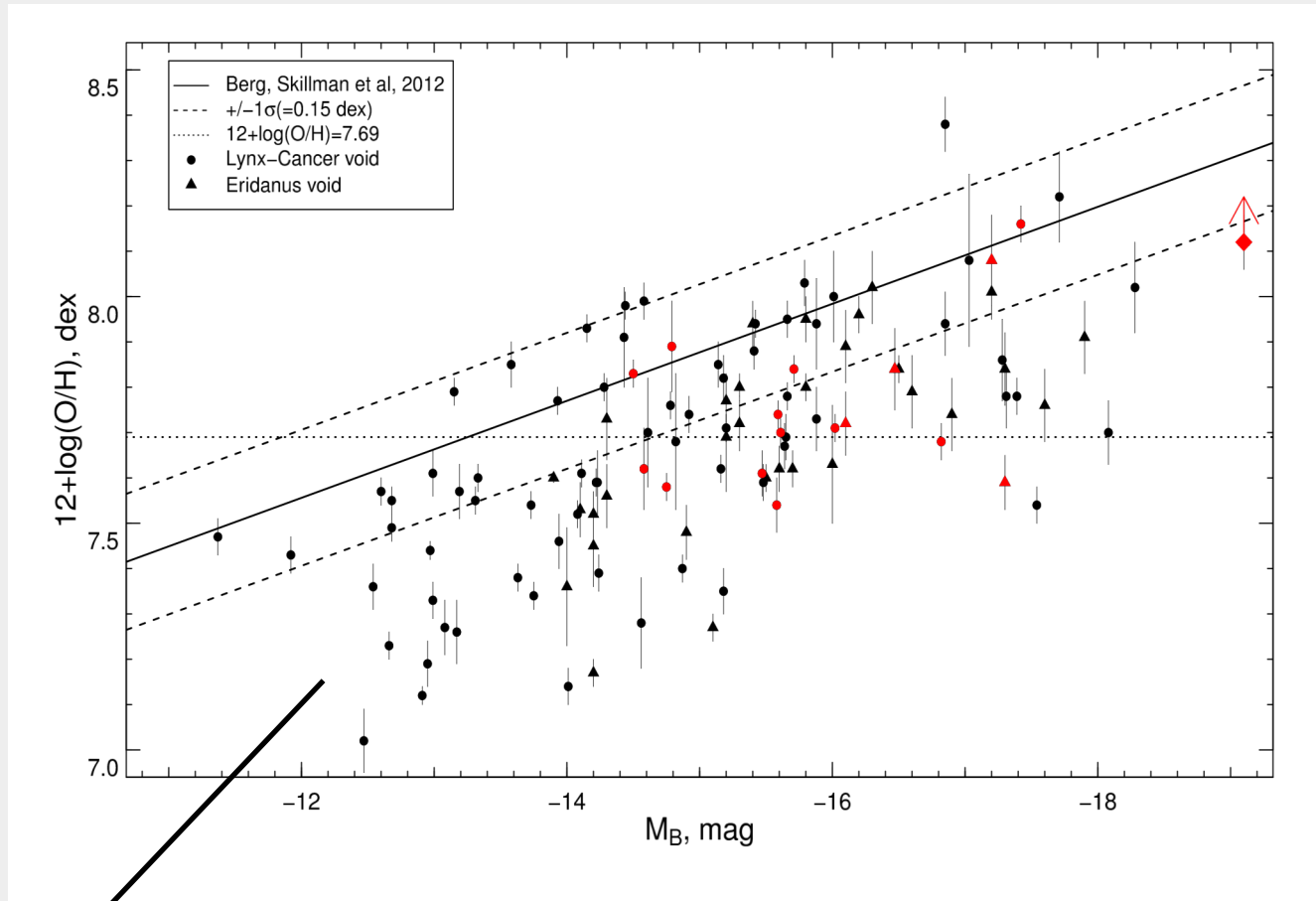
# Galaxies in voids



← Berg et al, 2012

*Pustilnik, Tepliakova, 2011*  
*Pustilnik et al, 2016*  
*Kniazev, Egorova, Pustilnik 2019*

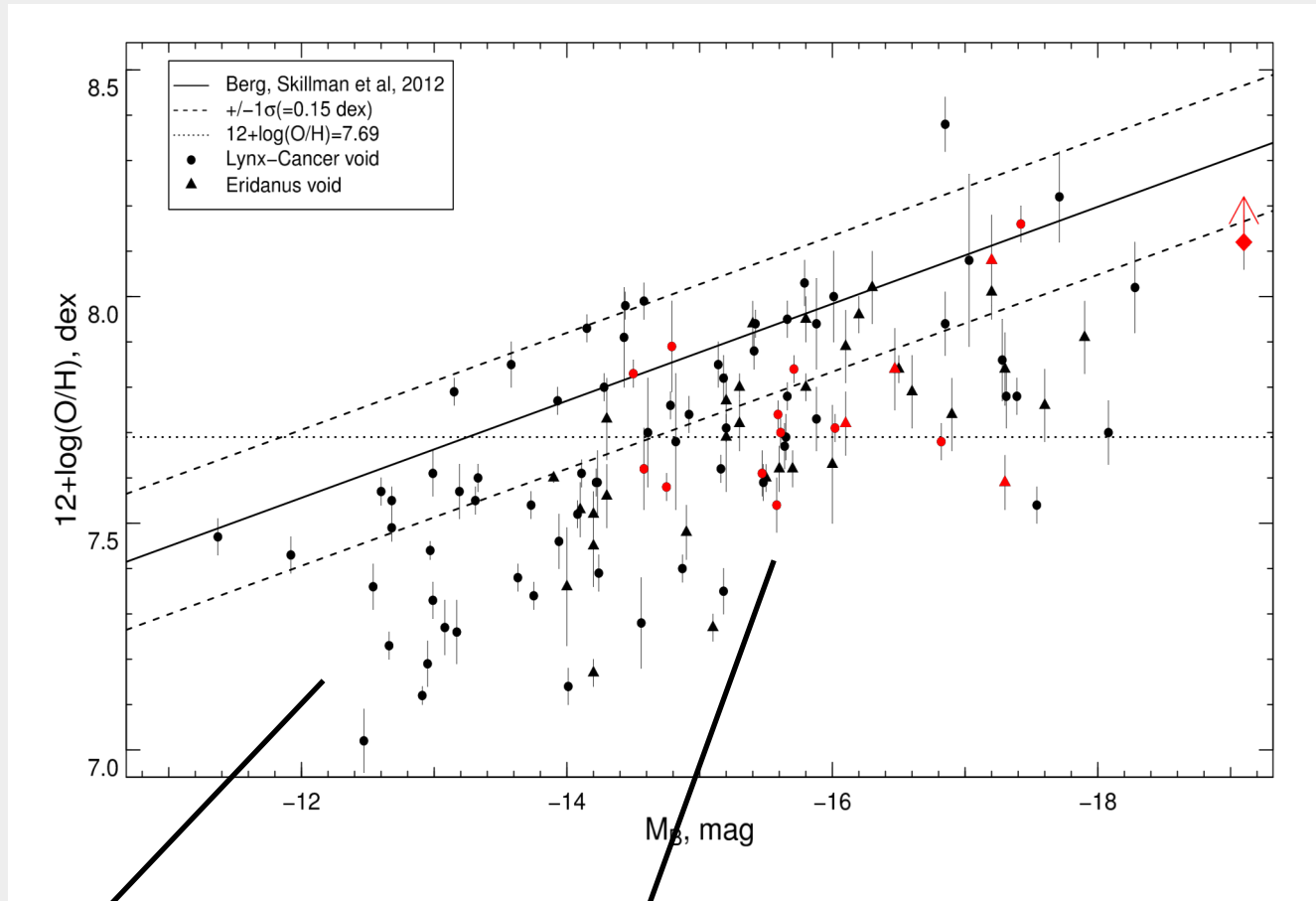
# Galaxies in voids



Young objects? (Tweed et al, 2018)

Pustilnik, Tepliakova, 2011  
Pustilnik et al, 2016  
Kniazev, Egorova, Pustilnik 2019

# Galaxies in voids

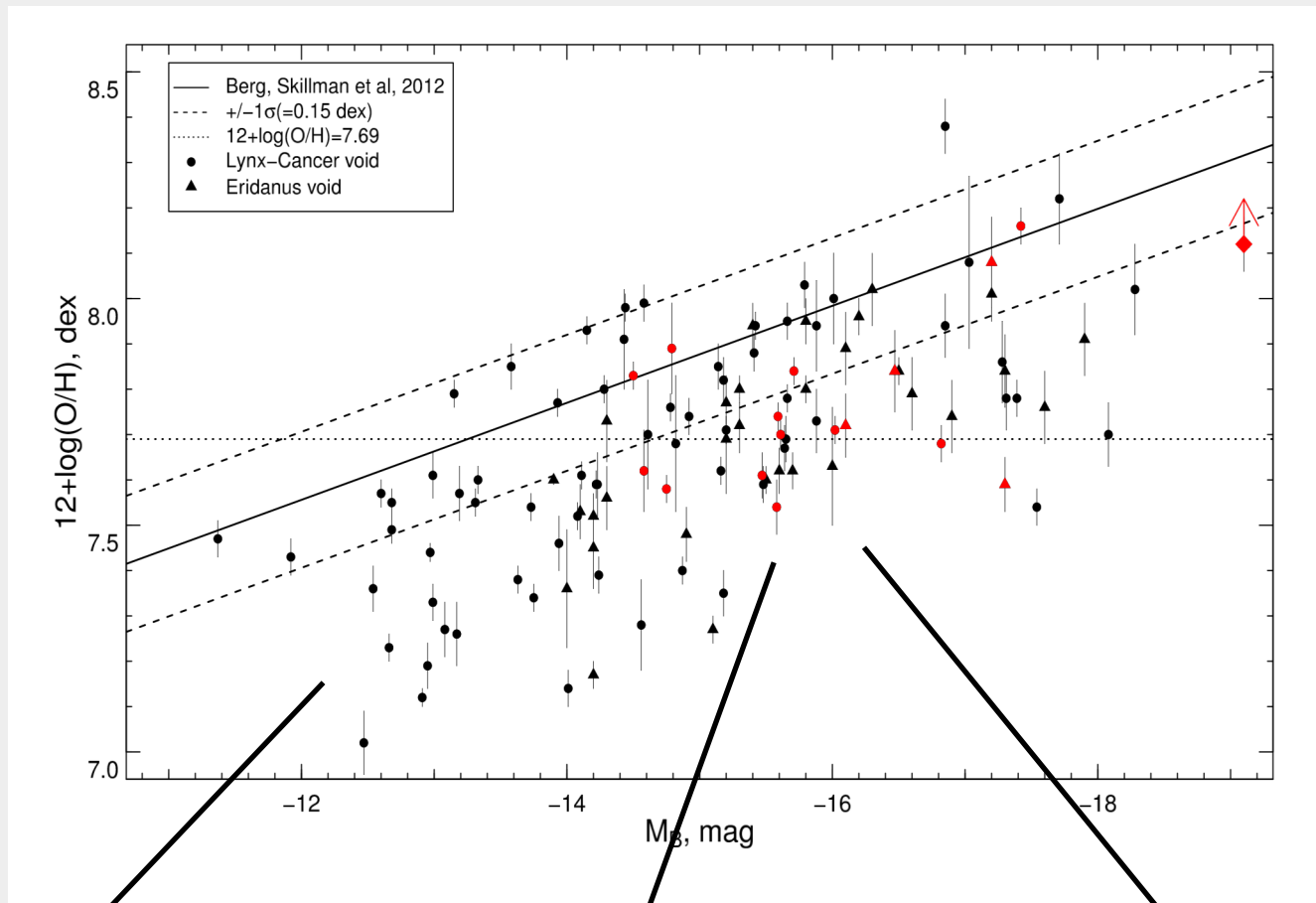


*Young objects? (Tweed et al, 2018)*

*Mergers  
(for example, paper by  
Ekta & Chengalur 2010)*

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Kniazhev, Egorova, Pustilnik 2019*

