

# **Analysis of shape parameters of early-type lensing galaxies and testing the existence of dark matter haloes**



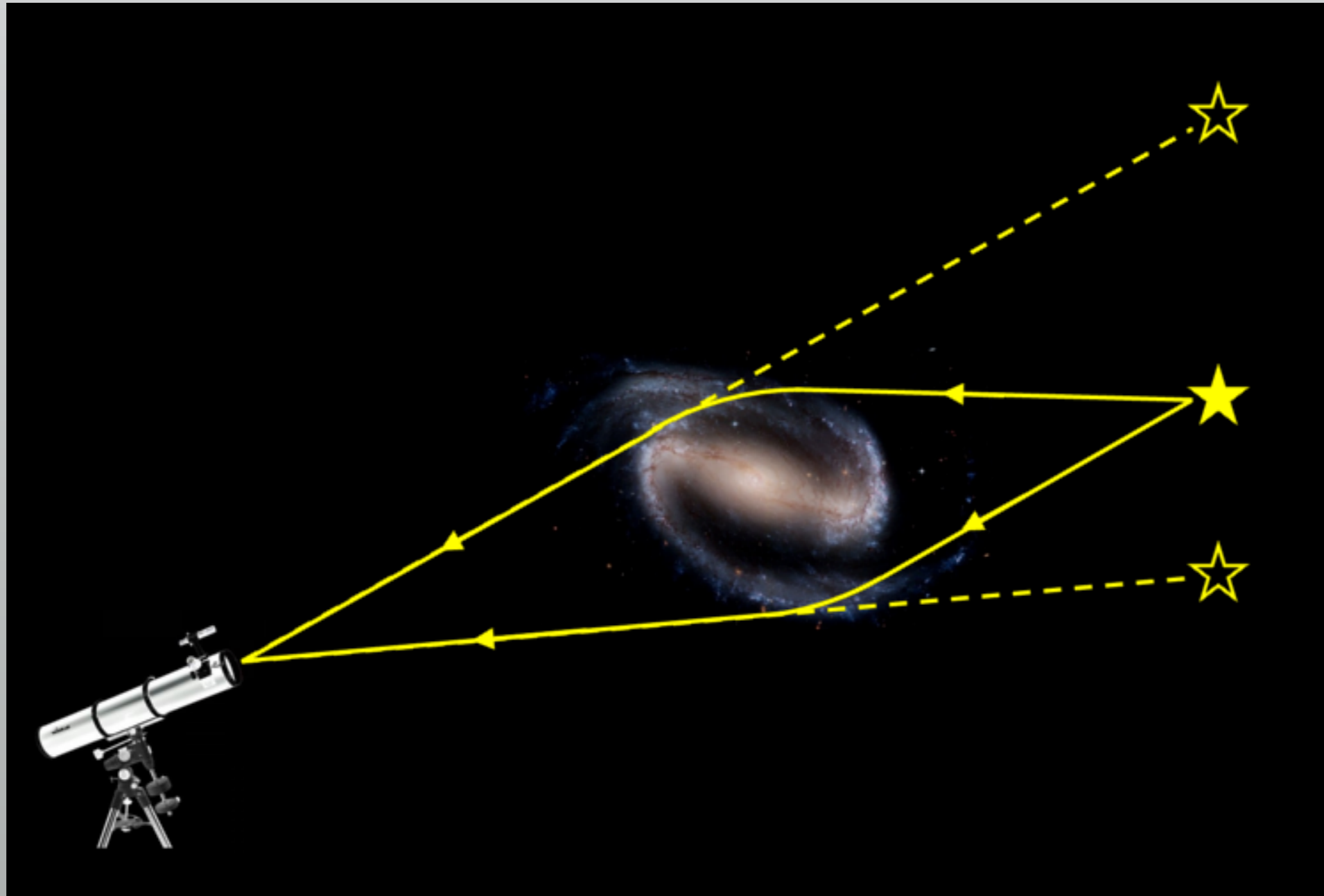
4th CosPa Meeting  
UMons  
May 20, 2015

Judith Biernaux  
Groupe OrCA - AGO  
Université de Liège

## Dark matter halos



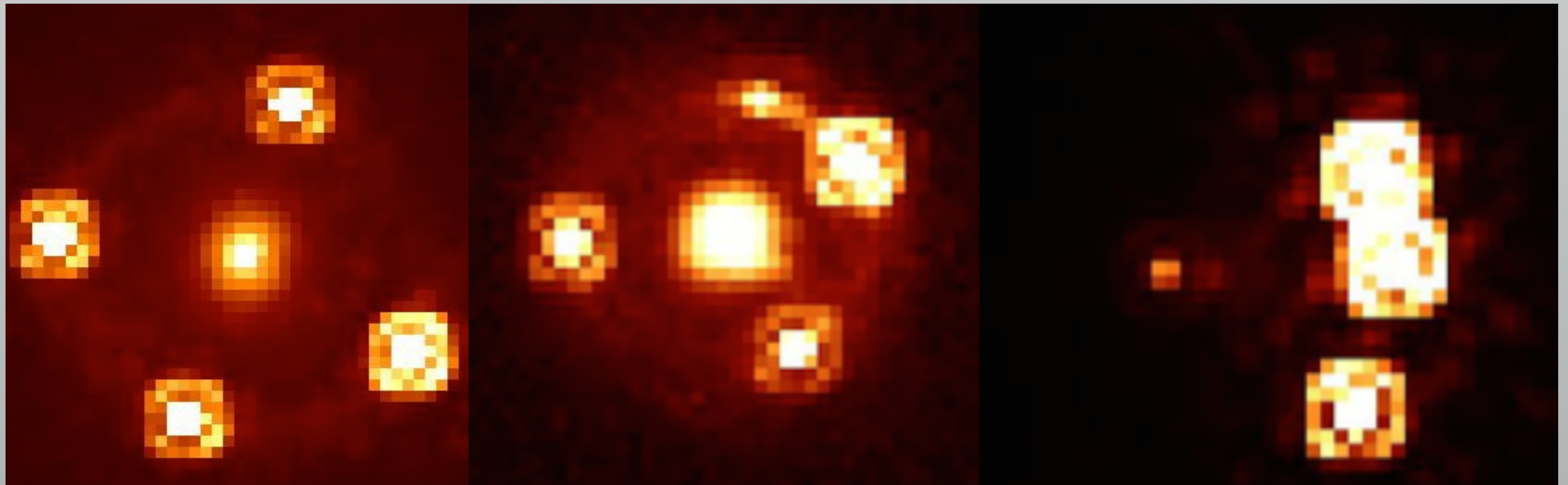
# Gravitational lensing





## Gravitational lensing images

- Lots of diffuse components (lensed arcs, ...)
- Parasite signal from the lensed images



