Secular evolution in the host galaxies of gamma-ray emitting Narrow-line Seyfert 1s (NLSy1)

Leon-Tavares+ 2014, ApJ, 795, 58
JK+ 2016, ApJ, 832, 157
Olguin-Iglesias+2017, MNRAS, 467, 3712
+ in prep.

Jari Kotilainen
FINCA, Univ. Turku, Finland

SUNBIRD Workshop
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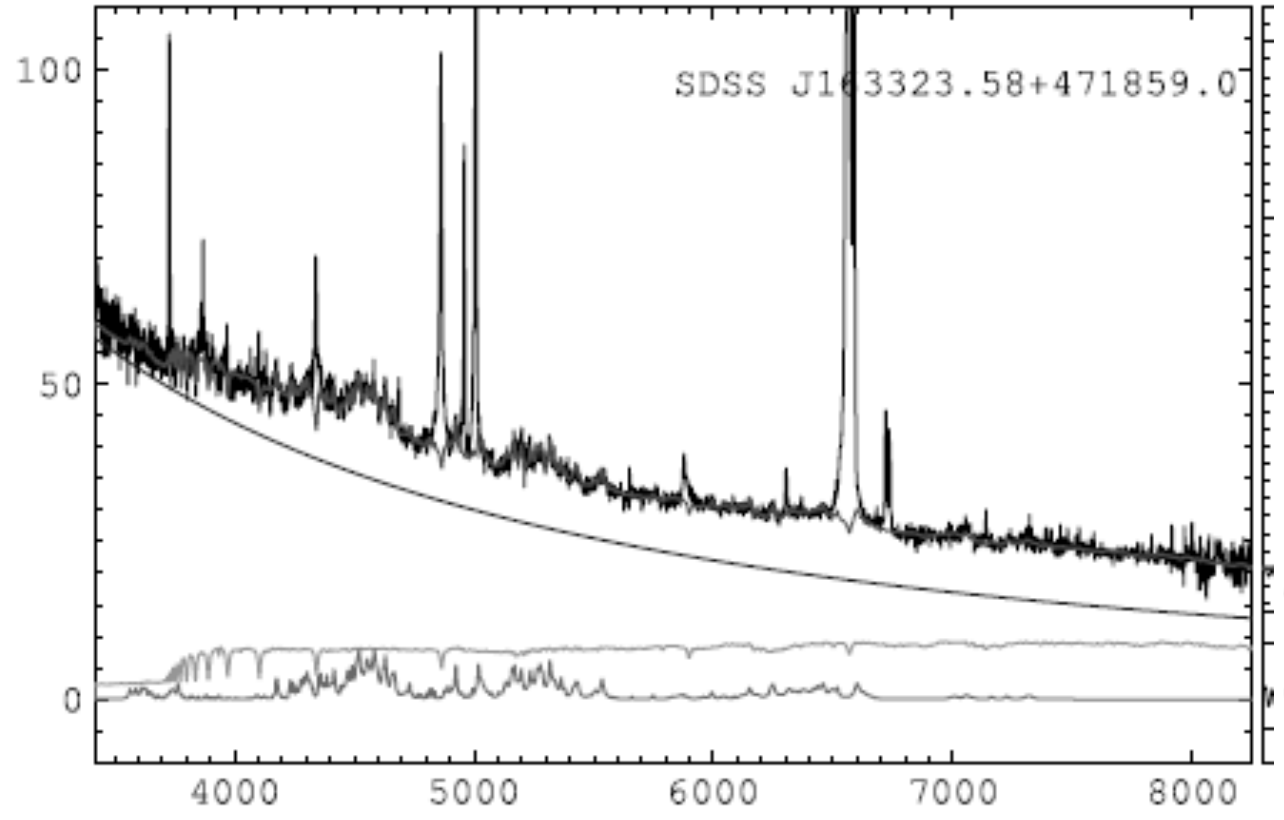
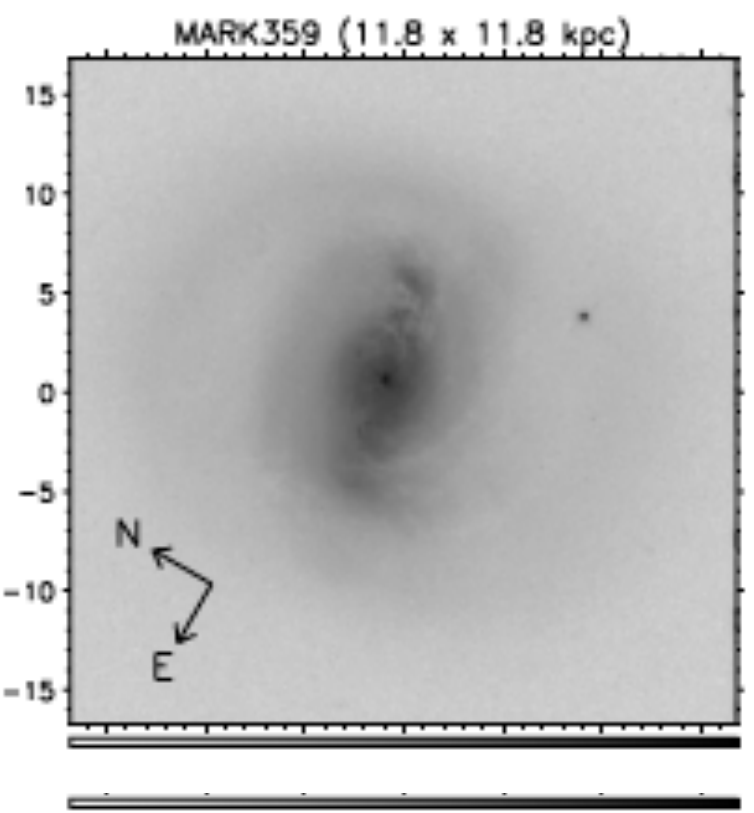
Turun yliopisto
University of Turku