# Galaxies in voids



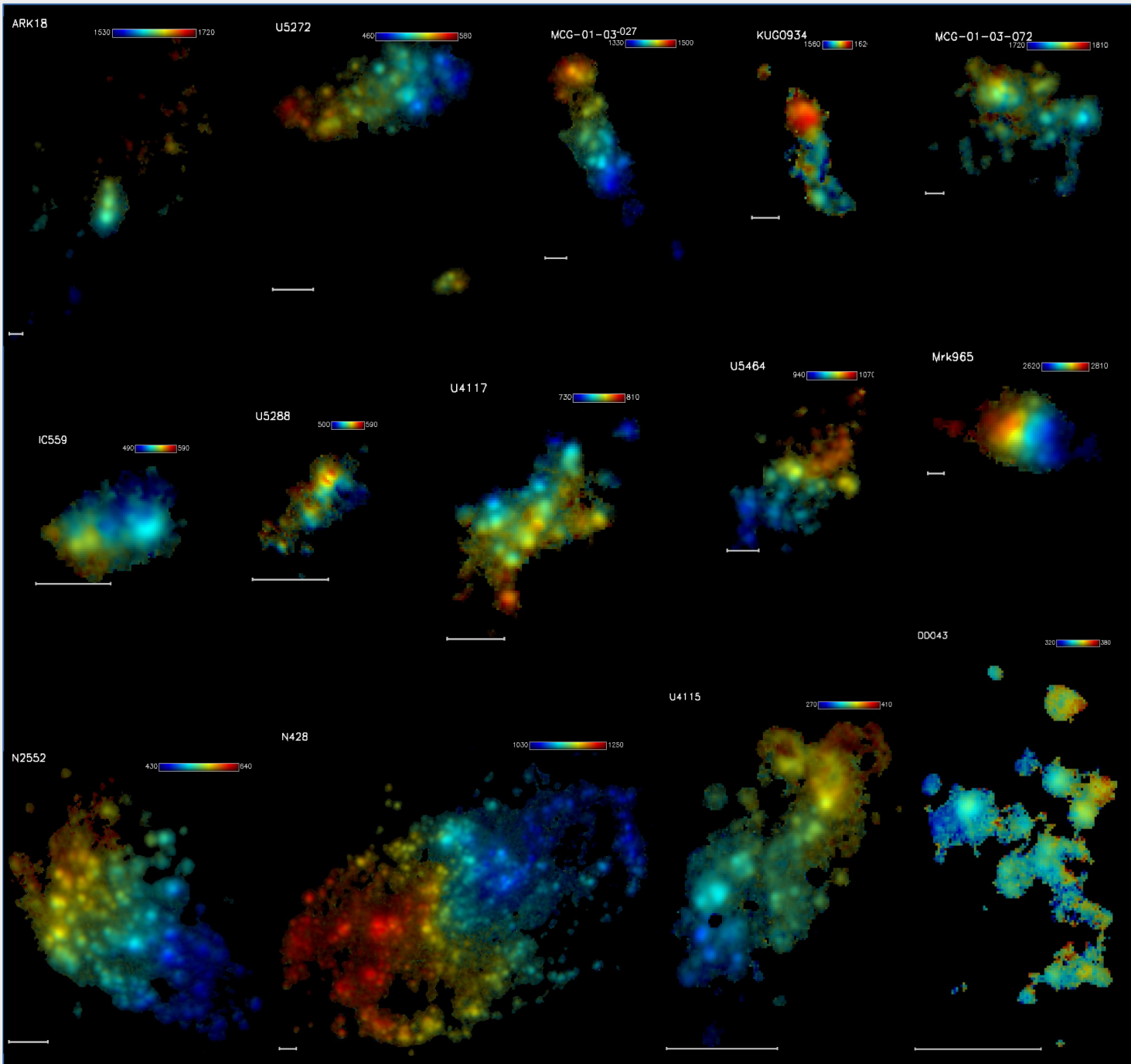
*Young objects? (Tweed et al, 2018)*

*Mergers  
(for example, paper by  
Ekta & Chengalur 2010)*

*Accretion of metal-poor gas  
(review by Sánchez Almeida et al., 2014)*

*Aragon-Calvo & Szalay (2013): haloes in  
voids could accrete gas from the cosmic  
web in a steady and coherent way for  
long periods of time*

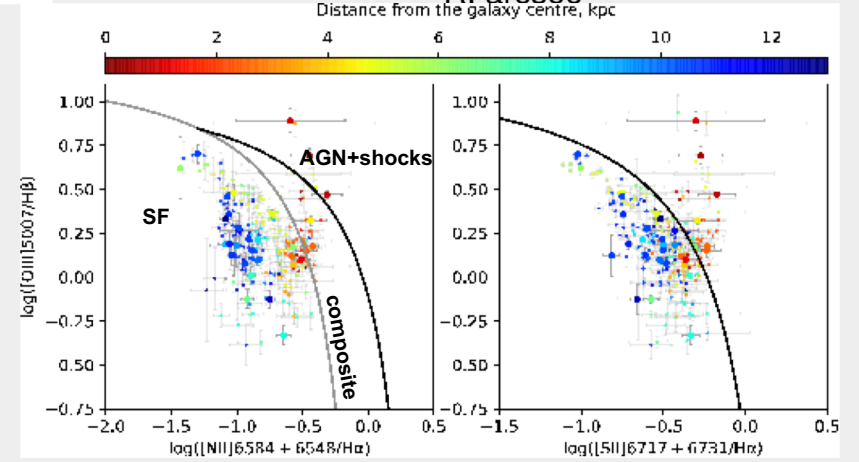
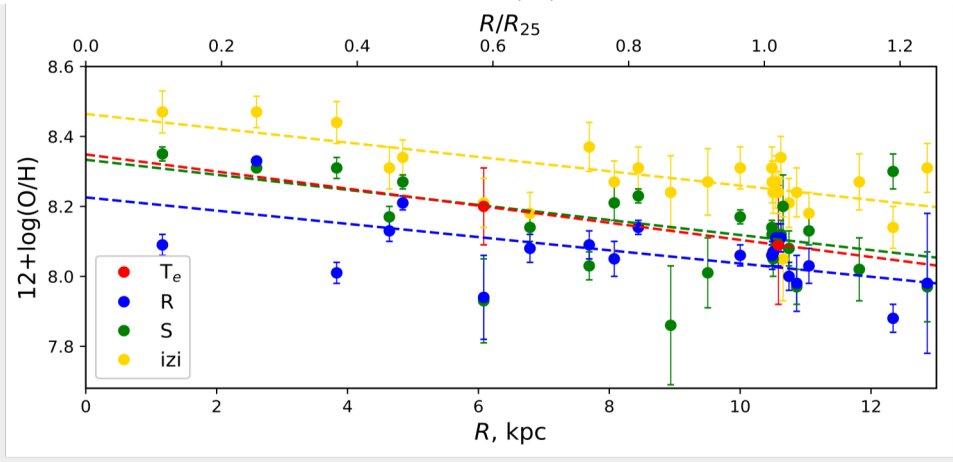
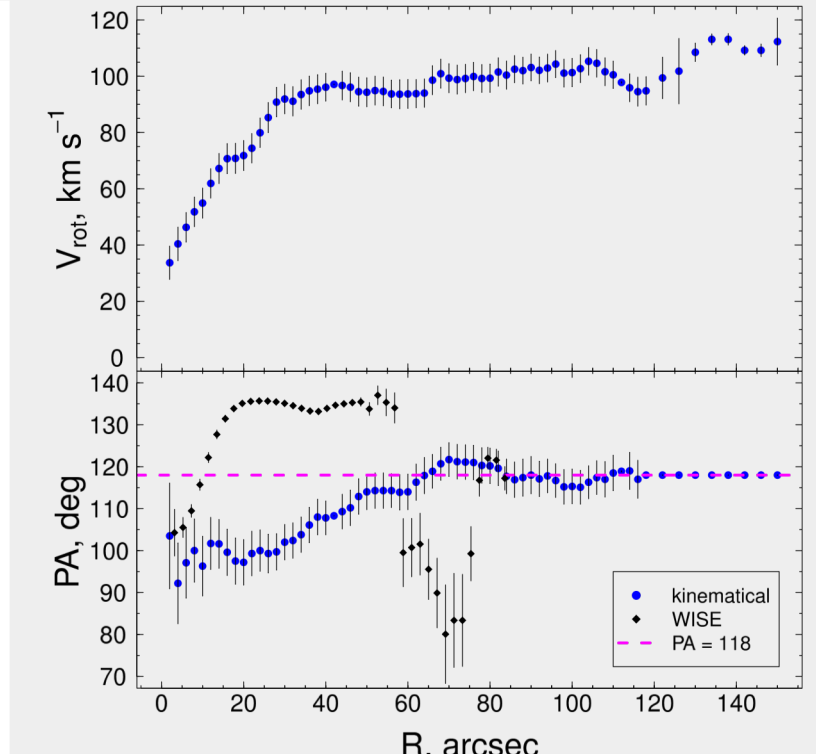
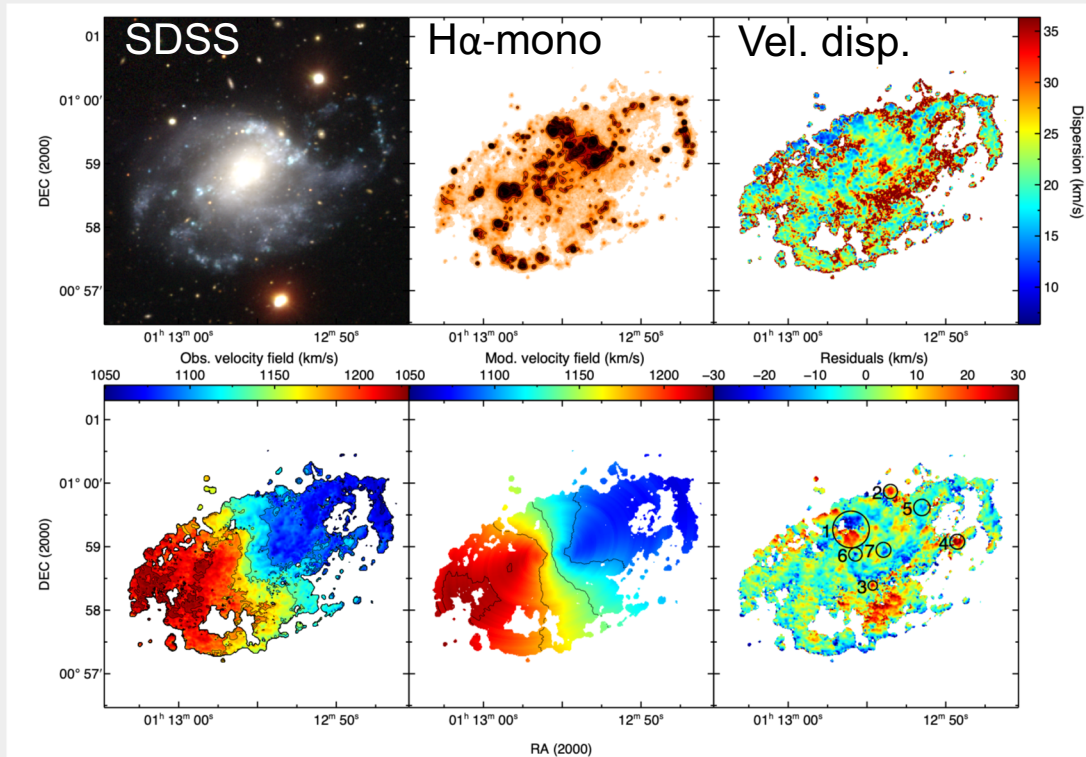
# ***Ionized gas kinematics***



Fabry-Perot interferometer  
SCORPIO-2  
Russian 6m telescope  
(SAO RAS)

+ photometry  
with 2.5m telescope  
of SAI MSU  
(Russia)