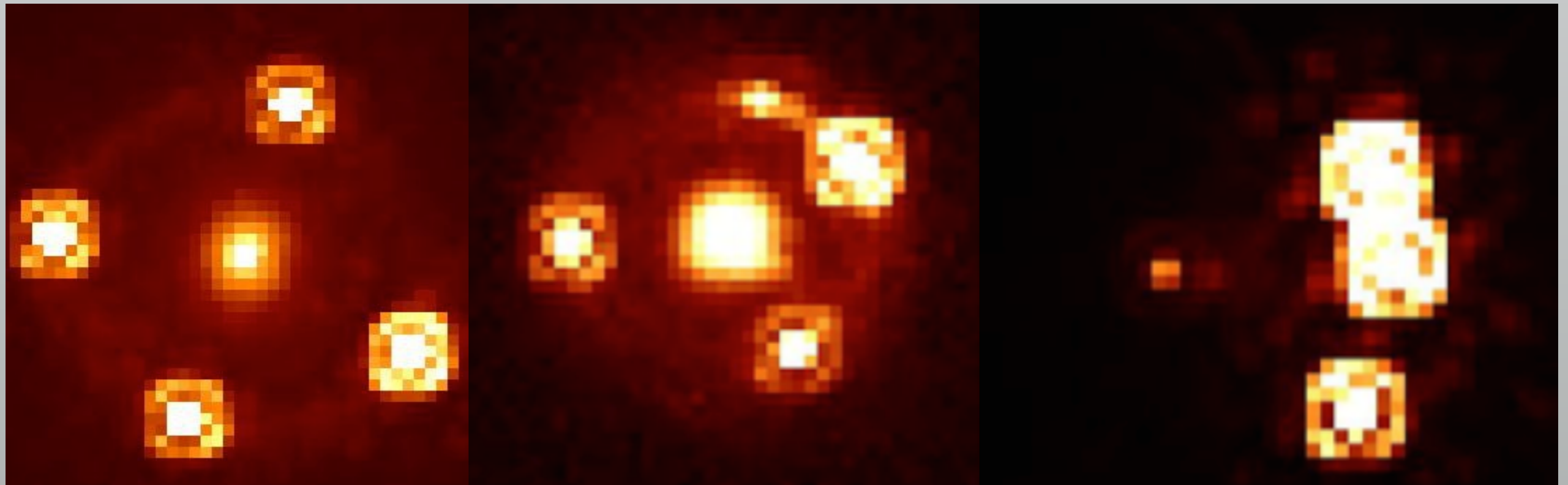
HE0435-1223

SDSS0924+0219

B1422+231

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**HE0435-1223**

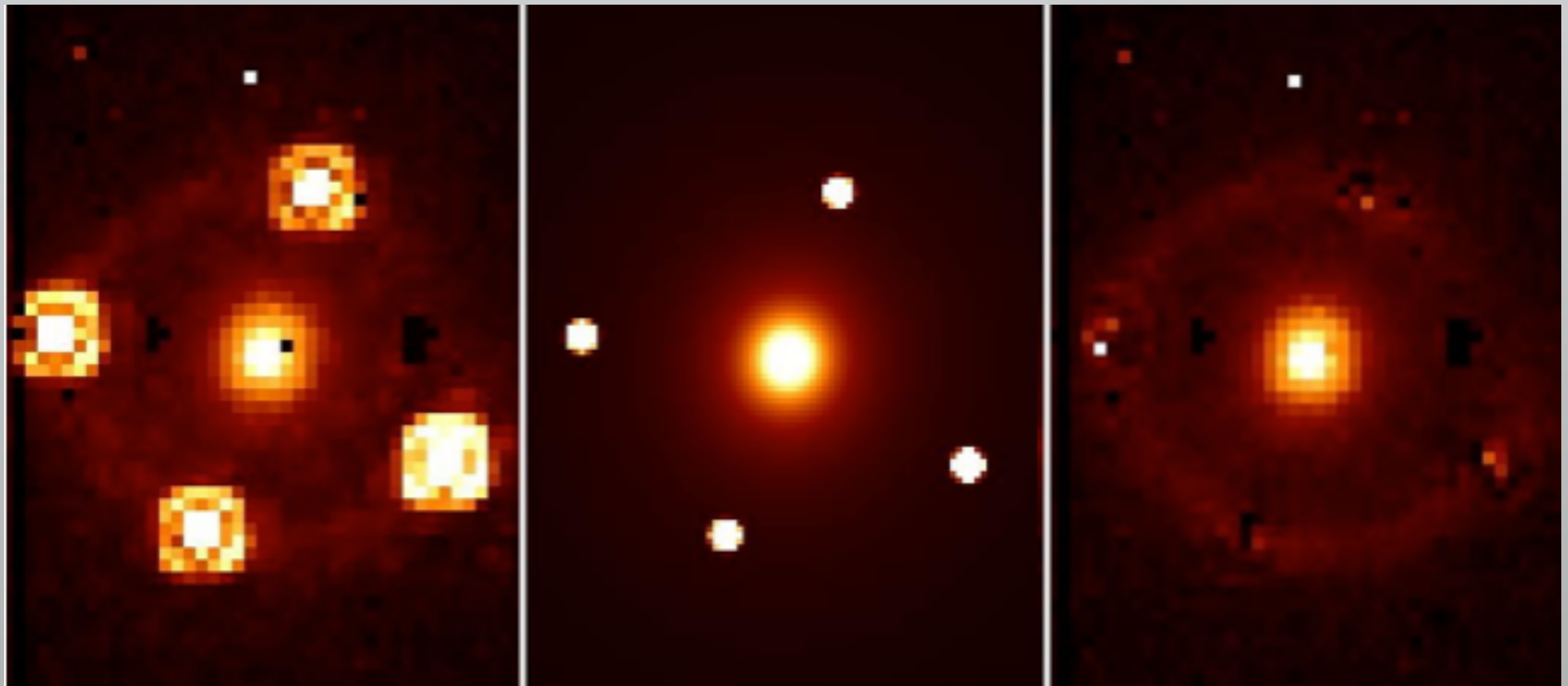
**SDSS0924+0219**

**B1422+231**

## **Gravitational lensing images**

- Lots of diffuse components (lensed arcs, ...)
- Parasite signal from the lensed images
  - ➔ Need to subtract that influence
  - ➔ Deconvolution using MCS algorithm (Magain, Courbin & Sohy, 1998)
  - ➔ Subtraction of the lensed images

## Gravitational lensing images



HE0435-1223

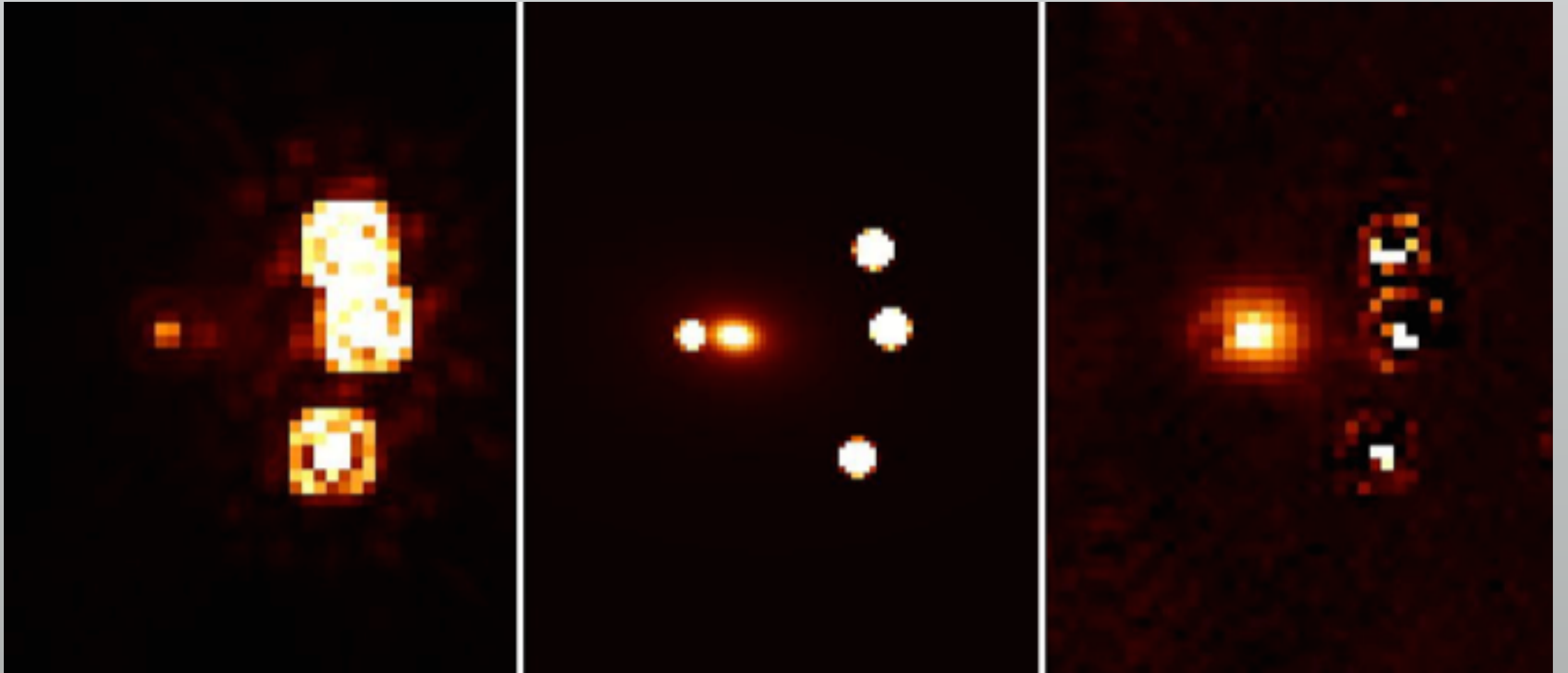
## Gravitational lensing images



**SDSS0924+0219**



# Gravitational lensing images



**B1422+231**

## The local minima issue

$$I(r) = I_{eff} \exp\left\{-k\left[\left(\frac{r}{r_{eff}}\right)^{1/4} - 1\right]\right\}$$