FINCA
Finnish Centre for Astronomy with ESO

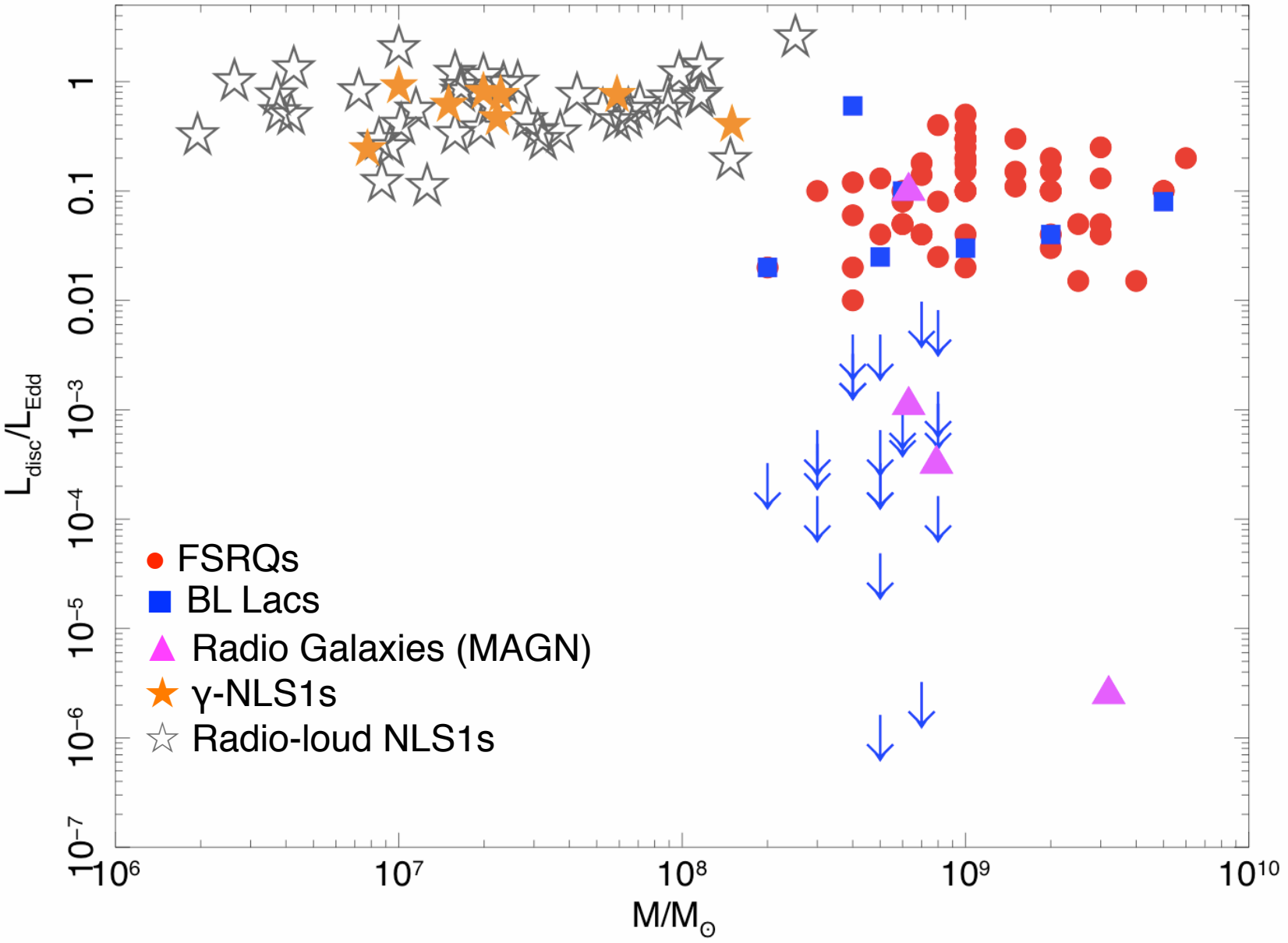
Introduction

- NLSy1s:
  - narrow permitted optical lines (FWHM(Hβ) < 2000 km/s; OIII/Hβ)<3)
    not due to obscuration: FeII bump => BLR different from other AGN
  - usually hosted in spirals, often pseudobulges, bars, star formation



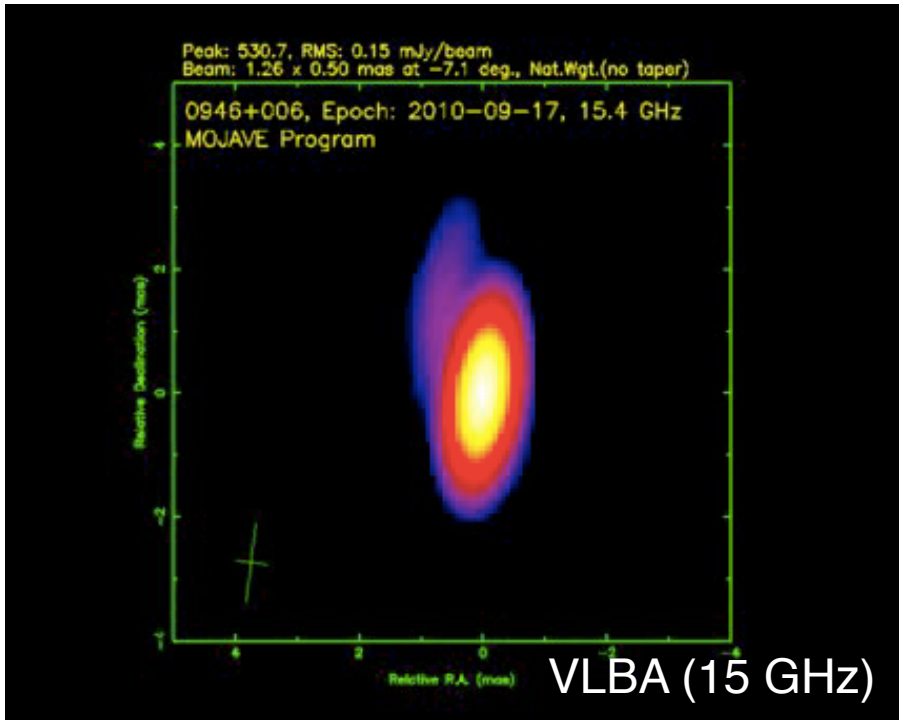


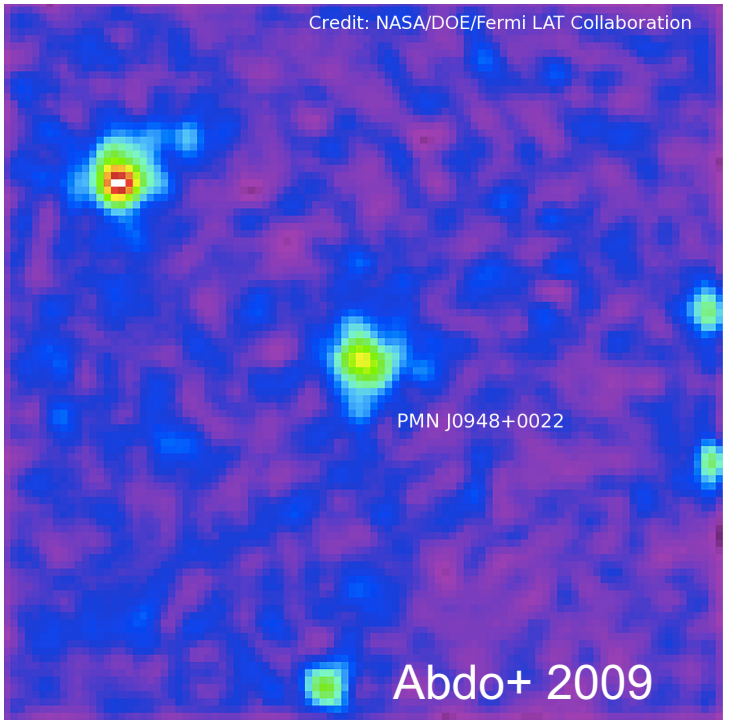
– small black hole mass < 10^8 Msun; high accretion rate (=> Edd)
=> young AGN?



- Extragalactic γ-ray sky dominated by blazars => relativistic jets only launched from massive ellipticals built through galaxy mergers

- BUT: Fermi detection of γ-ray emitting radio-loud NLSy1s => casts doubt on this paradigm => young AGN able to launch relativistic jets?