# NGC 428



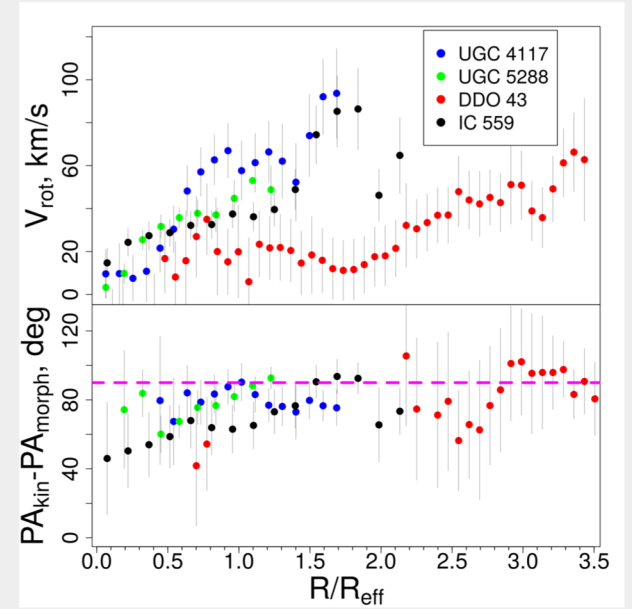
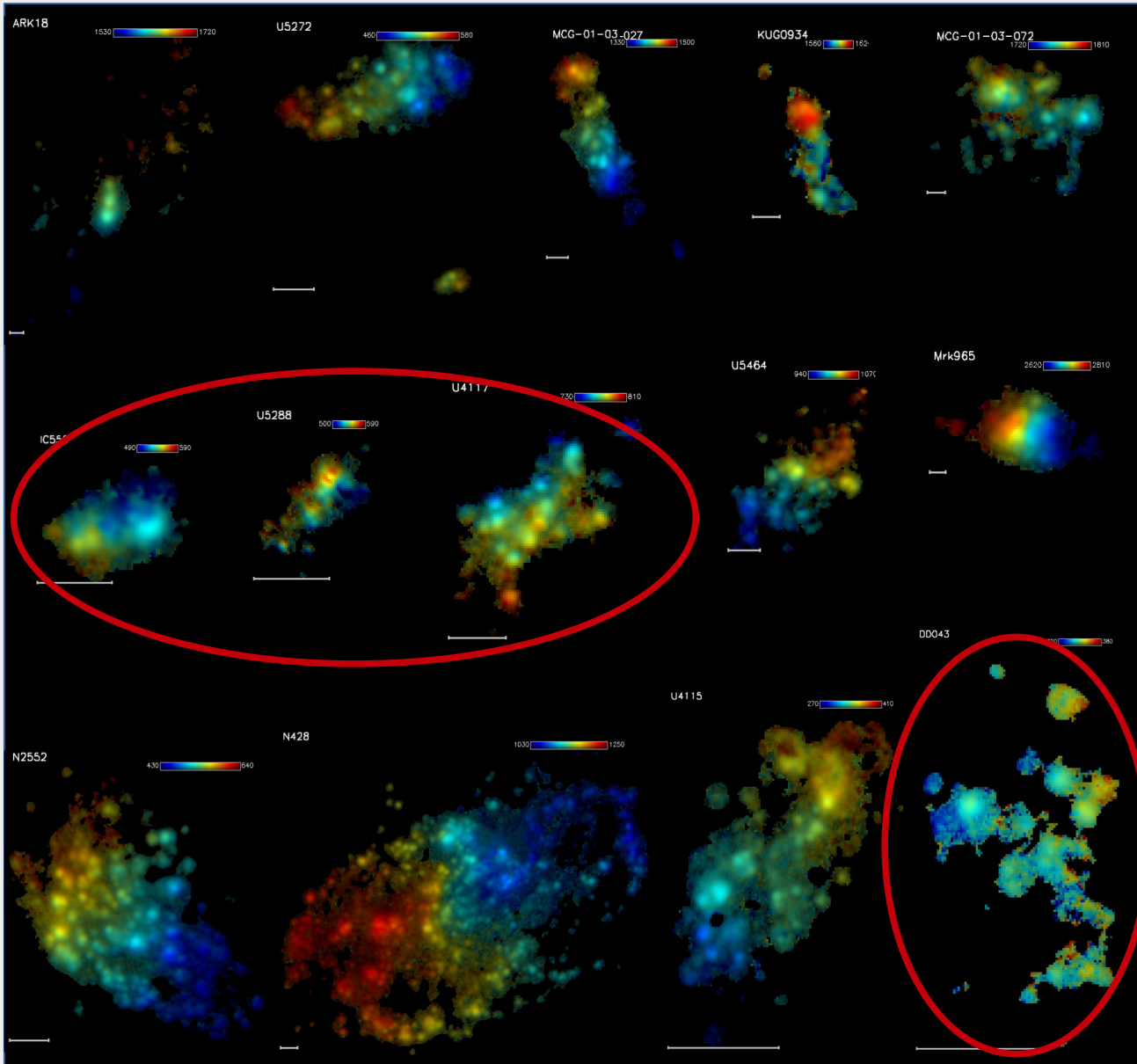
Velocity field is well described by pure circular rotation in a thin flat disc with streaming motions in the central bar