- Classical fit : minimizing a merit function in a p-dimensional space (p = # parameters)
  - ➔ Local minima

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**Independent measurement of each shape parameter is needed (ellipticity, PA, effective (half-light) radius)**

## Effective radius

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**Independent measurement of each shape parameter is needed (ellipticity, PA, effective (half-light) radius)**

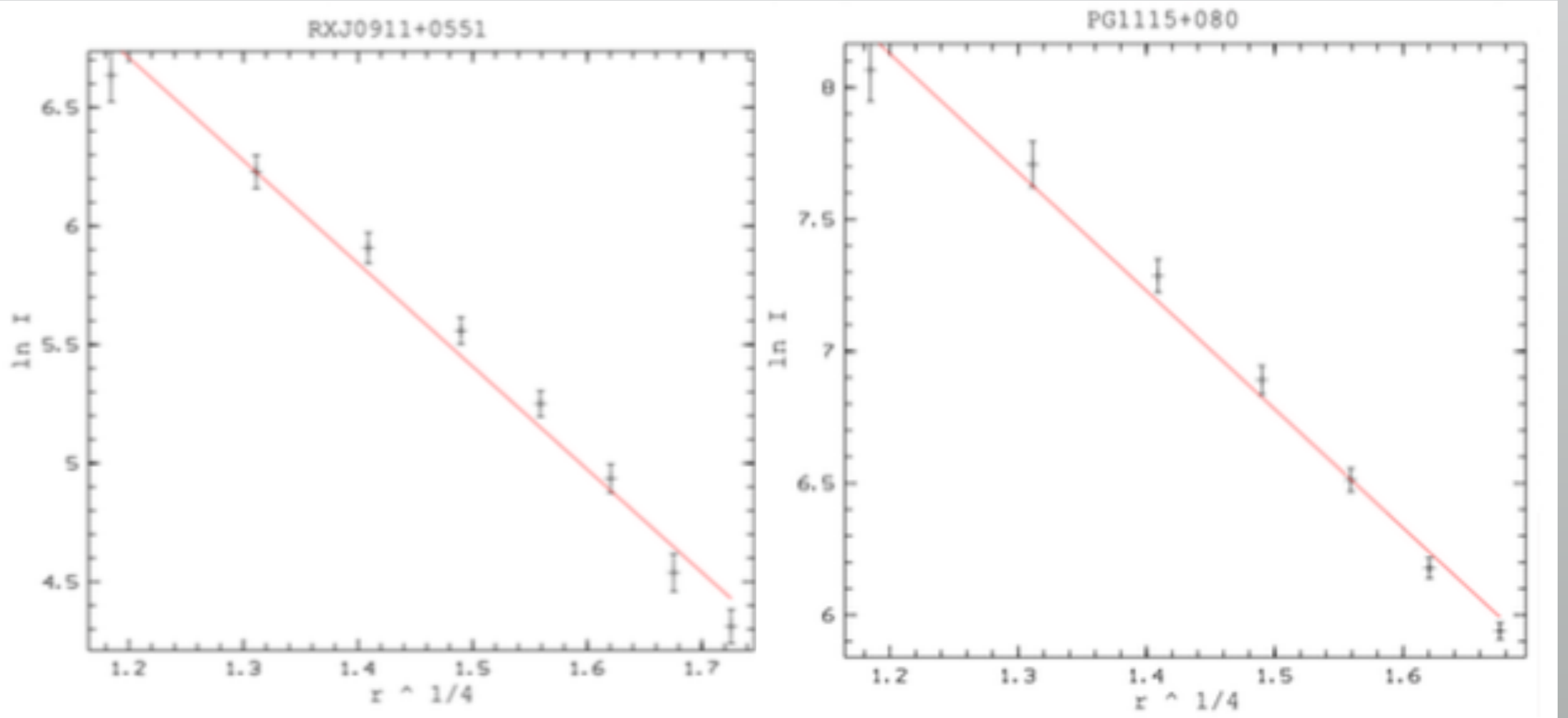
Effective (half-light) radius : **linear regression**