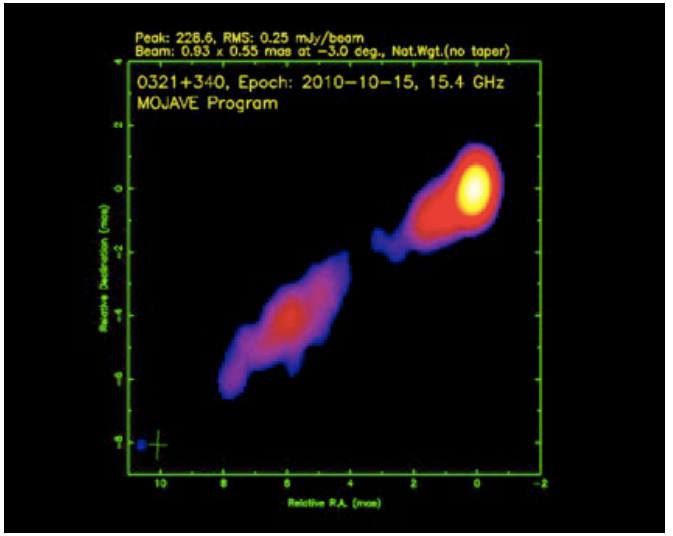


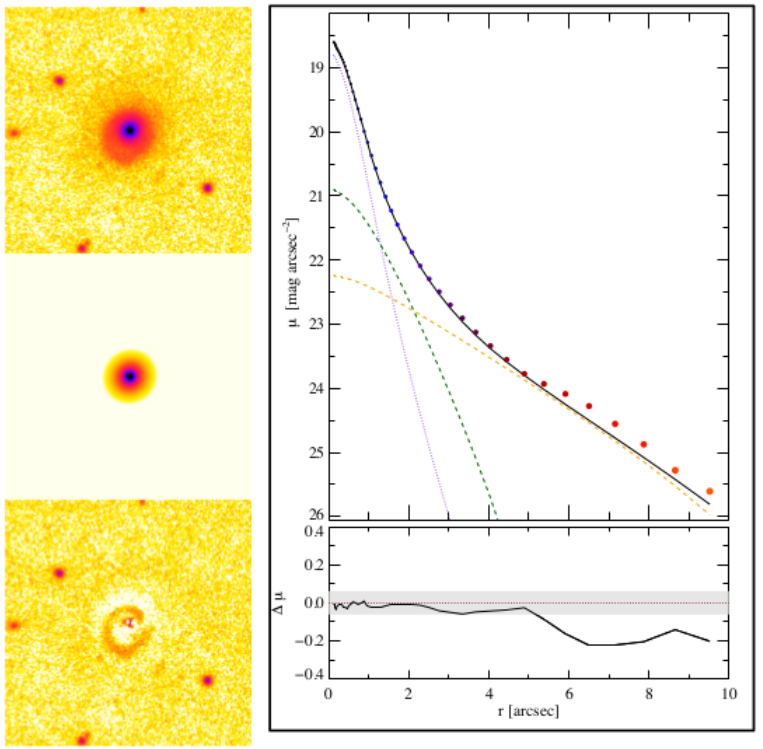


The host galaxy of the closest γ-ray NLSy1 1H 0323+342 (z=0.061)