**BUT** some indications of recent accretion event

*Egorova, Moiseev, Egorov, 2019*



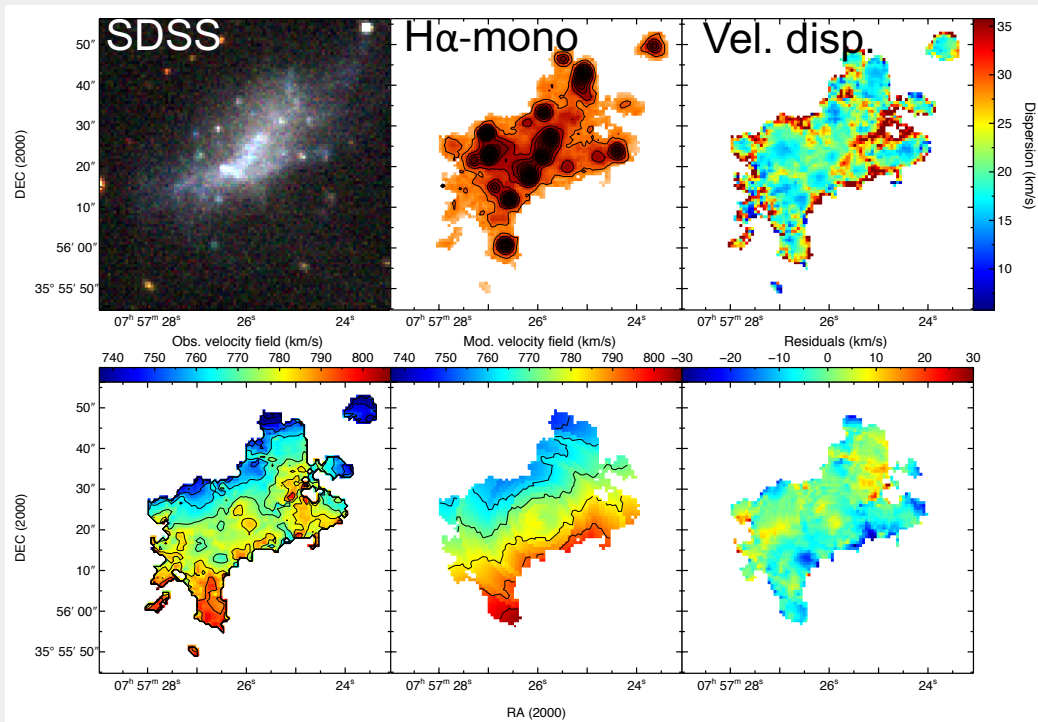
# ***Ionized gas kinematics***



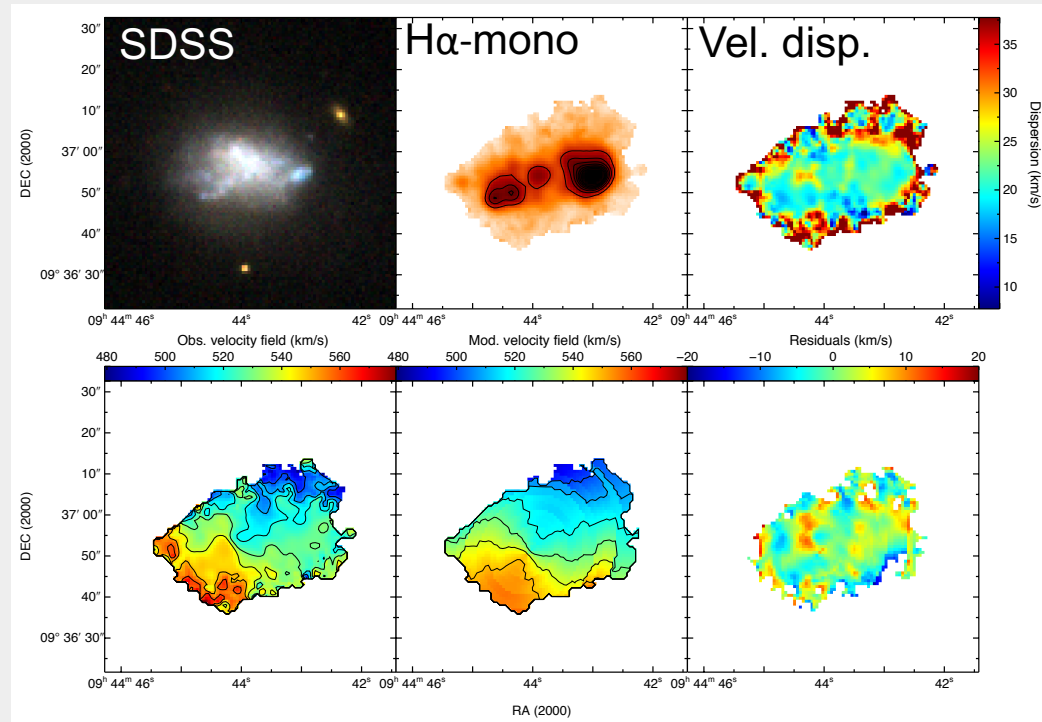
These objects are **isolated**

# Strongly misaligned galaxies

## UGC 4117

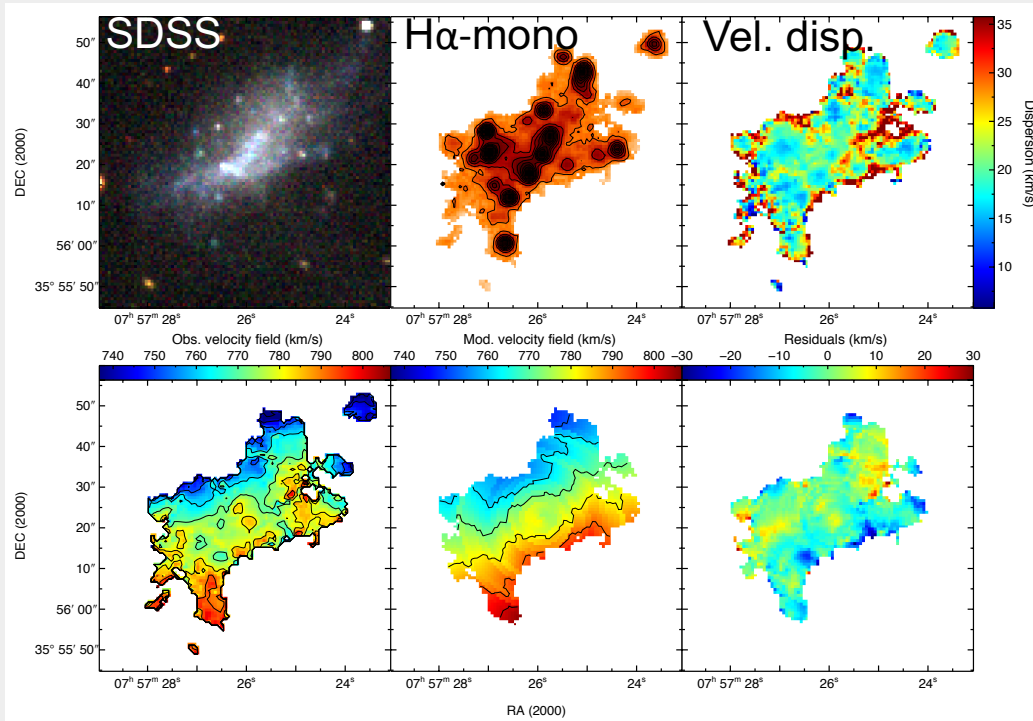


## IC 559

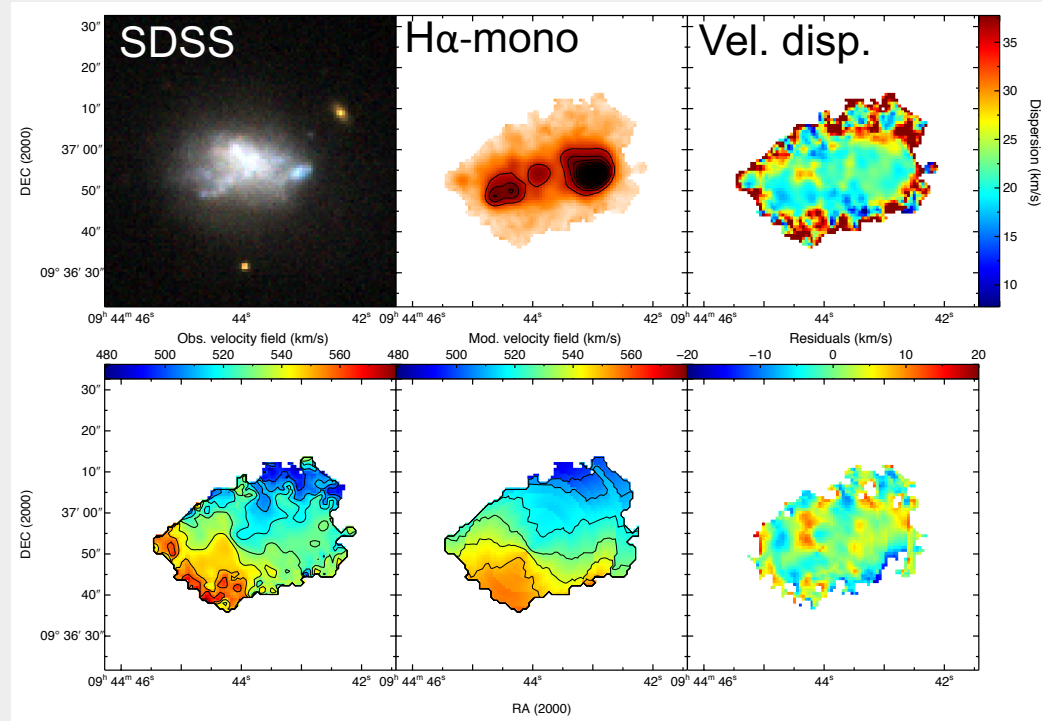


# Strongly misaligned galaxies

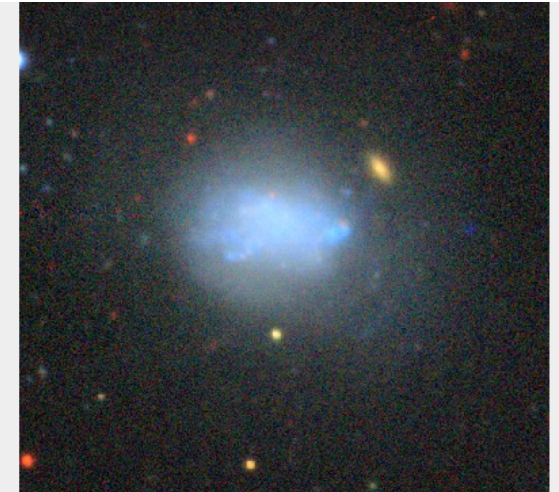
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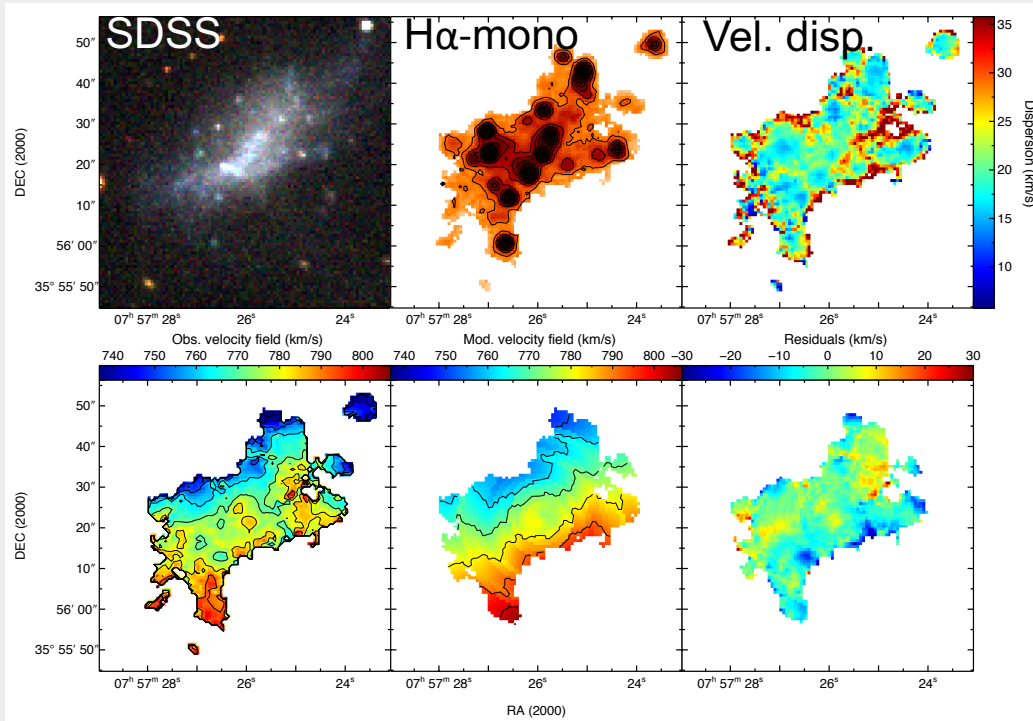


## DECaLS

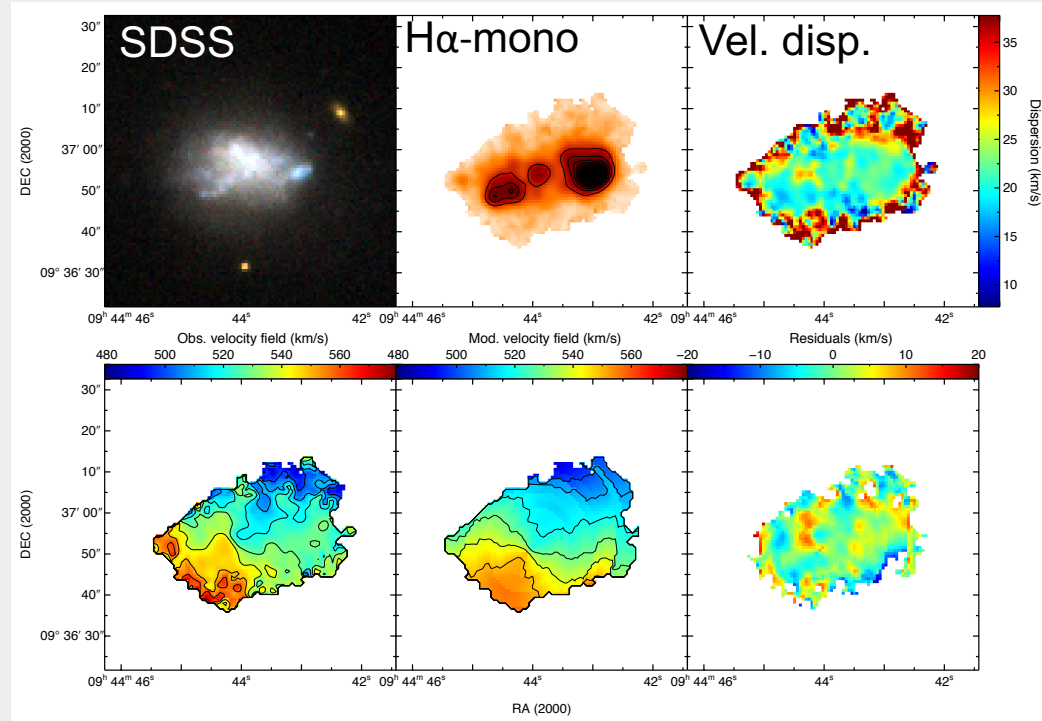


# Strongly misaligned galaxies

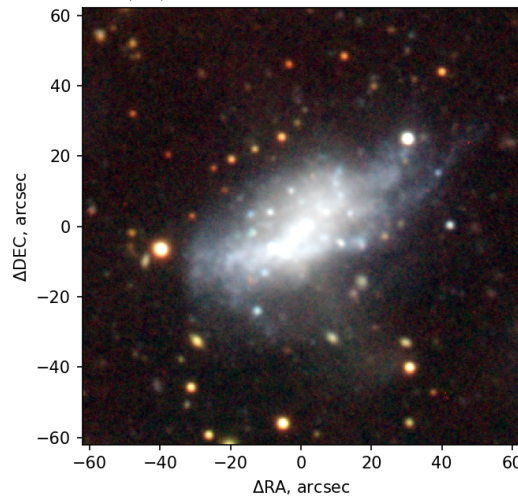
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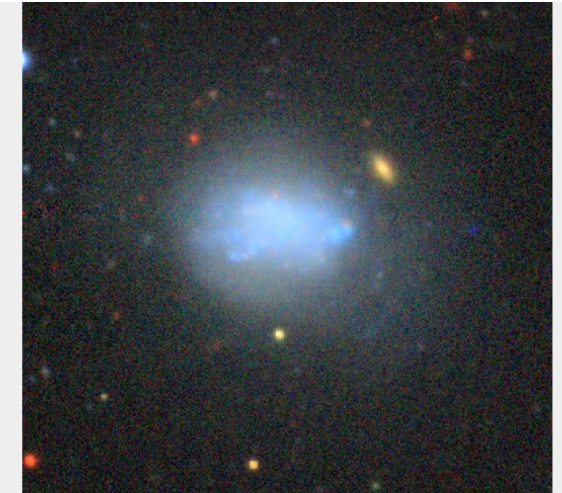


2.5m telescope  
of SAI MSU  
(Russia)



DECaLS

*Egorova et al., in prep.*



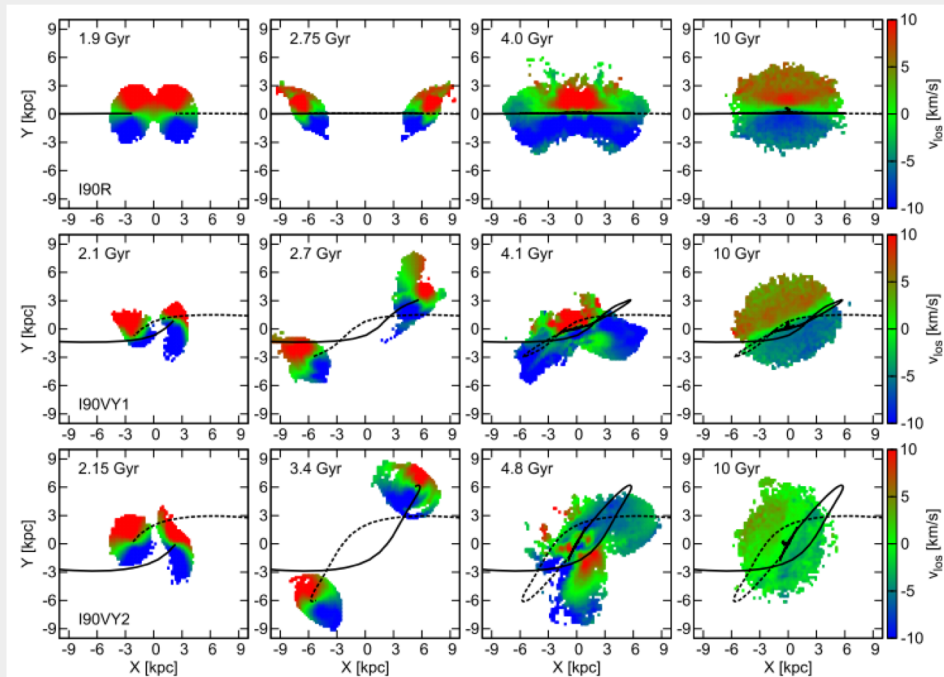
# Strongly misaligned galaxies

The result of merger?