$$\ln I = \ln I_{eff} - k \left( \frac{r}{r_{eff}} \right)^{1/4} - k$$

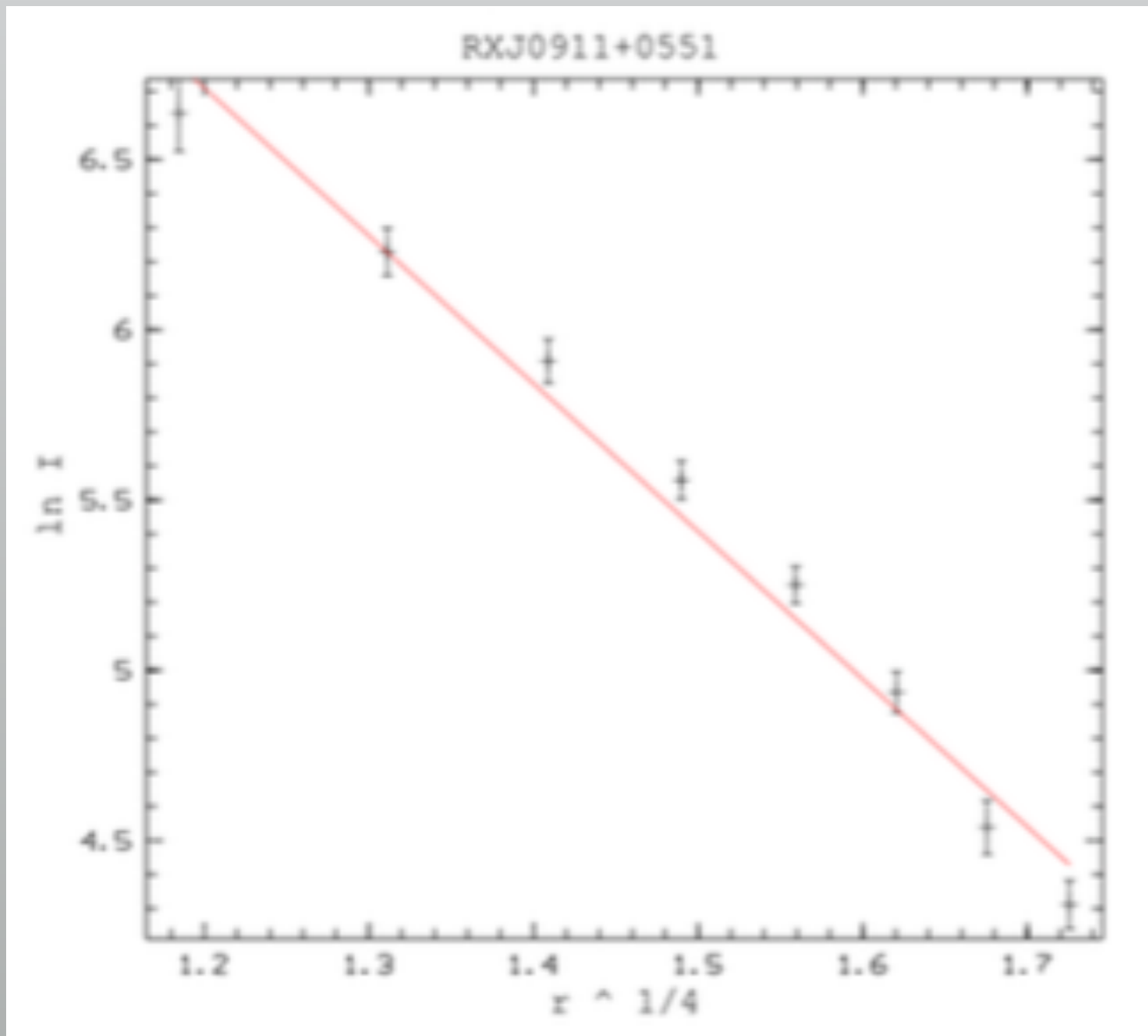
slope :  $s = -\frac{k}{r_{eff}^{1/4}}$



## Effective radius

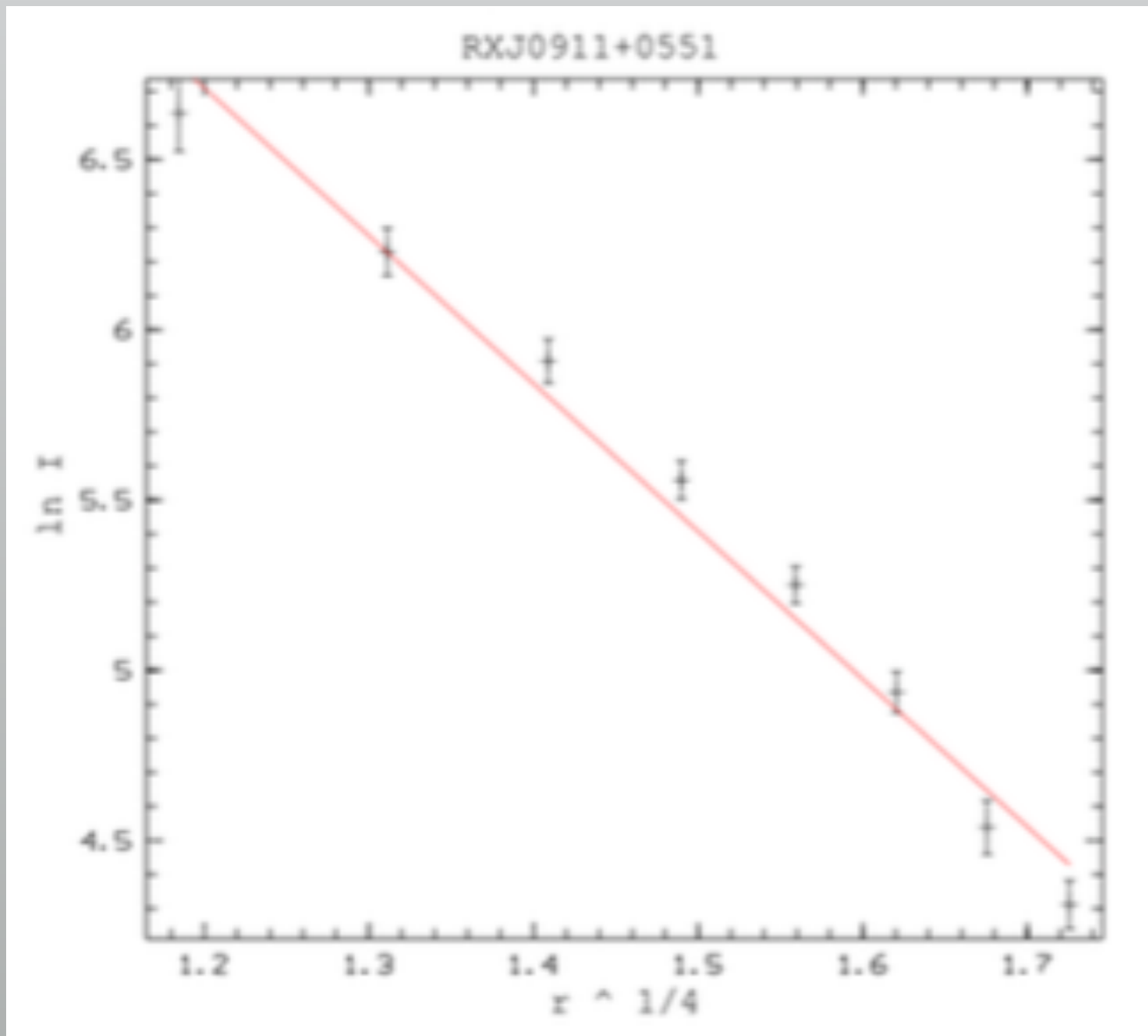


## Effective radius



$$I(r) = I_{eff} \exp\left\{-n\left[\left(\frac{r}{r_{eff}}\right)^{1/4} - 1\right]\right\}$$

## Effective radius

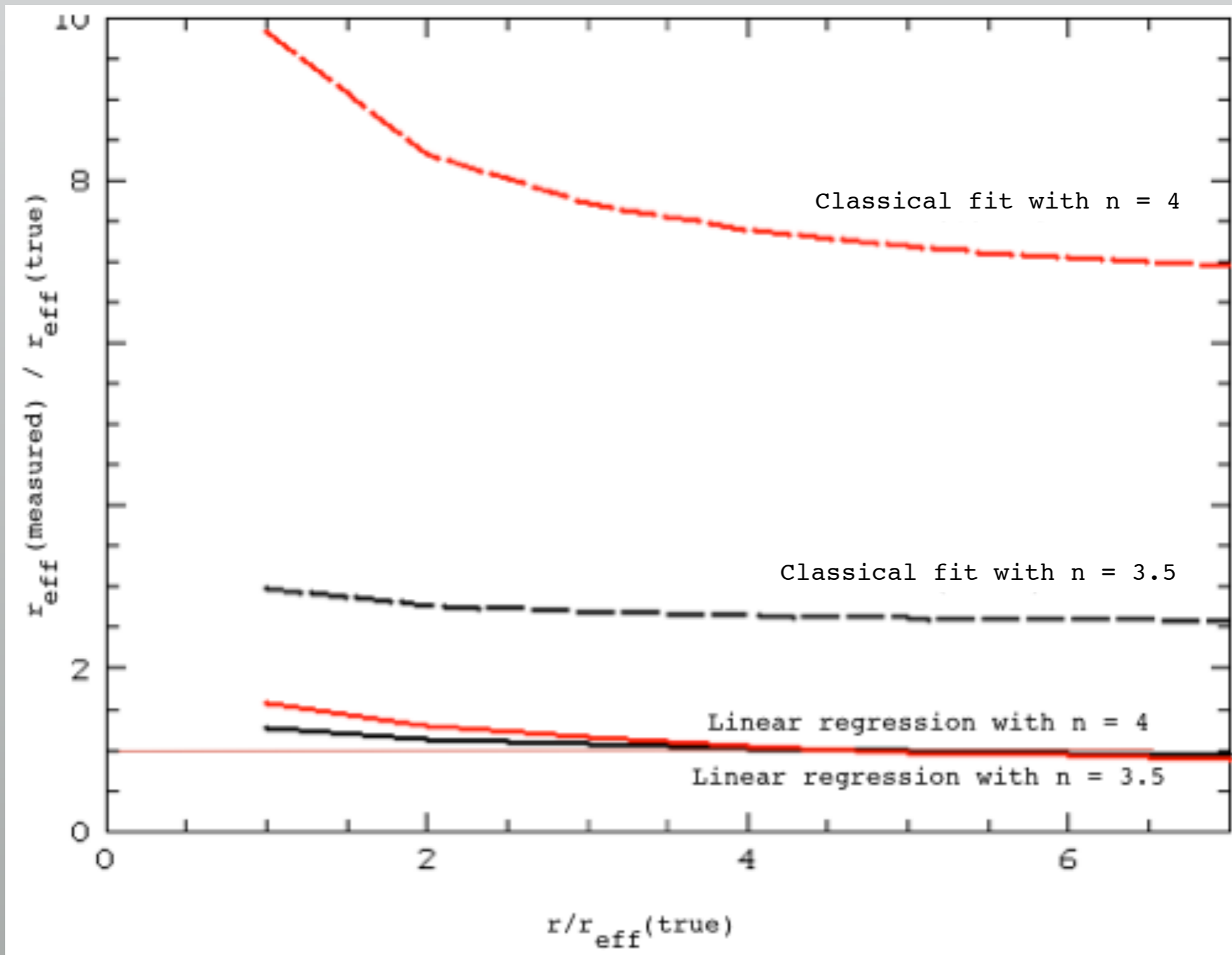


$$I(r) = I_{eff} \exp\left\{-n\left[\left(\frac{r}{r_{eff}}\right)^{1/4} - 1\right]\right\}$$