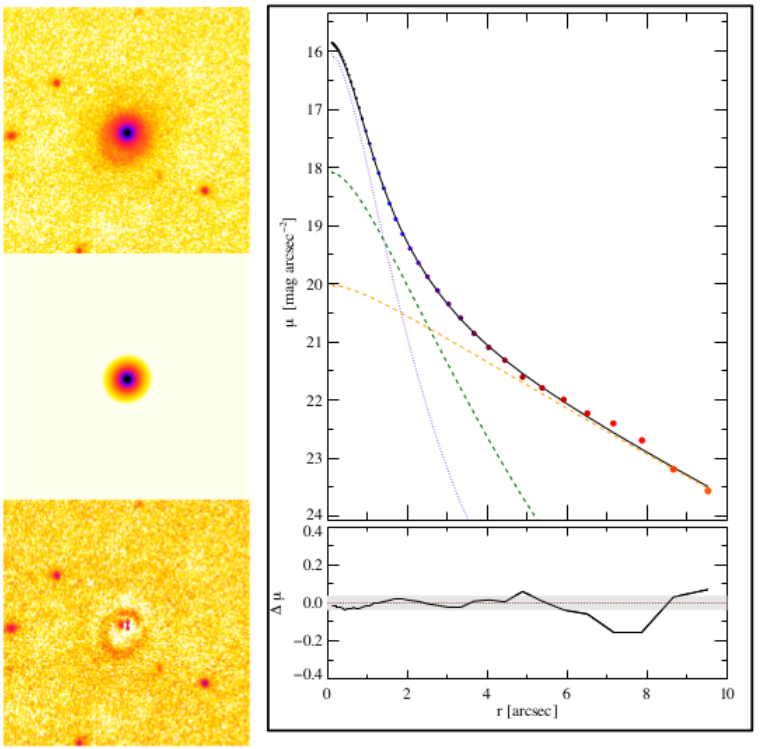
Leon-Tavares, JK + 2014, ApJ, 795, 58

NOT ALFOSC + NOTCAM BRJKs-band imaging



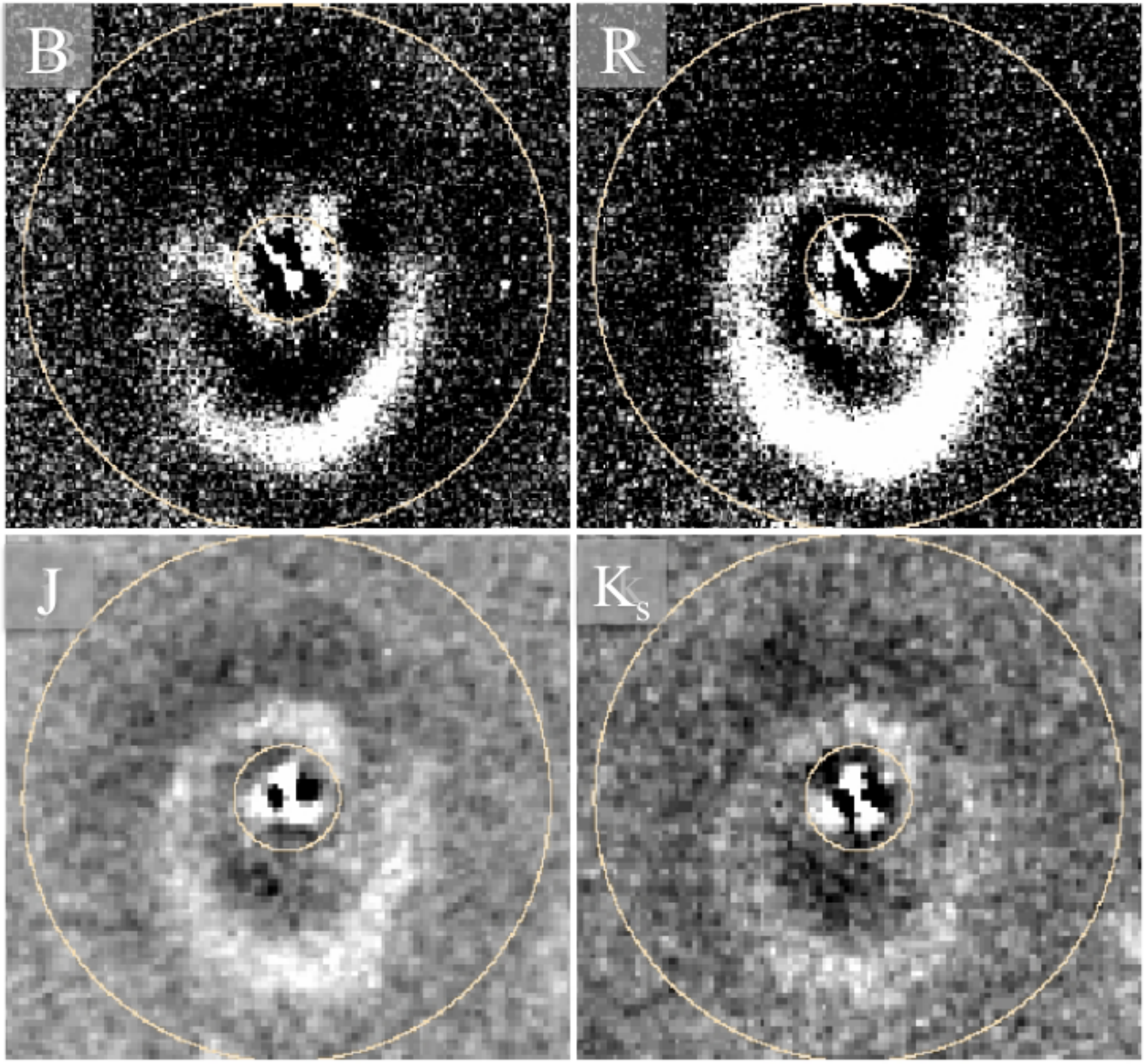


(c) J-band

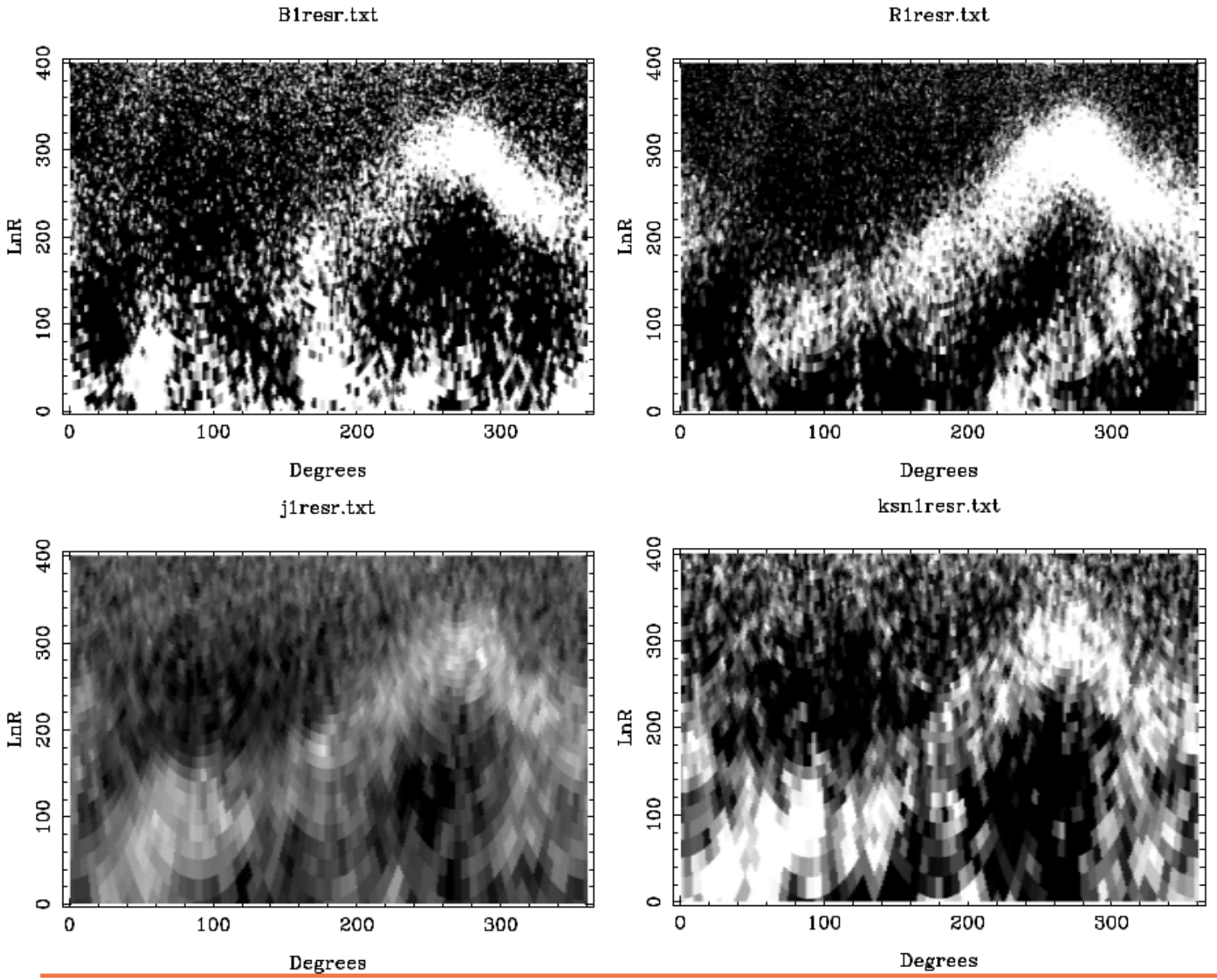


(d) K_s-band

PSF + Sersic + Disk



The curved structure: a broken ring or an m = 1 spiral arm



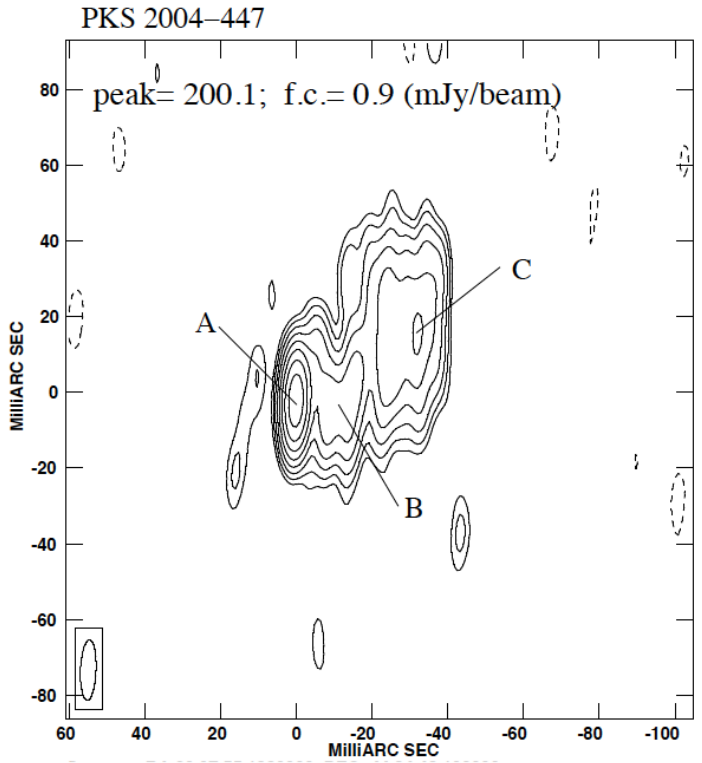
(ln(R), θ) plane, “saw-tooth” shape: a ring rather than spiral arms.