Models of AndII galaxy

Fouquet et al, 2016

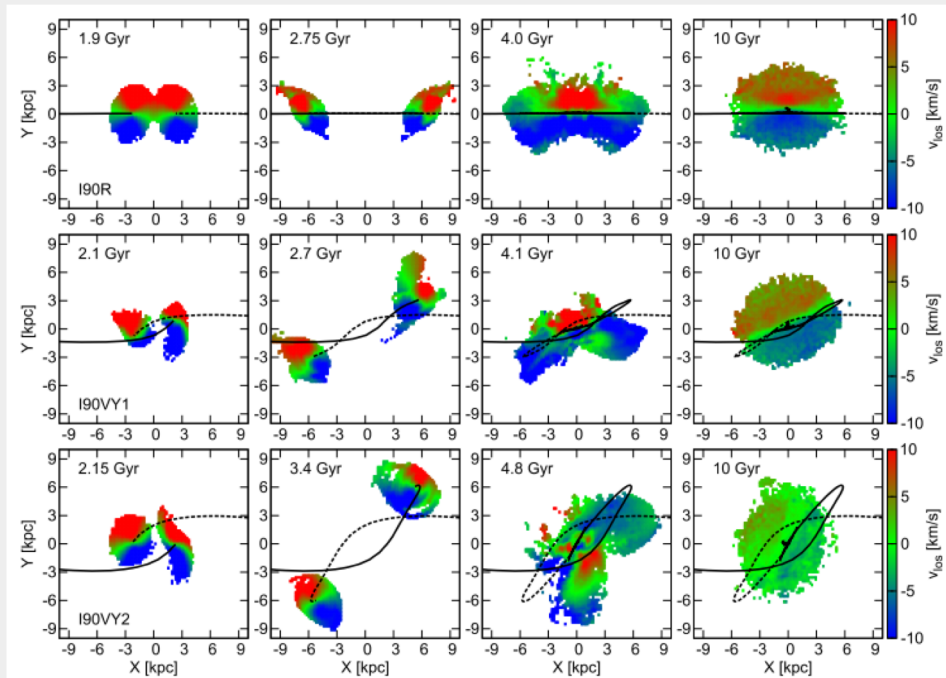
Ebrova&Lokas, 2015, 2017



# Strongly misaligned galaxies

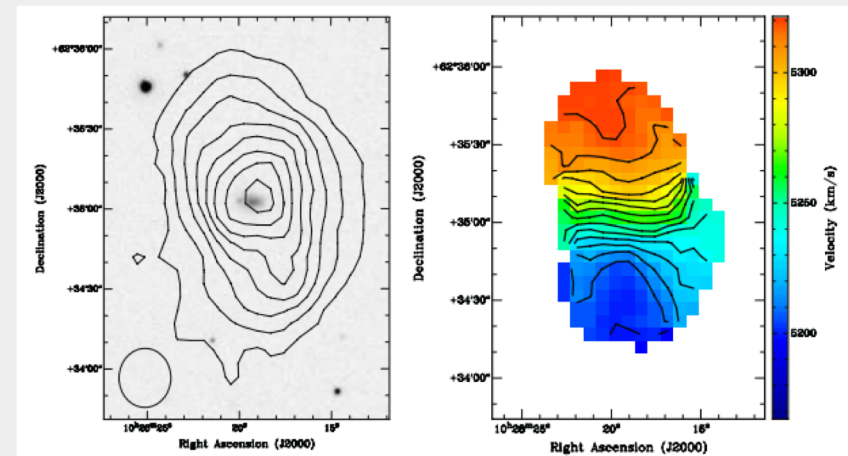
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Cold accretion from filaments?

SDSS J102819.24+623502.6

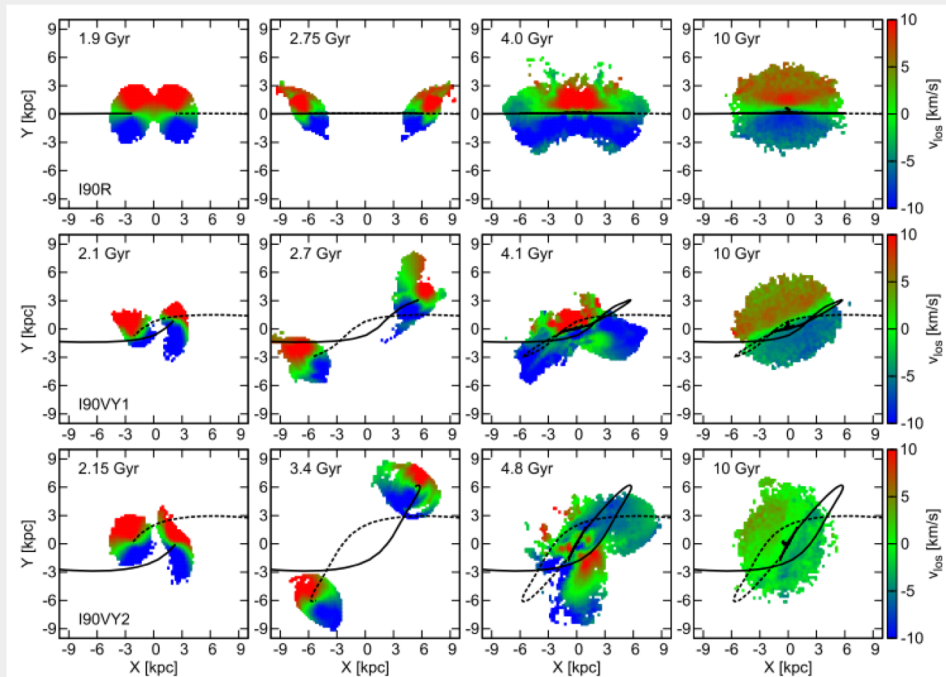


Stanonik et al, 2009

# Strongly misaligned galaxies

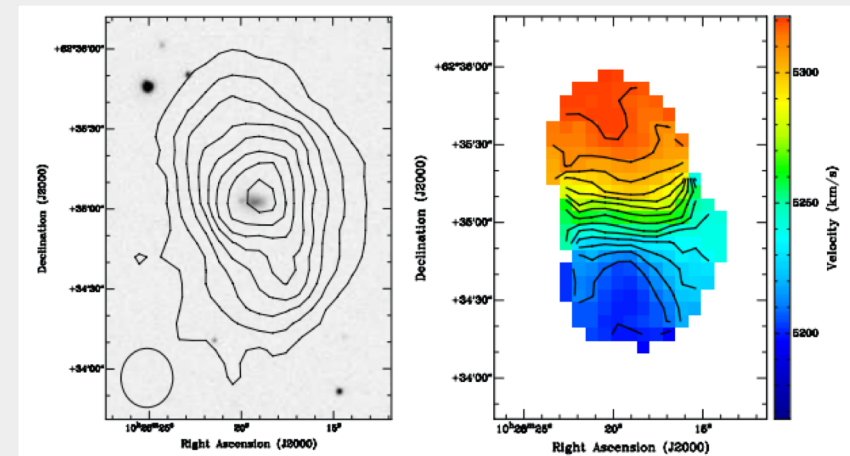
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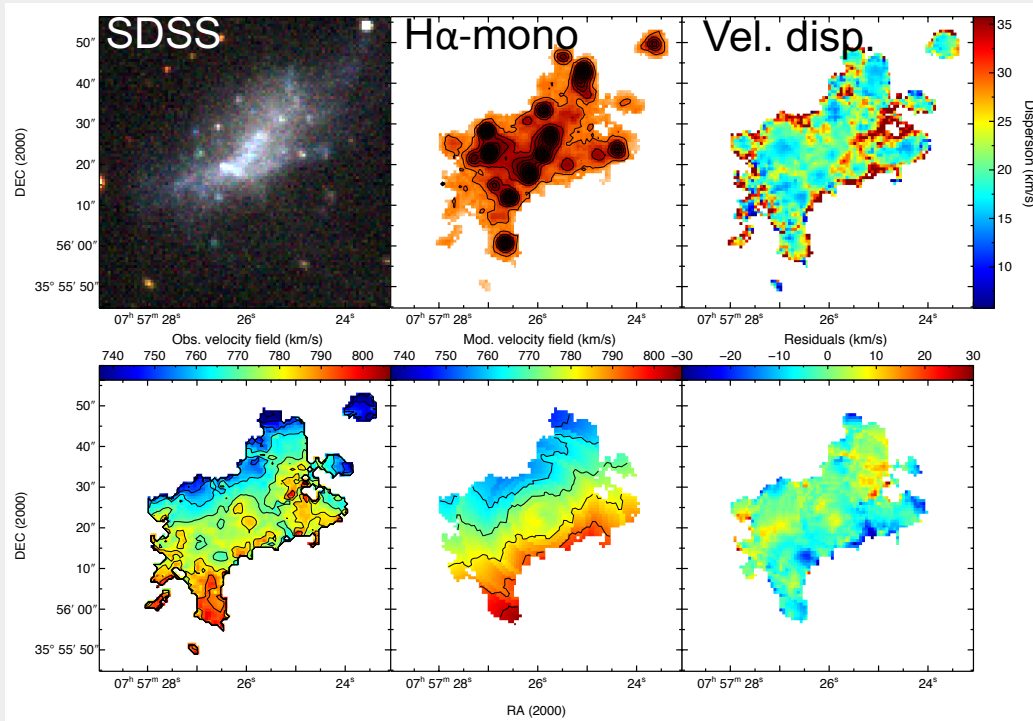


Stanonik et al, 2009

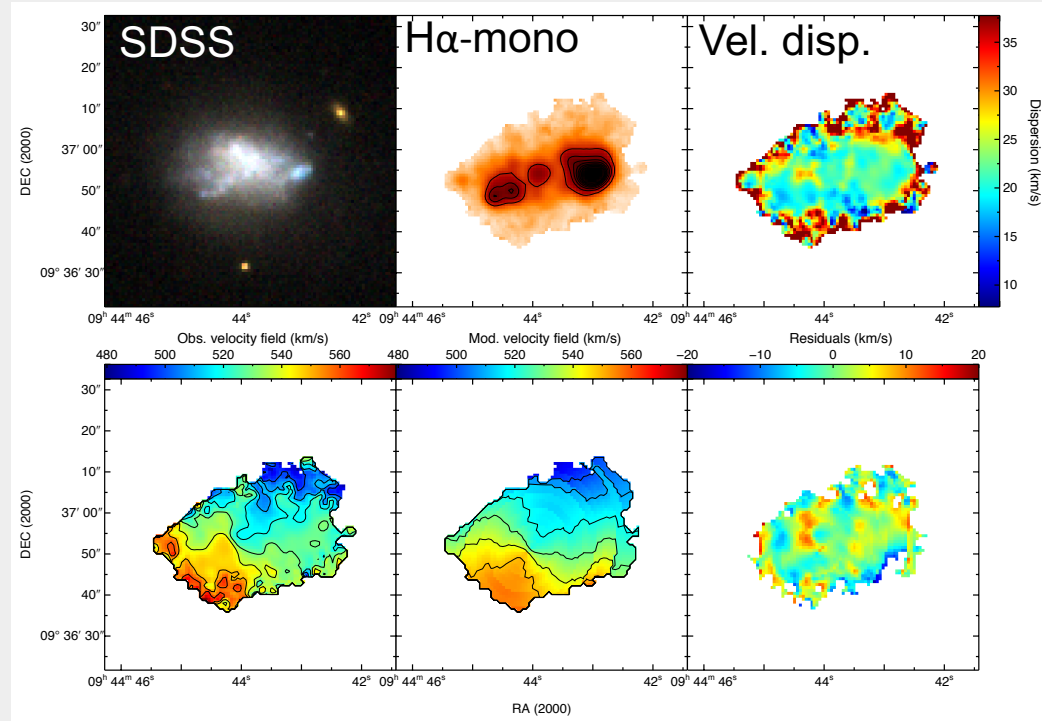
We need data on HI morphology and kinematics + more spectral data