$$I(r, n) = A \exp\left(-k\left(\frac{r}{r_{eff}}\right)^{1/n}\right)$$

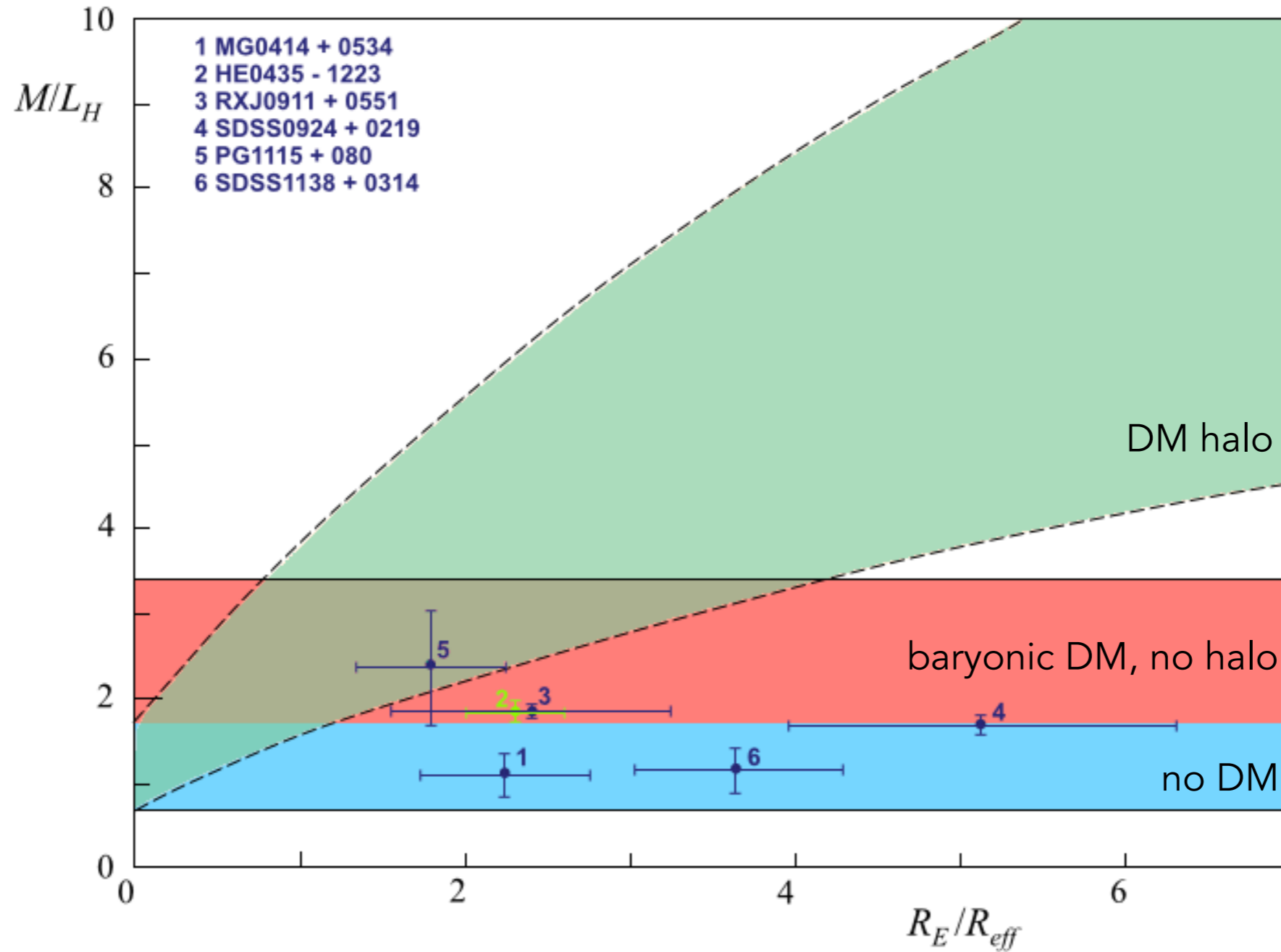
## Effective radius





# Preliminary results

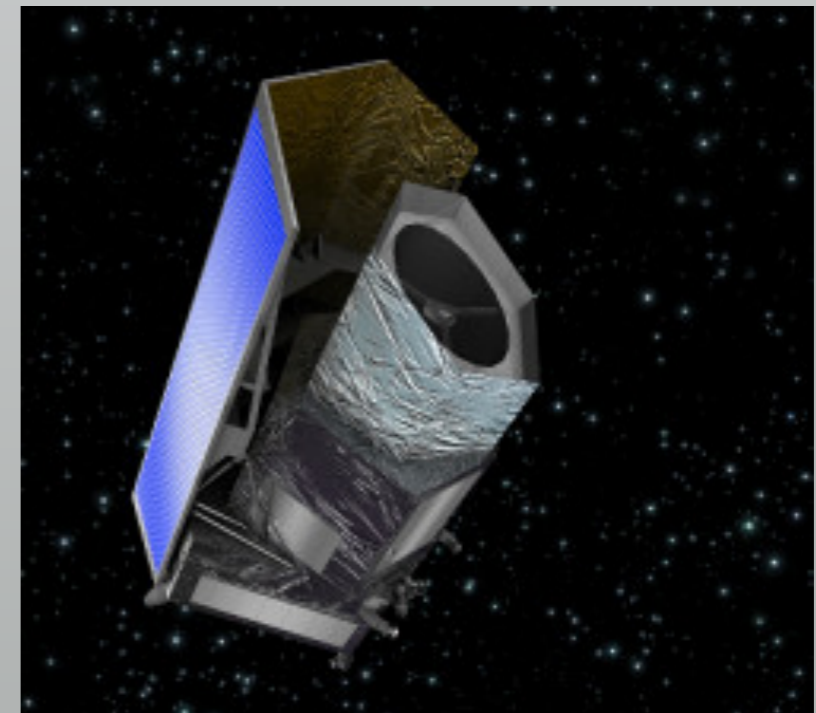
➔ No DM haloes



## Conclusions

New light on galactic evolution, cosmology, ...

- Need of a method to measure the exponent  $n$  of the Sérsic law
- Need to study a larger sample - Euclid



**Thank you !**

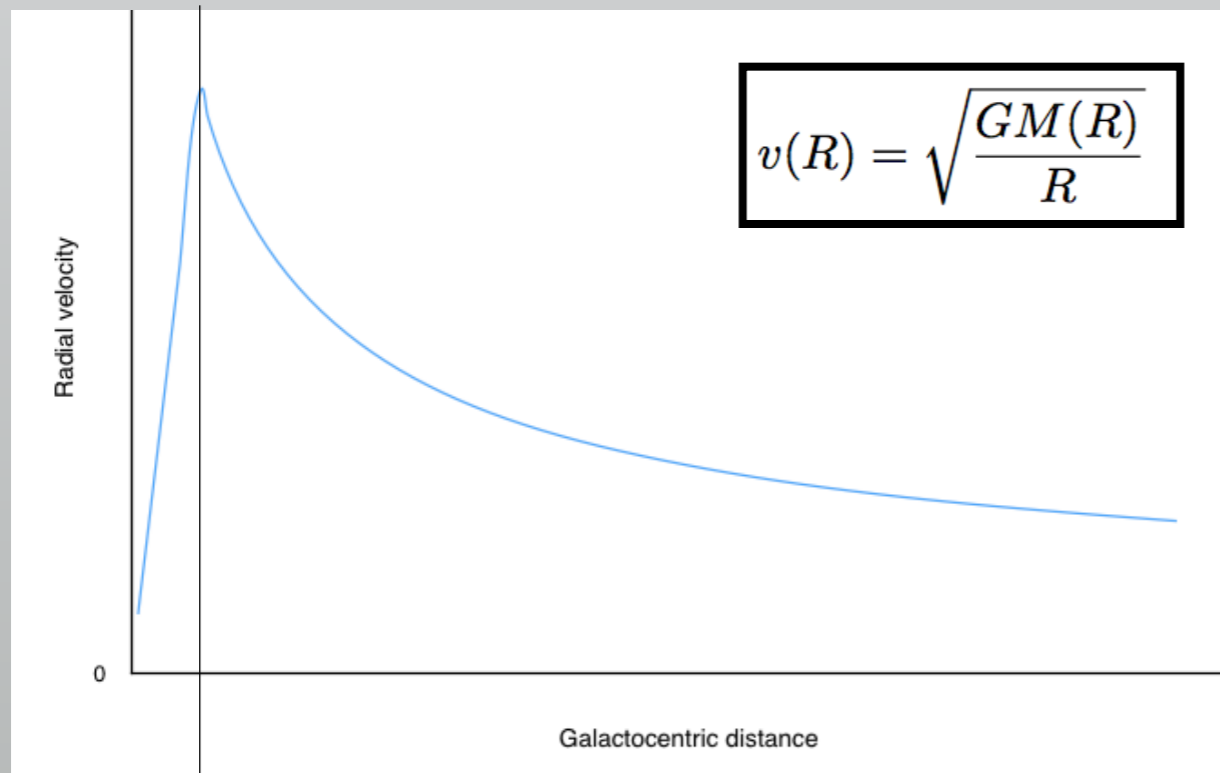
# Around elliptical galaxies ?