- recent violent dynamical interaction in 1H 0323+342, likely related to the triggering of the AGN activity.

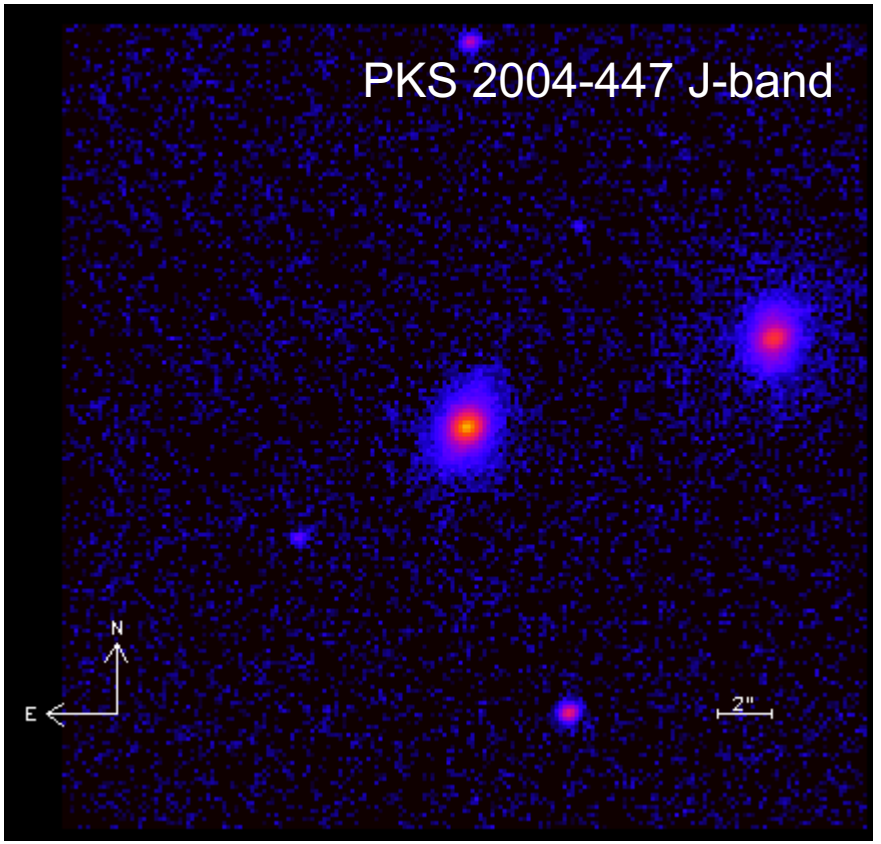
The host galaxy of the gamma-ray emitting Narrow-Line Seyfert 1 PKS 2004-447 (z=0,240)