# Strongly misaligned galaxies

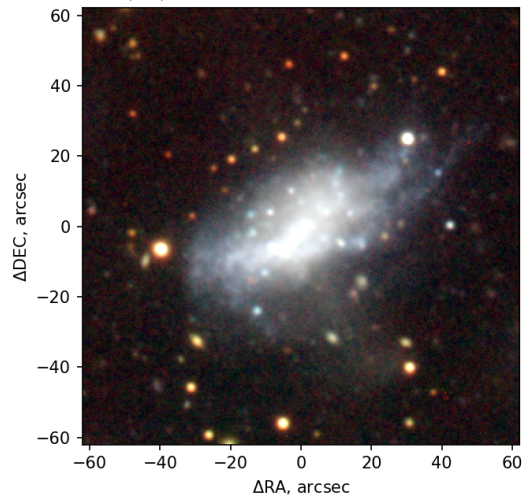
## UGC 4117



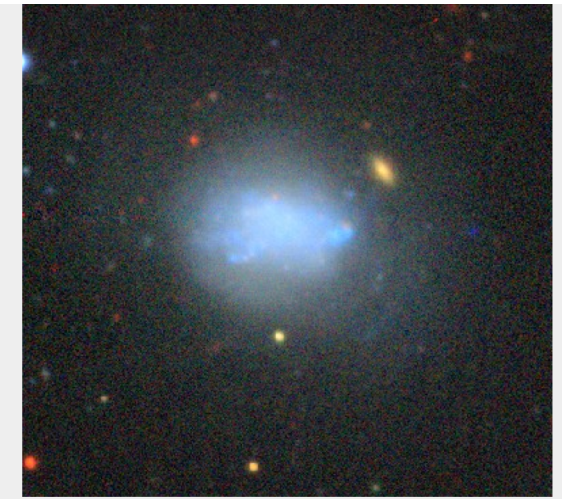
## IC 559



2.5m telescope  
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DECaLS

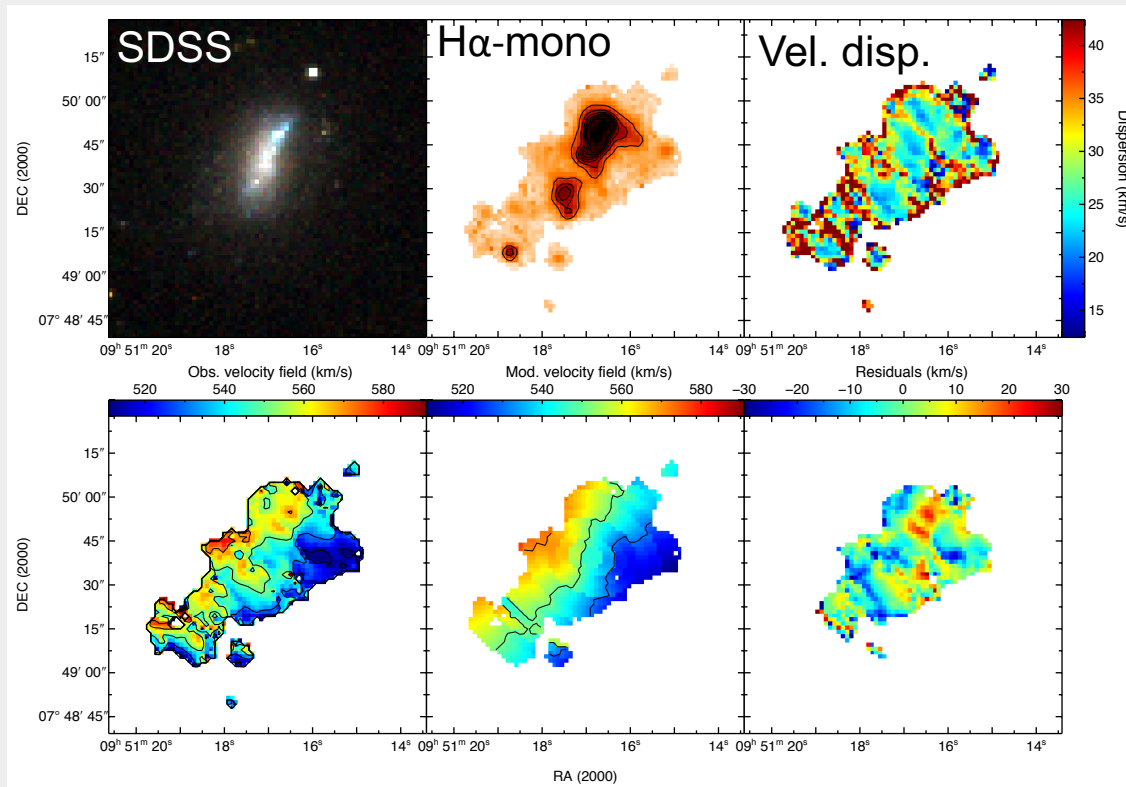


*Egorova et al., in prep.*



# Strongly misaligned galaxies

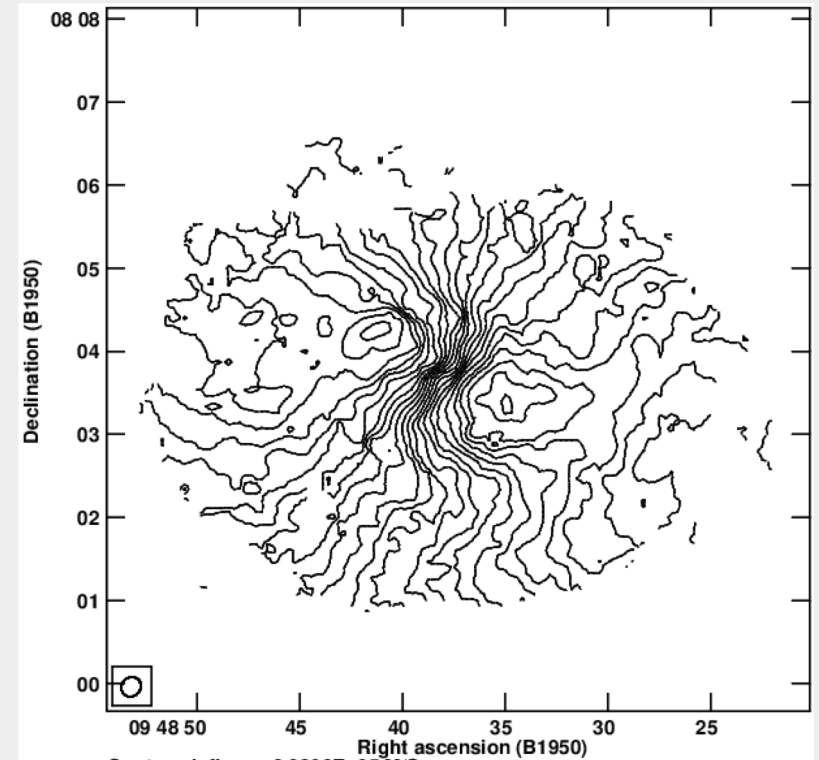
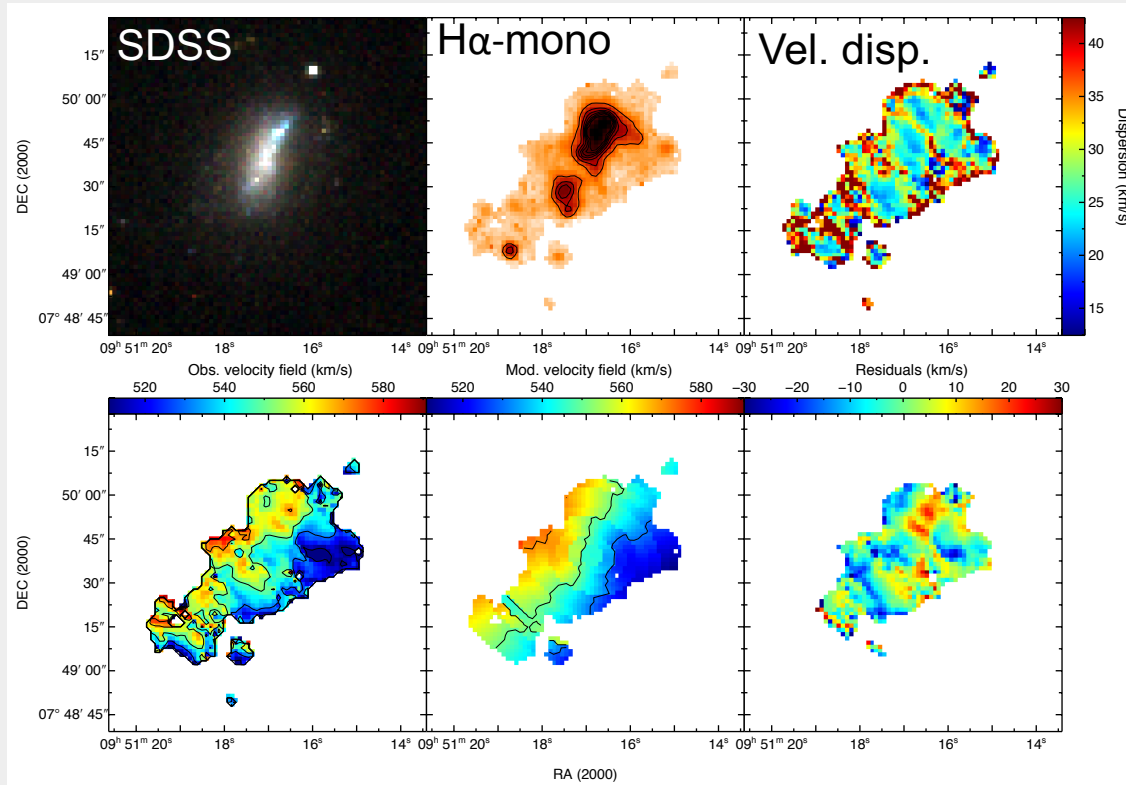
UGC 5288



Egorova et al., in prep.