- Planetary nebulae (Romanowsky et al., 2003) → no haloes !
- Simulations of merging disk galaxies (Dekel et al., 2005) → haloes !
- X-ray emission (Memola et al., 2011) → haloes !
- Stellar kinematics (Cappellari et al., 2015) → no haloes !

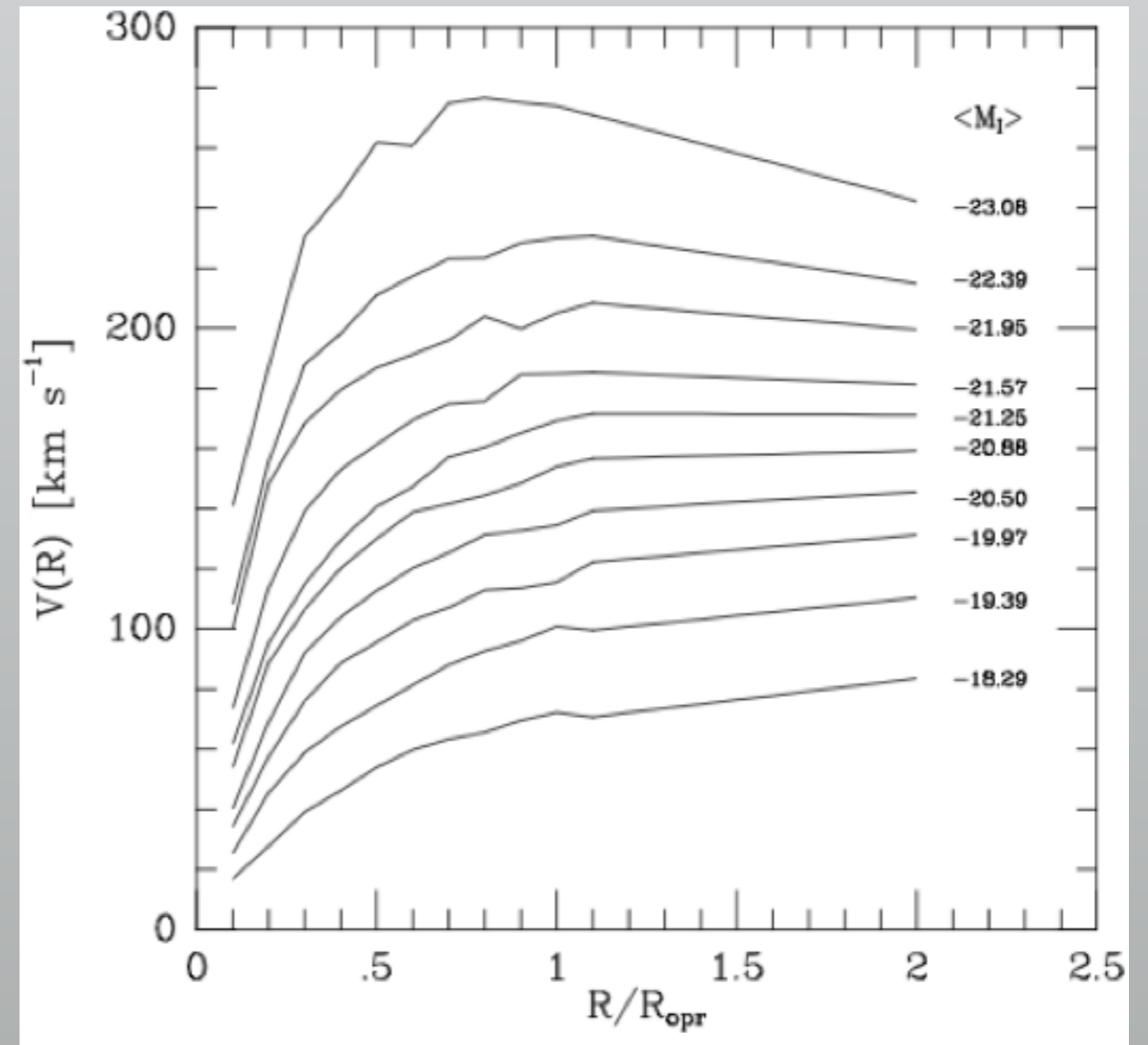