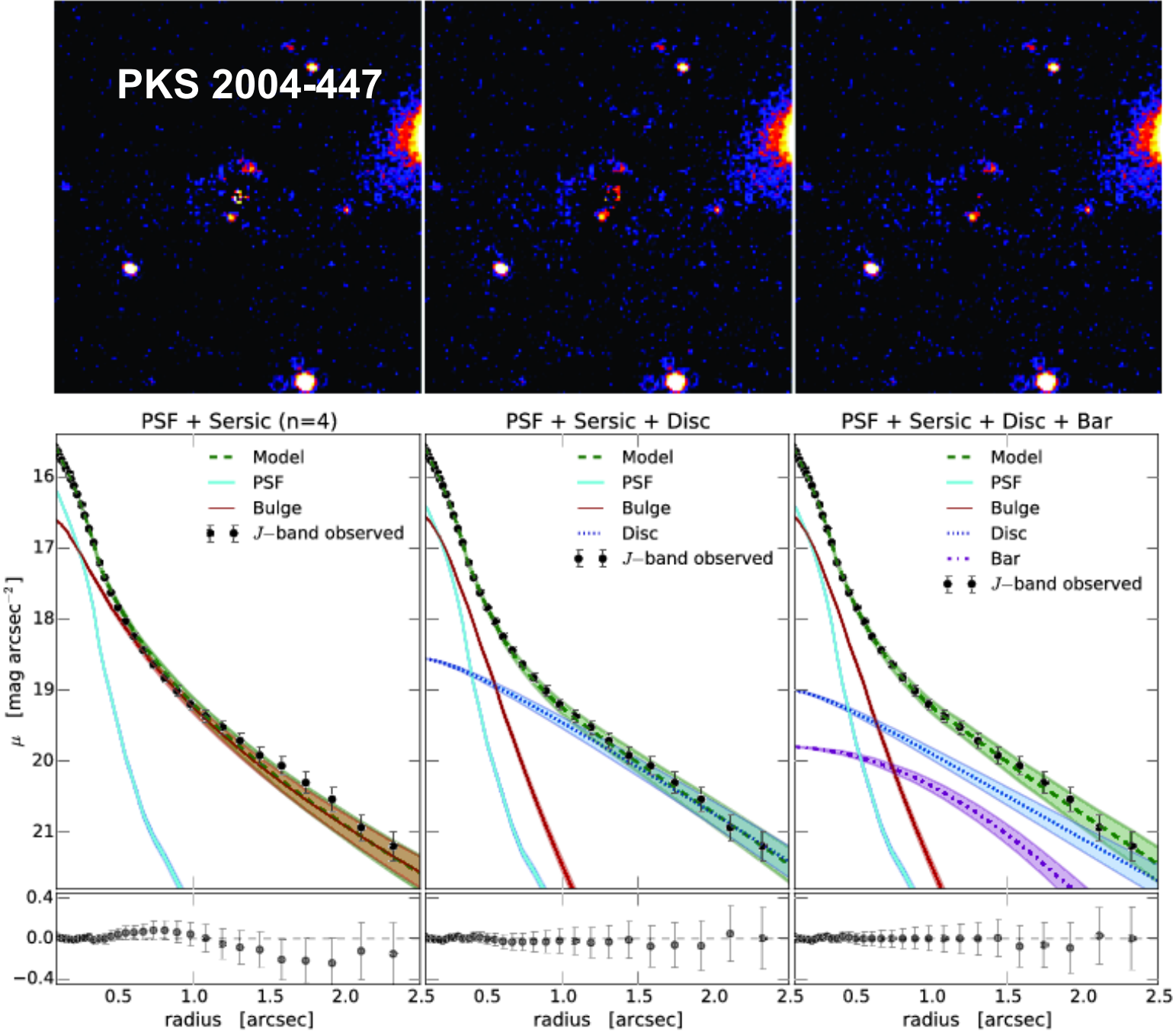
JK + 2016, ApJ 832,157

VLT+ISAAC J- and Ks-band imaging

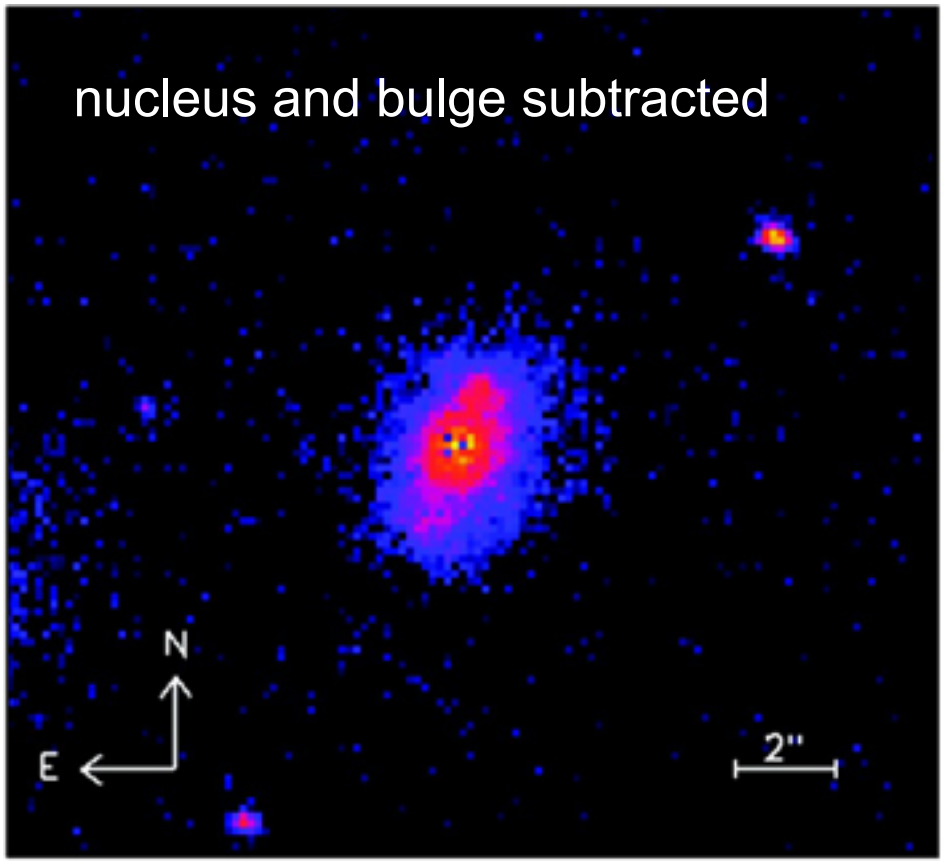


1.4 GHz VLBA (Orienti+2015)

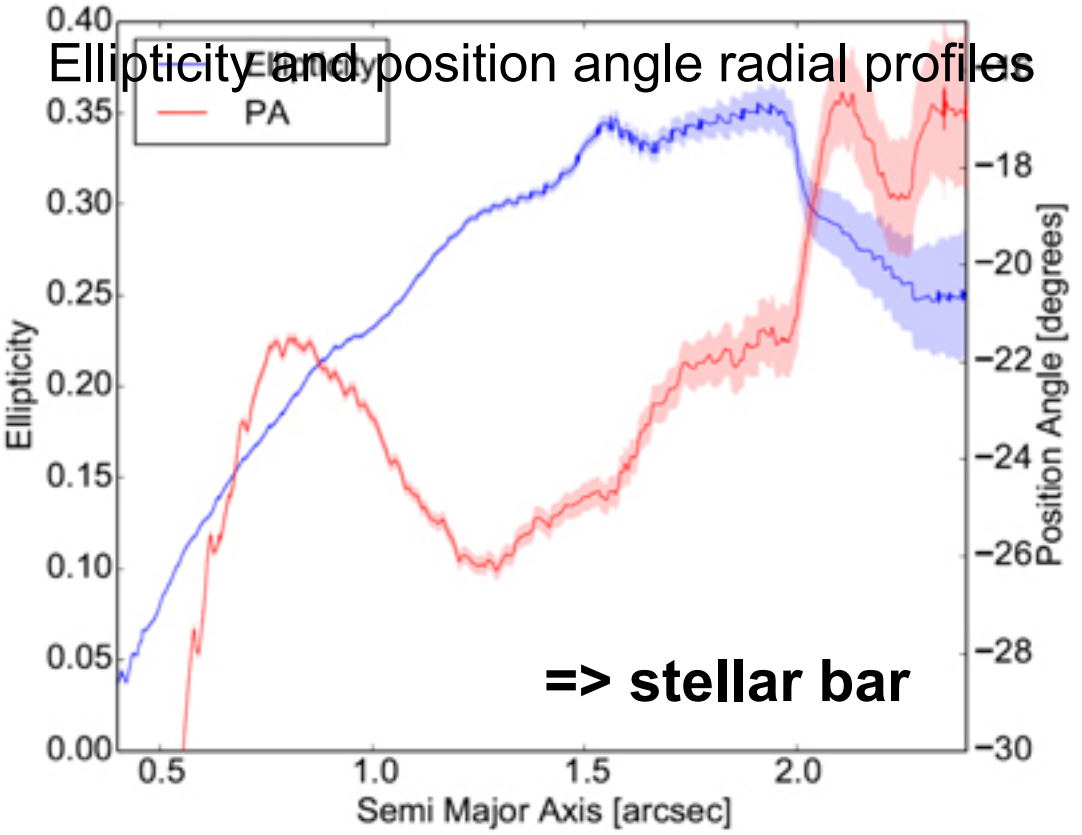




2D modeling of surface brightness distribution => bulge, disc and bar



Ellipticity and position angle radial profiles



i)Disky profile n < 2
ii)low bulge to total ratio (B/T < 0.4)
iii)stellar bar

=> Not classical but **pseudobulge**, as in R-Q NLSy1s