# Strongly misaligned galaxies

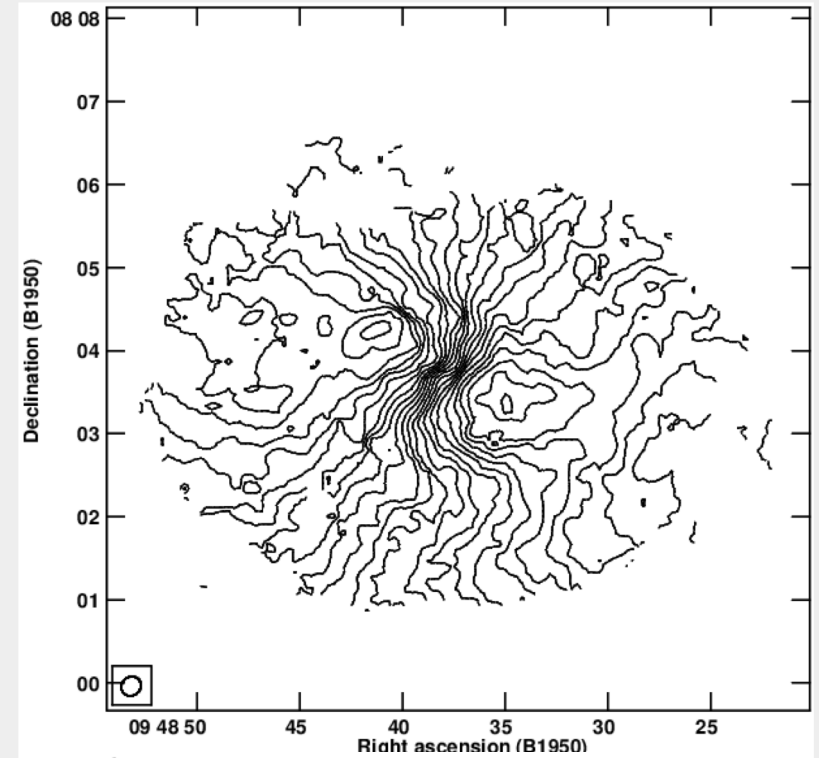
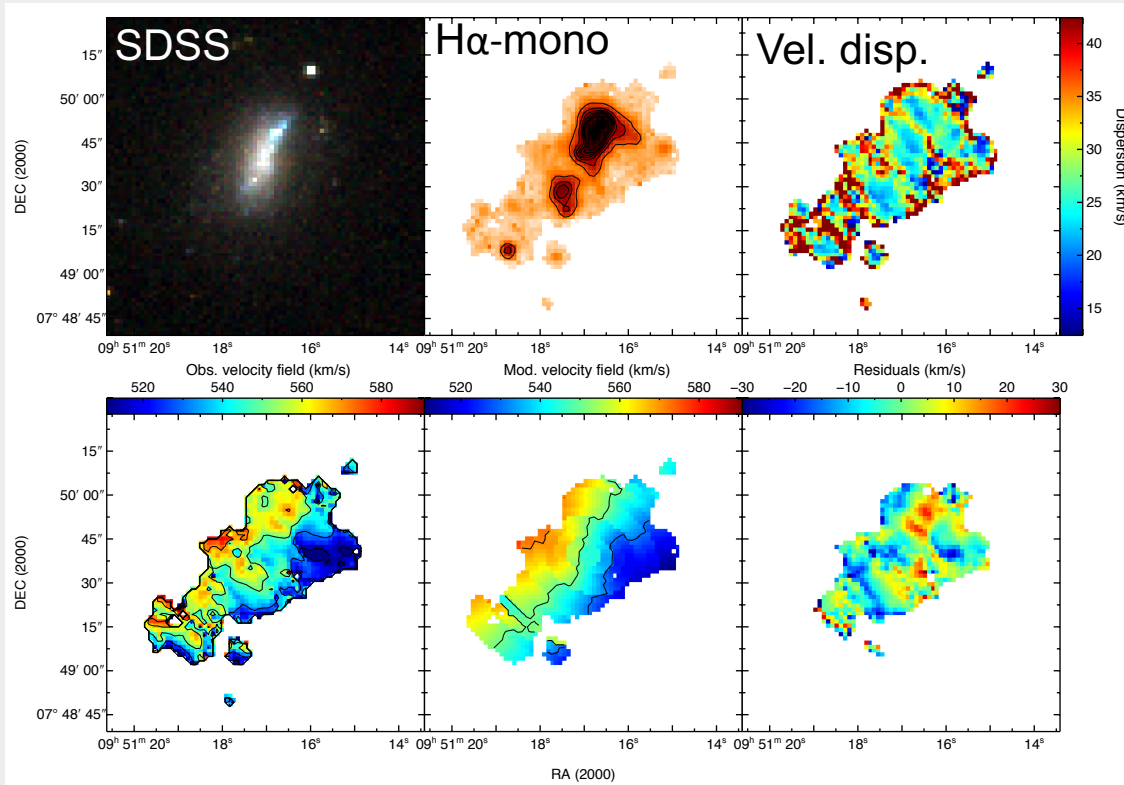
UGC 5288



*Egorova et al., in prep.*

# Strongly misaligned galaxies

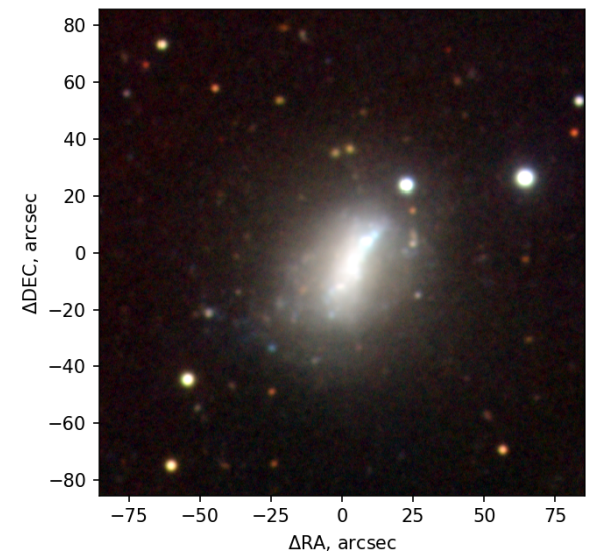
UGC 5288



Bar in low surface brightness disk?  
(van Zee 2004)

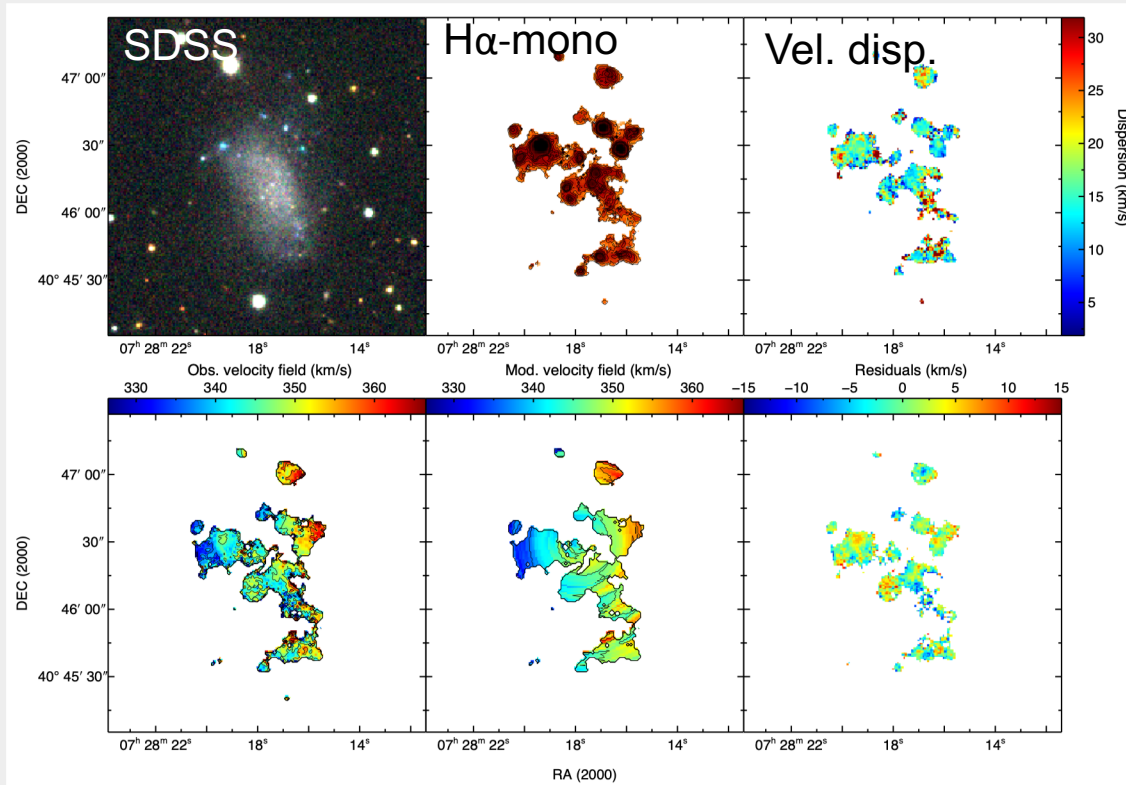
*Egorova et al., in prep.*

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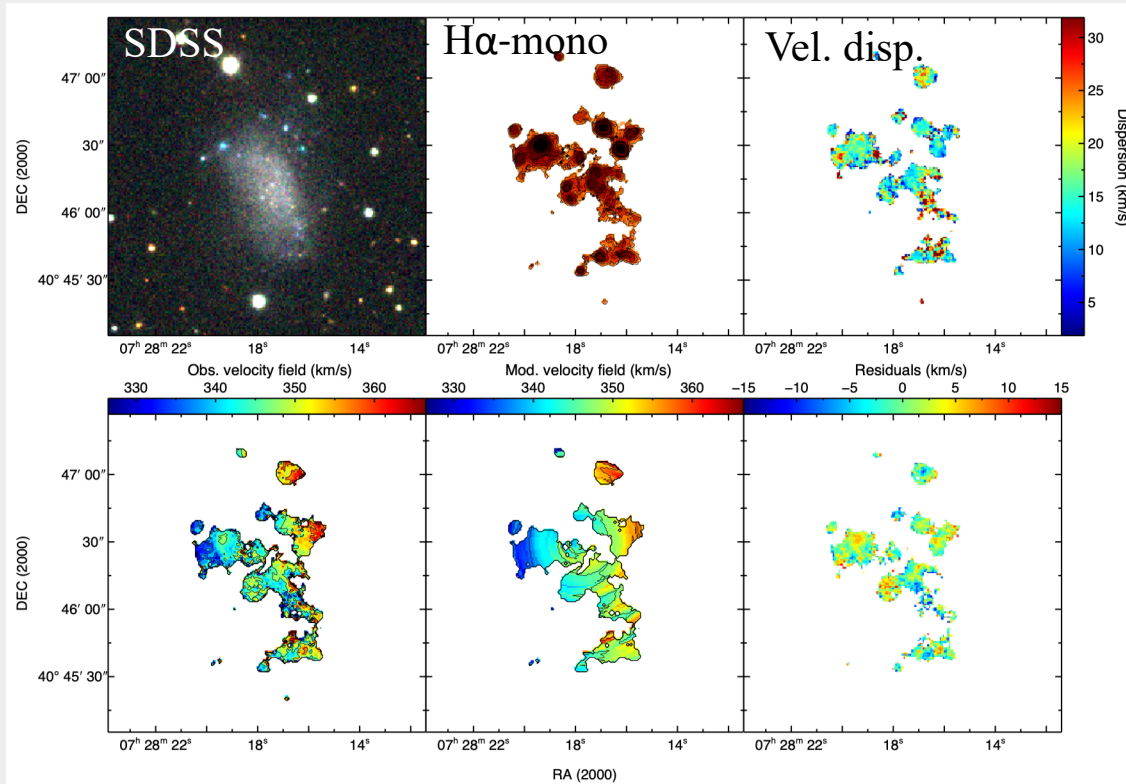
# Strongly misaligned galaxies

DDO43

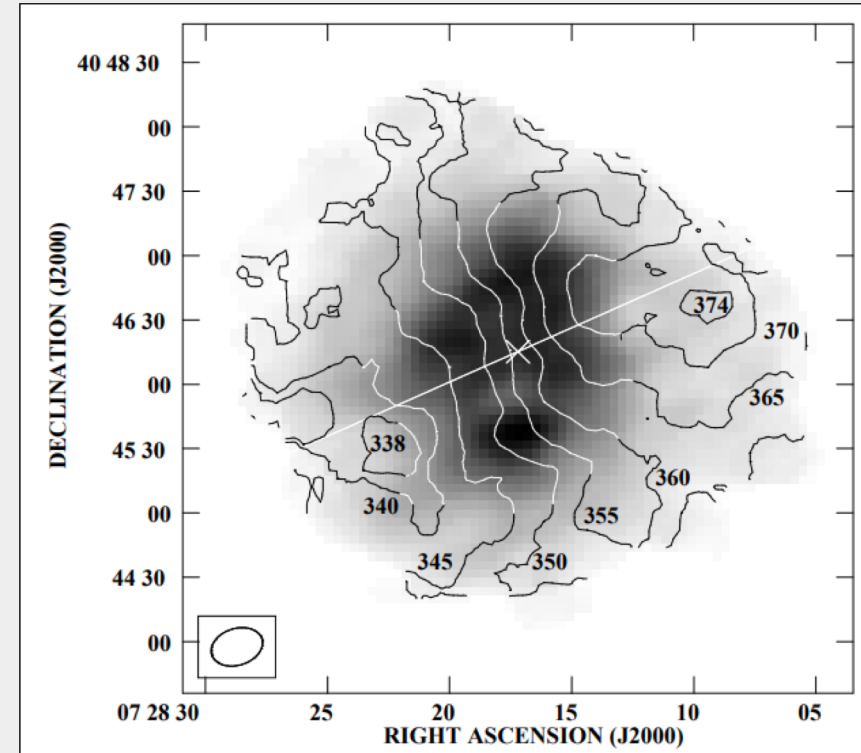


# Strongly misaligned galaxies

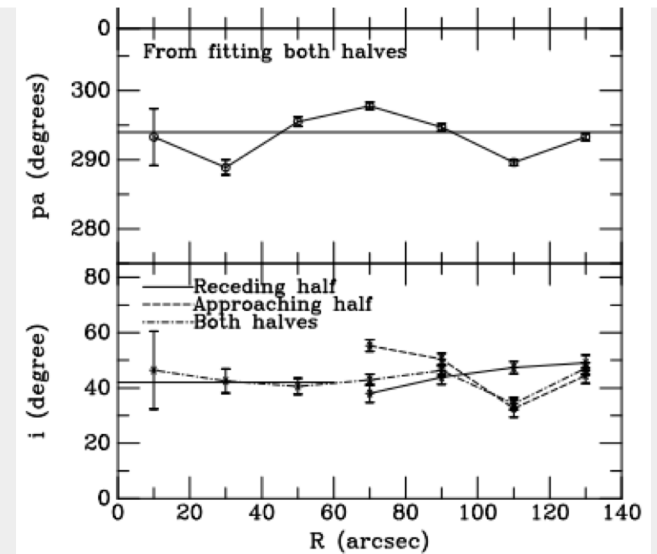
DDO43



Simpson et al., 2005:

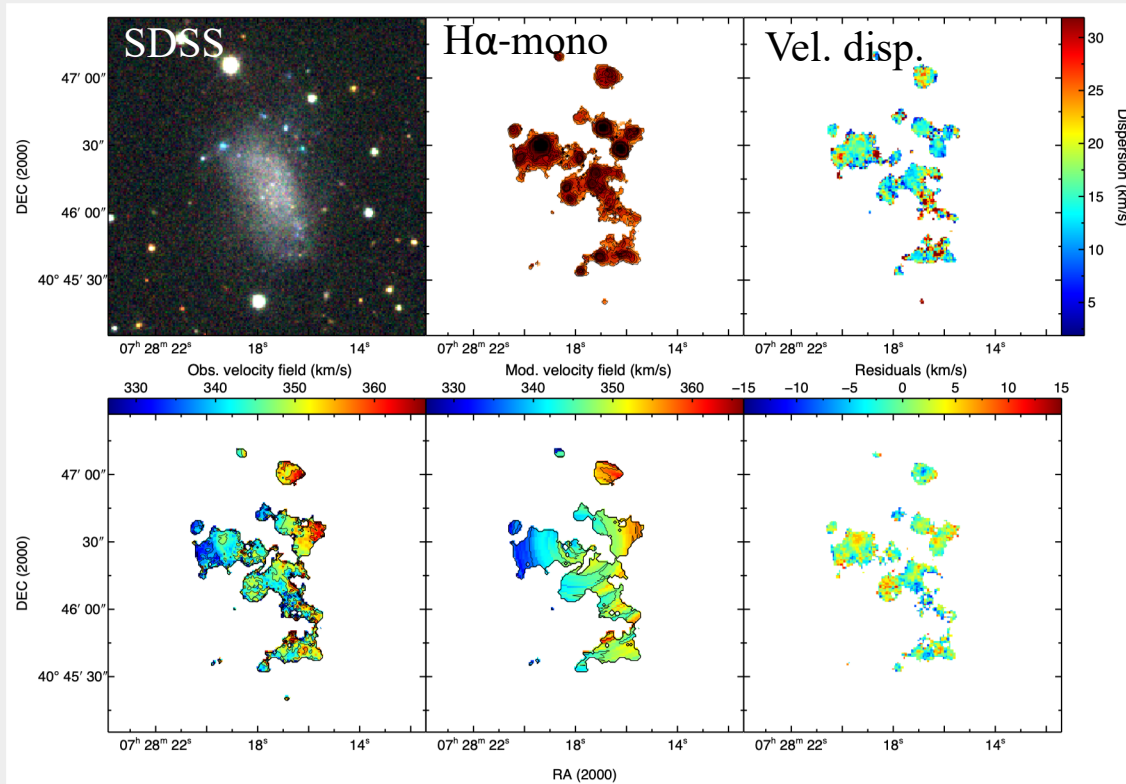


Simpson et al., 2005:[DDO43] probably hosts a large stellar bar: it exhibits boxy elliptical isophotes with a small shift in position angle proceeding from the inner to outer regions, and there is an almost 90° misalignment between the optical (bar) axis and the kinematic axis determined from the H i data.

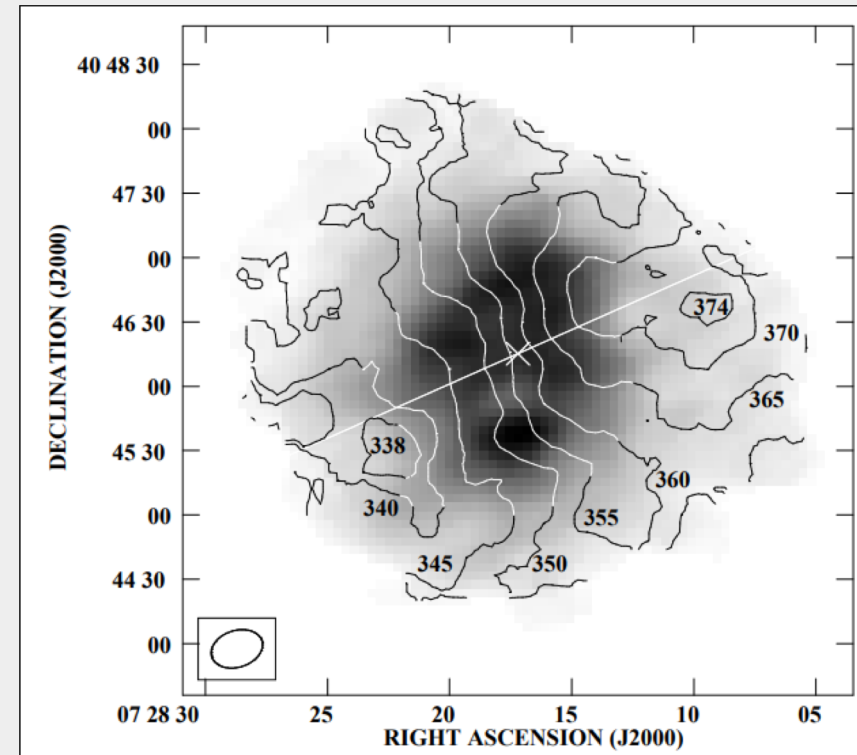


# Strongly misaligned galaxies

DDO43

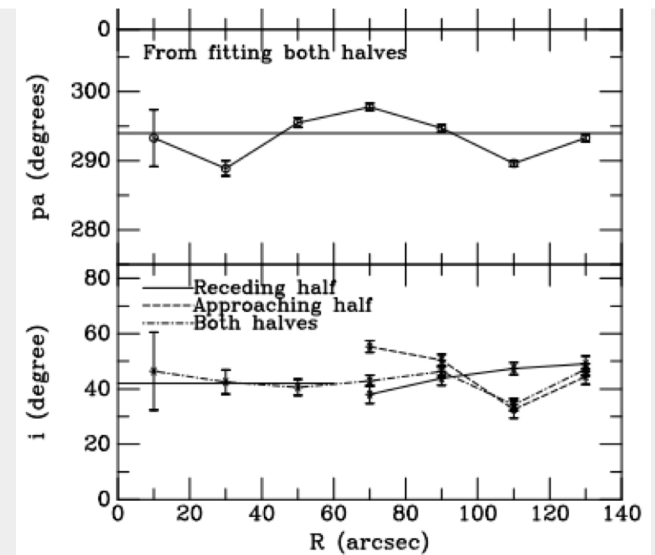


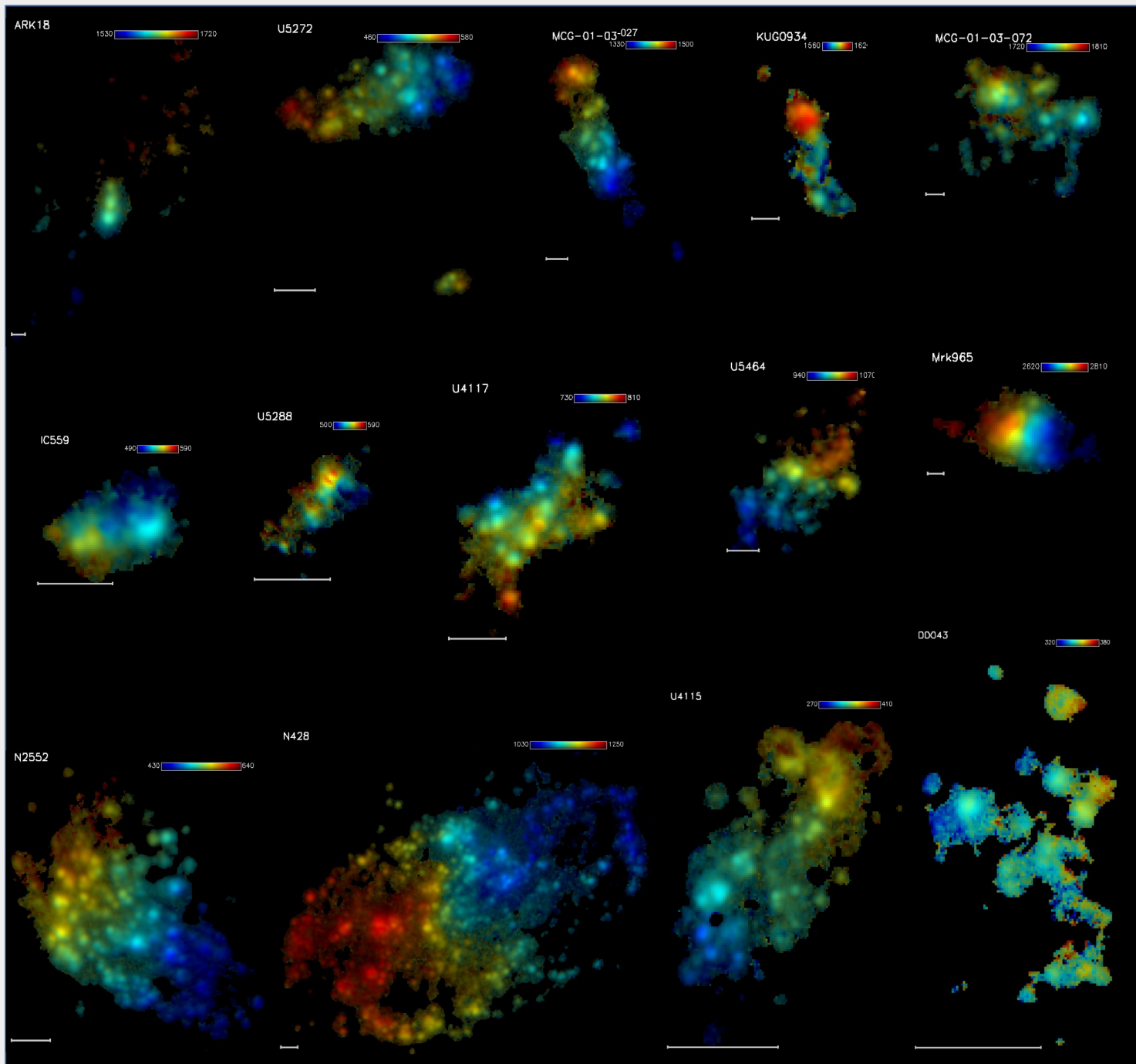
Simpson et al., 2005:



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Moiseev, Mustsevoi 2000





# ***Summary***

- A sample of void galaxies was selected according to their reduced metallicity (in comparison with the reference 'metallicity - luminosity' relation) and/or signs of disturbances in the optical morphology
- With our selection criteria we found several isolated objects with strong misalignment between morphology and kinematics
- Possible mechanisms for formation of such objects: in the case of UGC4117, IC 559 mergers or (less probable) cold accretion from filaments, in the case of UGC5288 and DDO43 — we may see the stellar bar in LSB/gaseous disk

***Thank you!***