→ **Discrepant results...**



# Dark matter halos ?



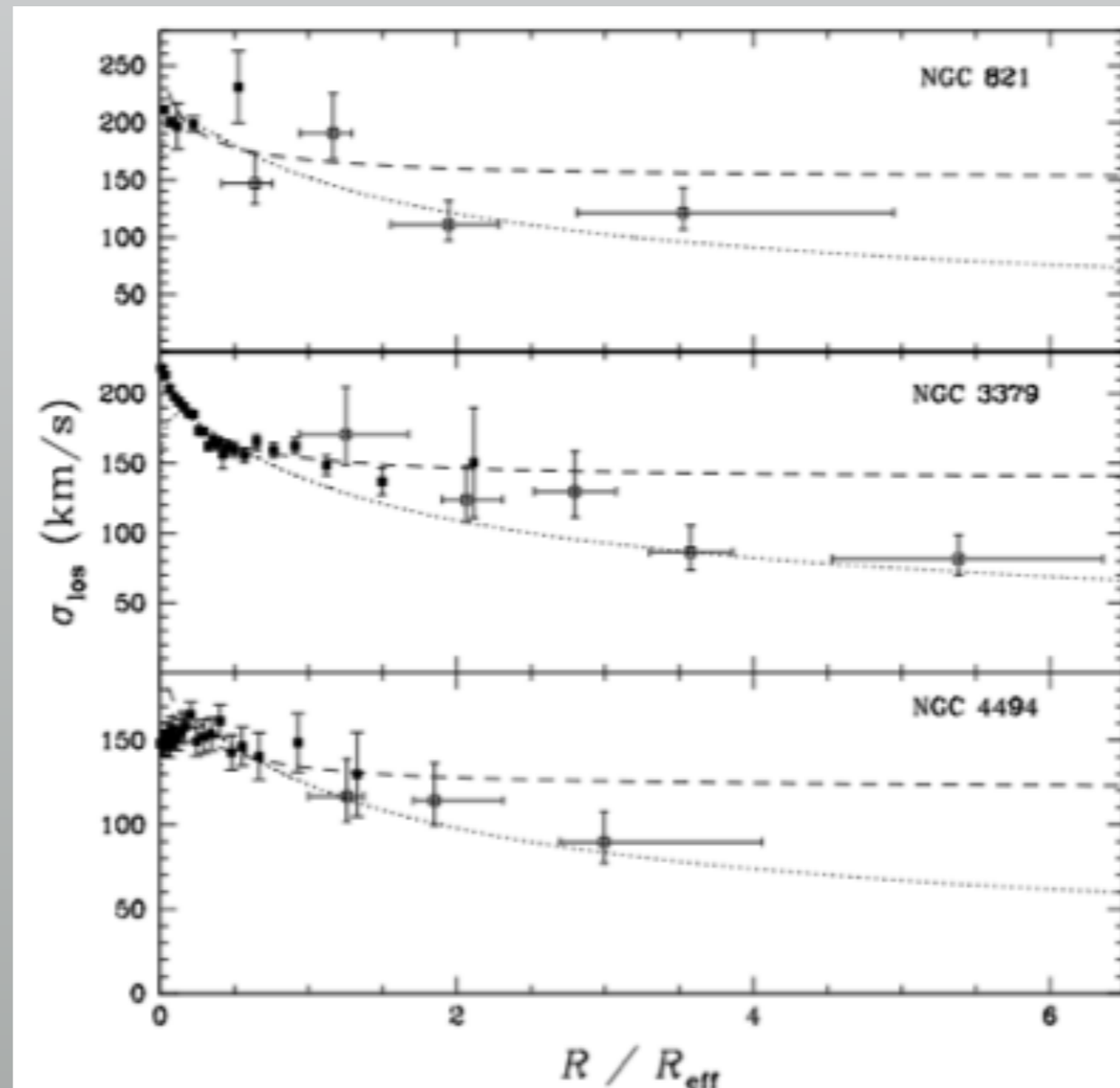
➔ **Dark matter halo around spirals**



*Persic, Salucci and Stel, 1995*

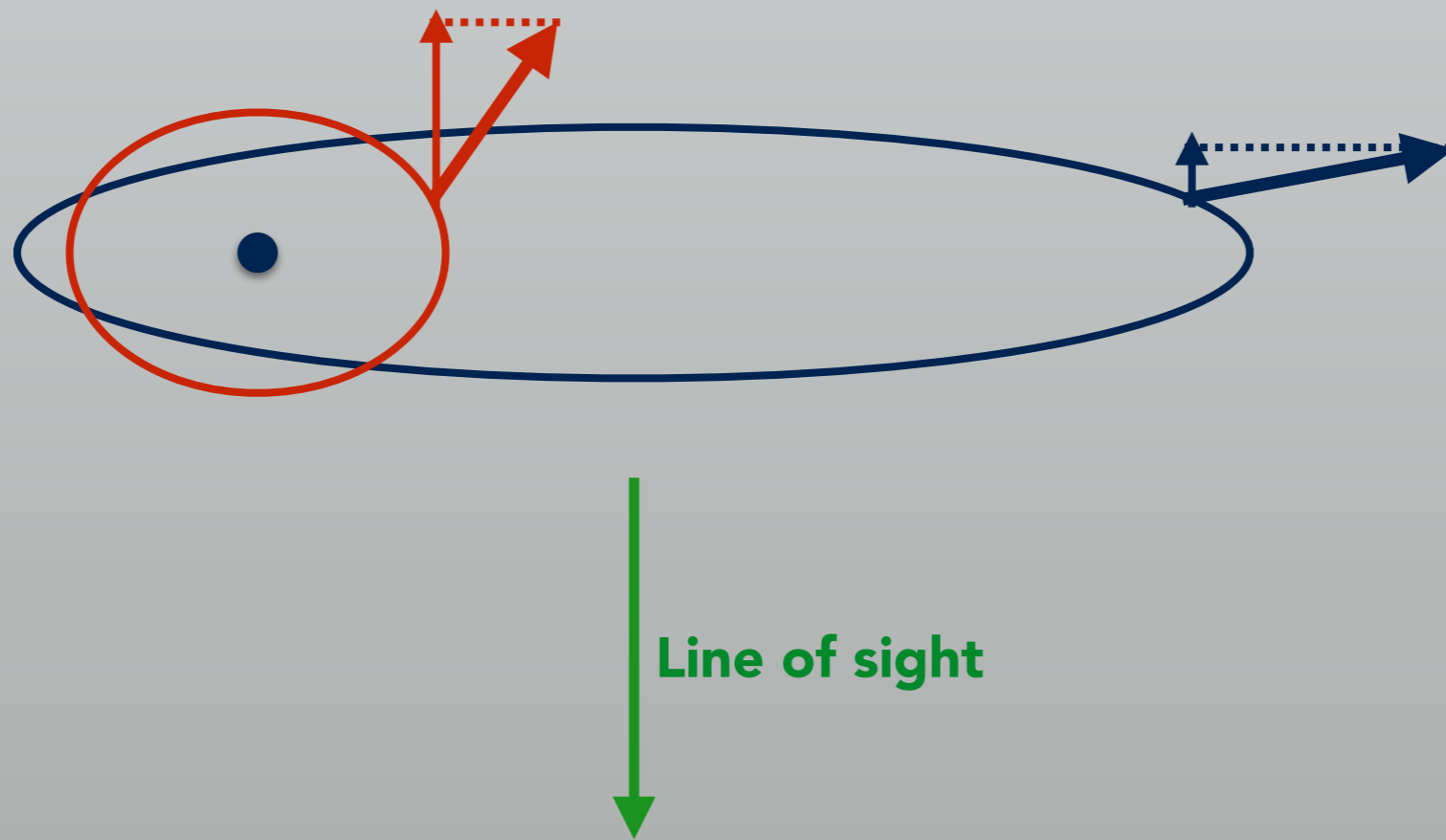
# Around elliptical galaxies ?

- Planetary nebulae (Romanowsky et al., 2003)