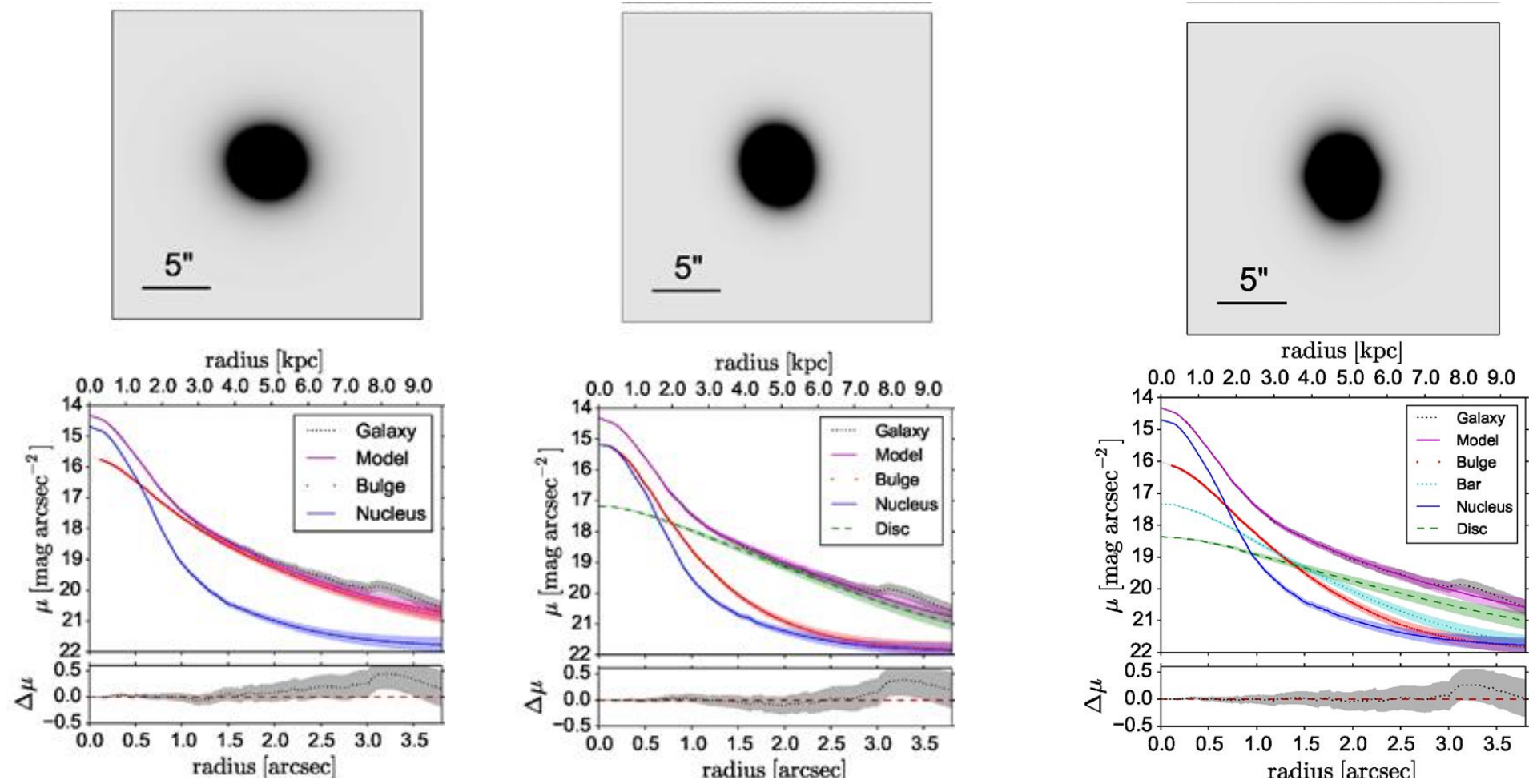
PKS 2004-447 is the first AGN where relativistic jets accelerating particles up to highest E, are launched from a system where both black hole and host galaxy have been growing secularly.

Alternative non-merger driven black hole-galaxy evolutionary path?

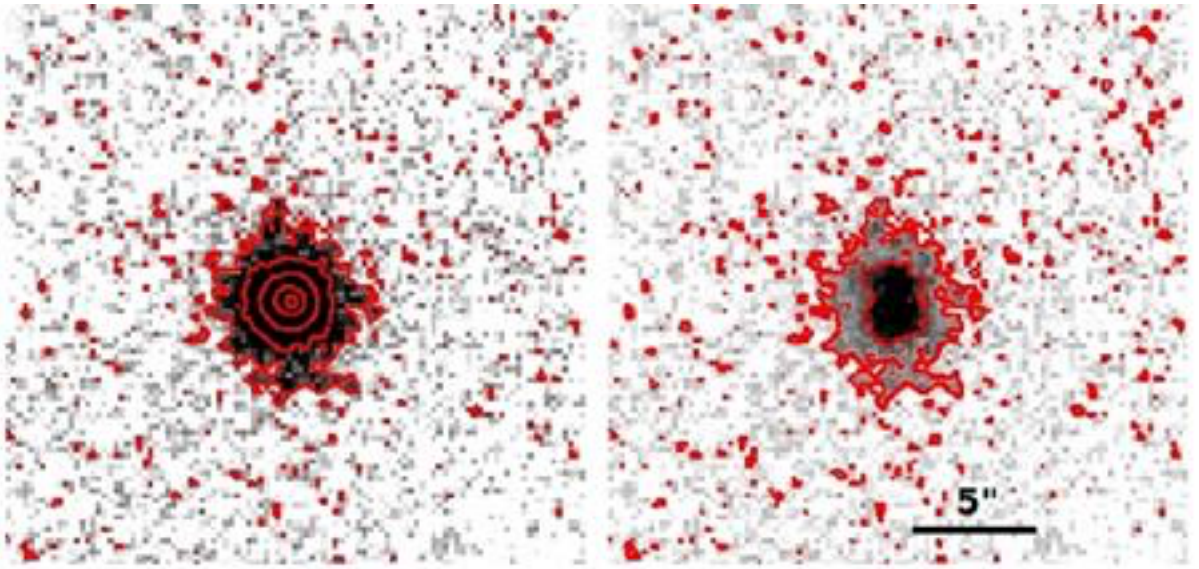
Bar-driven secular evolution in the gamma-ray NLSy1 FBQS J164442.5+261913 (z=0.145)