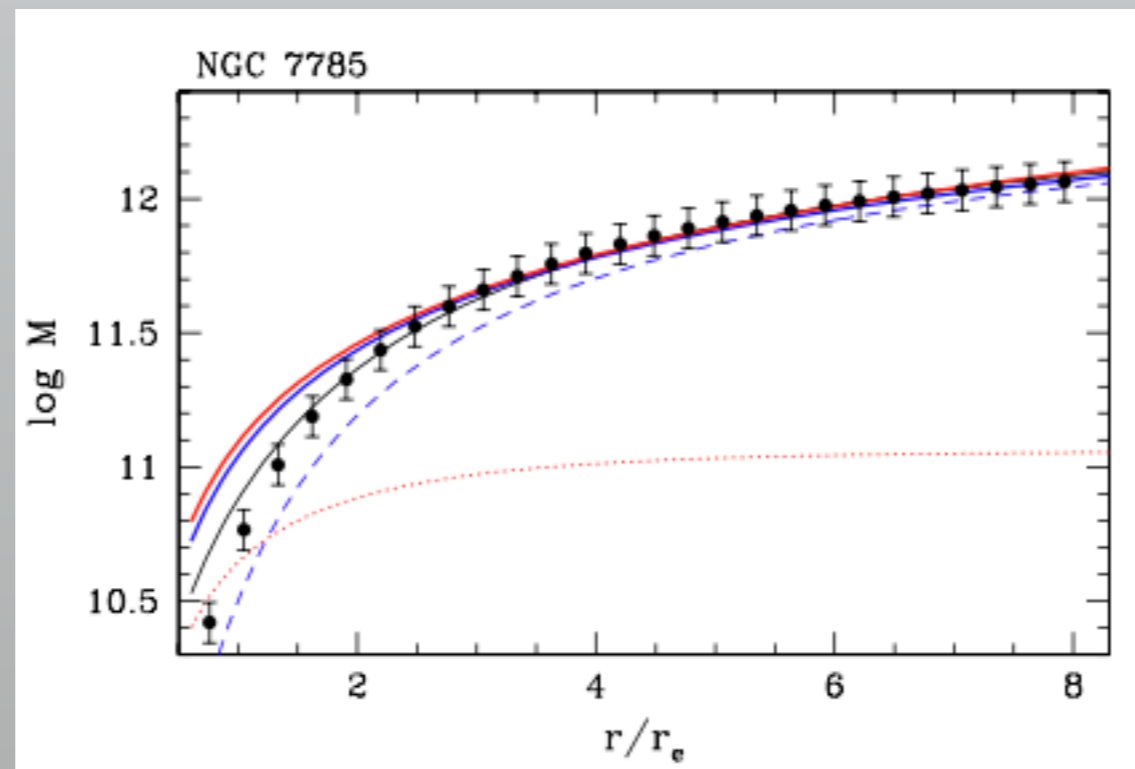
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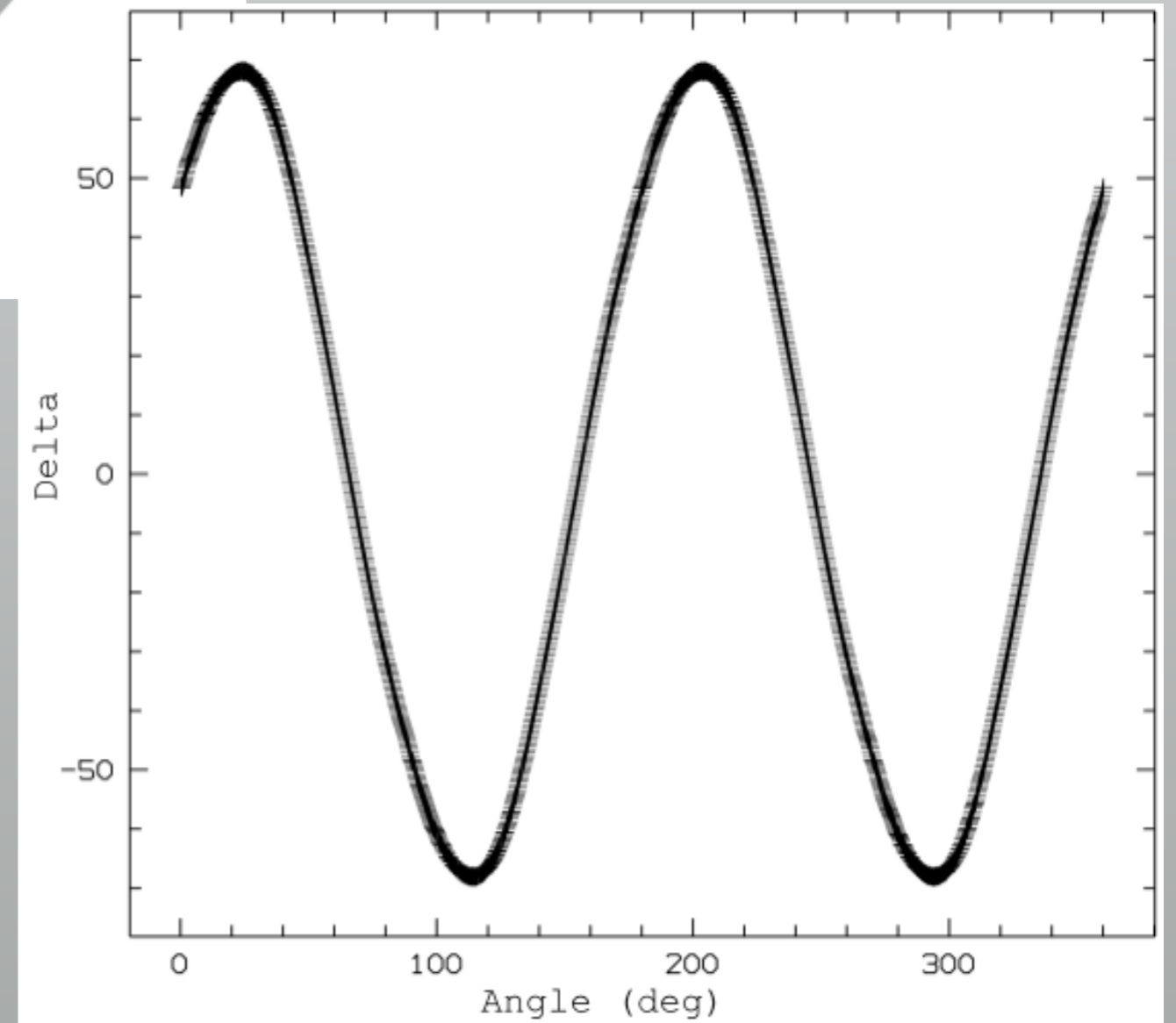
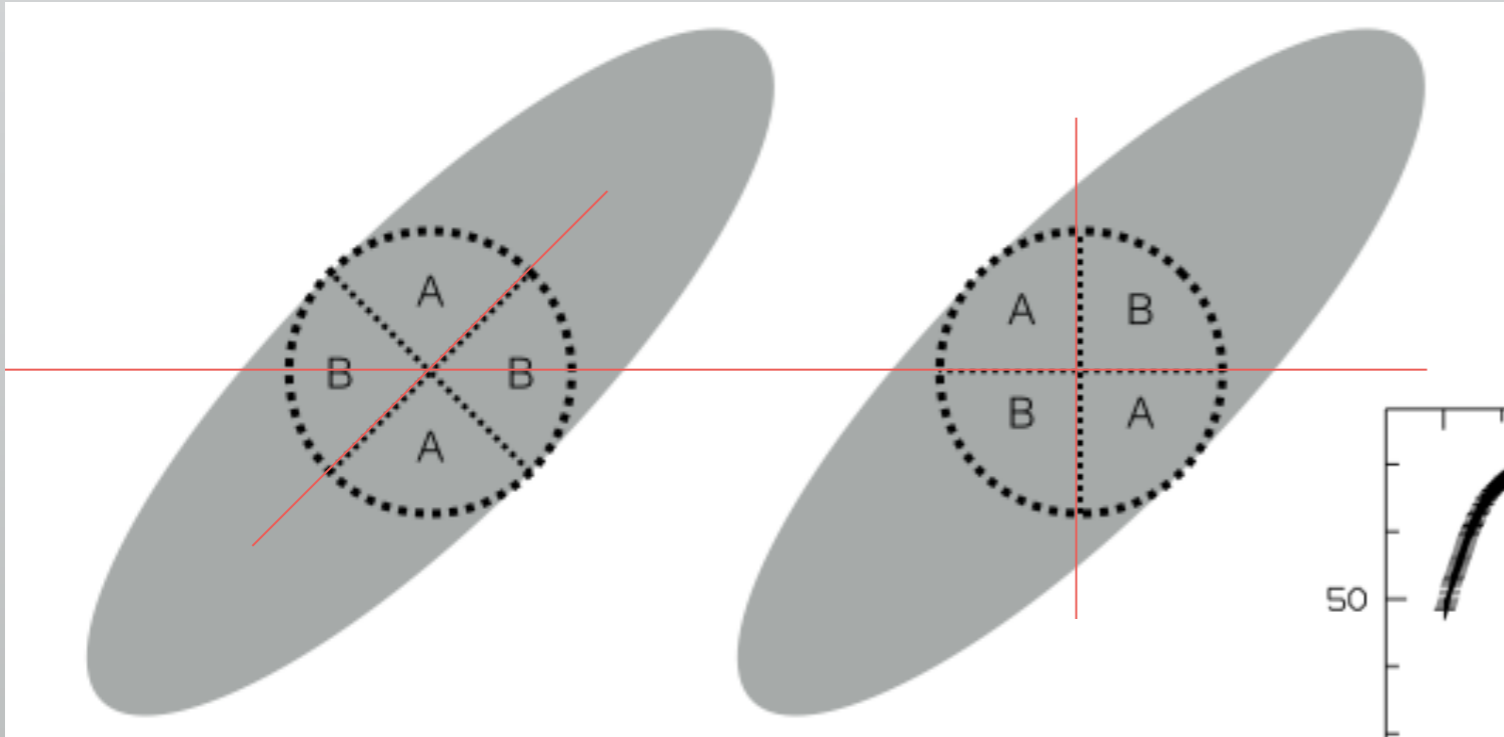
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- Simulations of merging disk galaxies (Dekel et al., 2005)
- X-ray emission (Memola et al., 2011)



# Around elliptical galaxies ?

System (galaxy)	With halo (SIE)	Without halo (constant M/L)
MG0414+0534	33	30
HE0435-1223	2.6	2.9
RXJ0911+0551	200	186
SDSS0924+0219	5	6
PG1115+080	20	6
SDSS1138+0314	1.2	0.7
B1422+231	7	43

# Measurement of position angle



# Measurement of ellipticity