Olguin-Iglesias, JK +2017, MNRAS, 467, 3712

NOT ALFOSC + NOTCAM BRJKs-band imaging

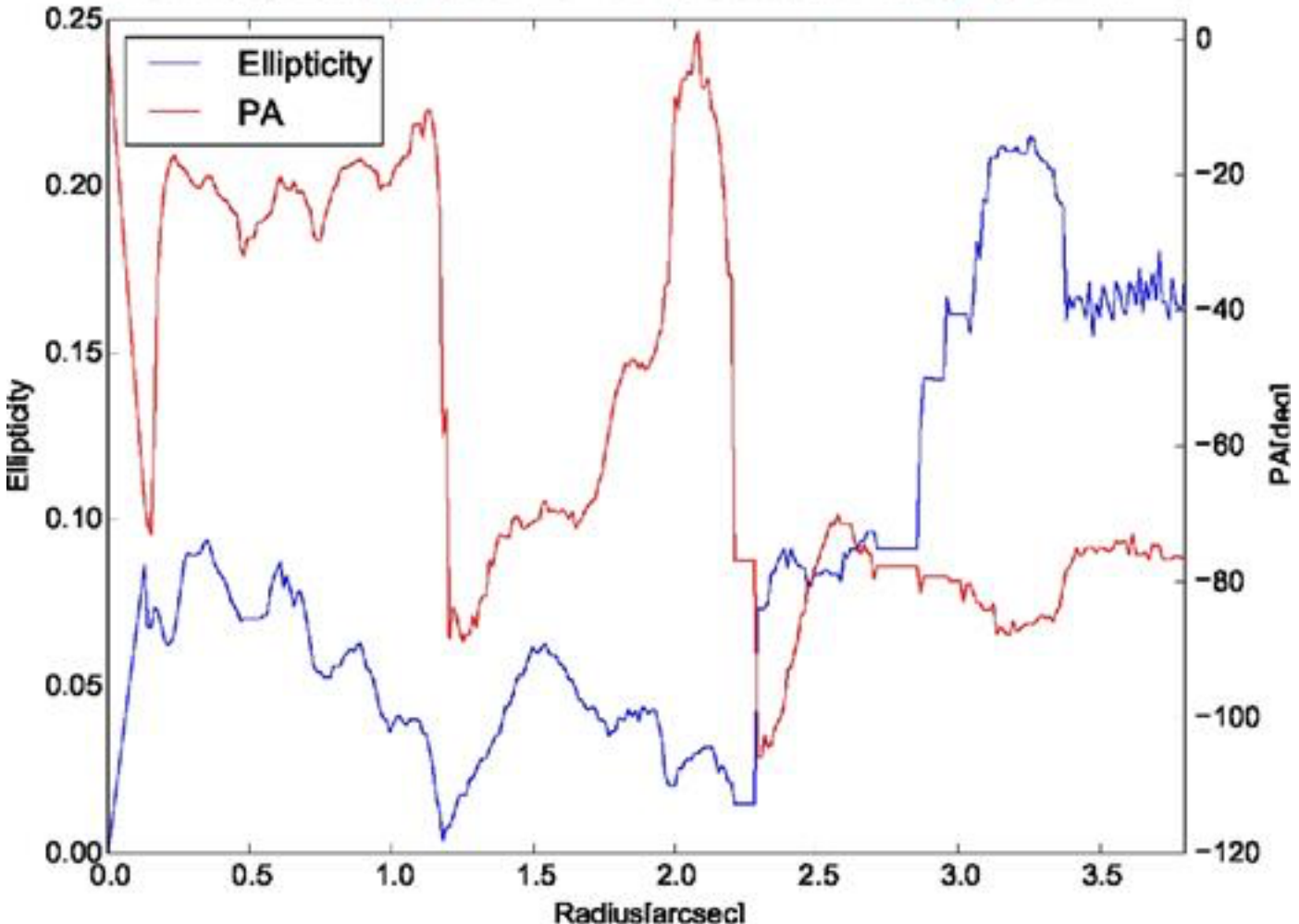


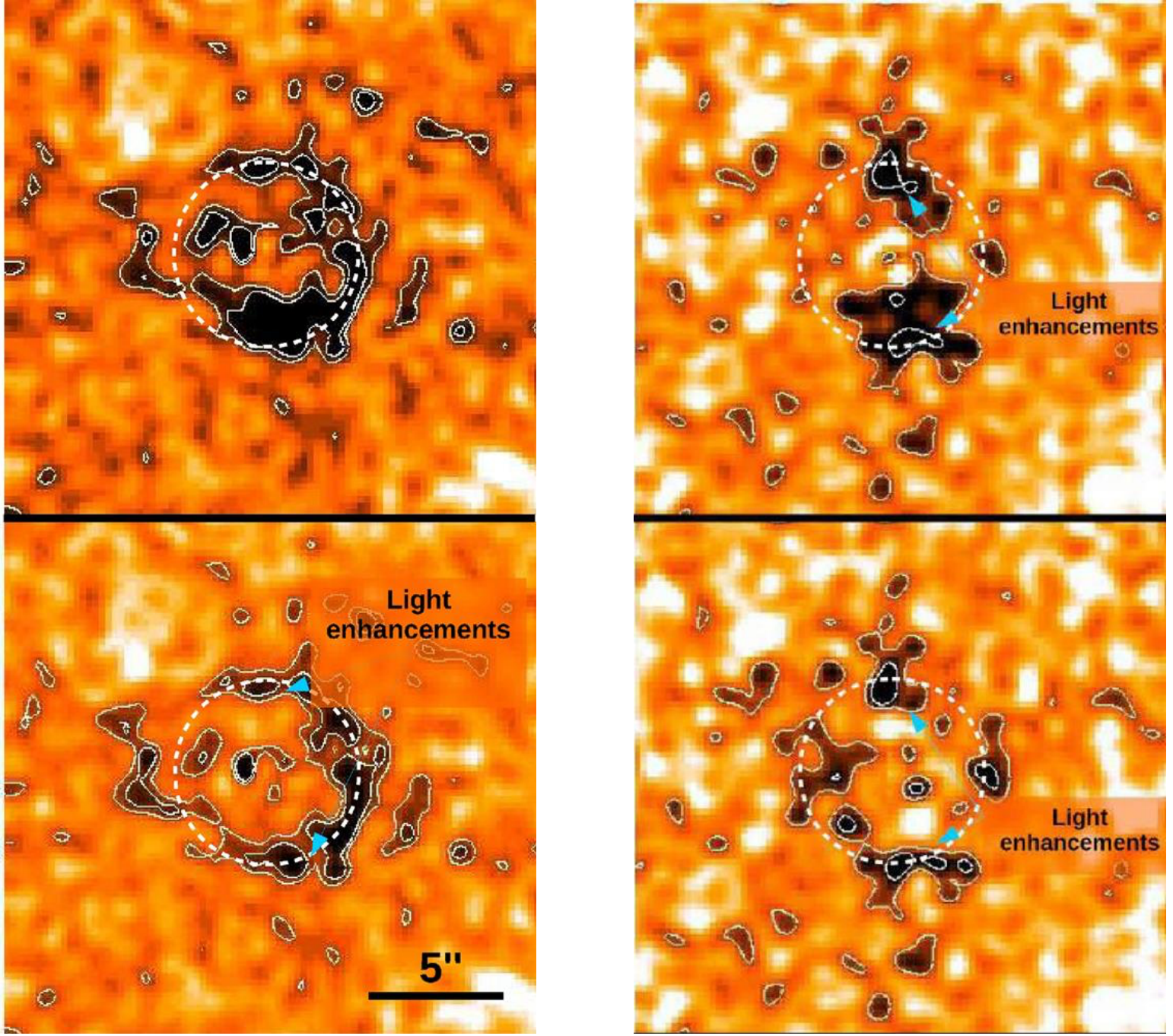
Best fit by nucleus, bulge, disc, and stellar bar => SB0 (barred lenticular)



LEFT: observed K_s-band

RIGHT: Bulge subtracted





J-band

Ks-band

• a ring (D=8 kpc) enclosing the bar, and recent minor merger remnant

i)Disky profile $n < 2$
ii)low bulge to total ratio ($B/T < 0.4$)
iii)stellar bar

=> Not classical but **pseudobulge**, as in R-Q NLSy1s

The prominent bar in the host galaxy of FBQS J164442.5+261913 drives strong secular evolution, which plays a crucial role in the onset of the nuclear activity and the growth of its massive (pseudo) bulge.

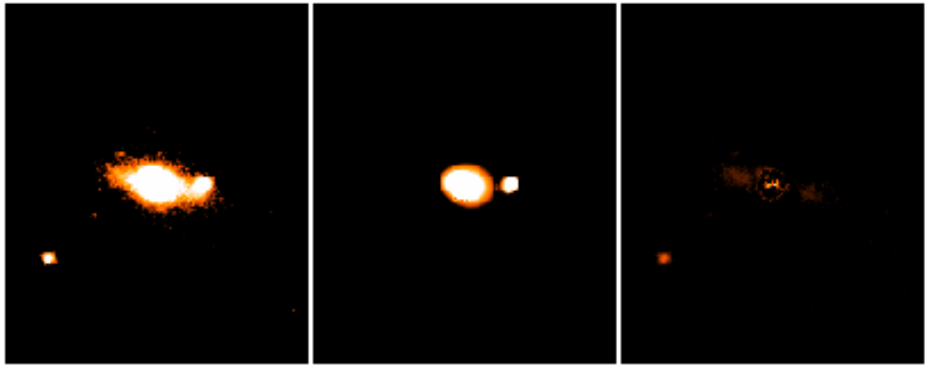
Minor mergers provide the necessary supply of gas to central regions

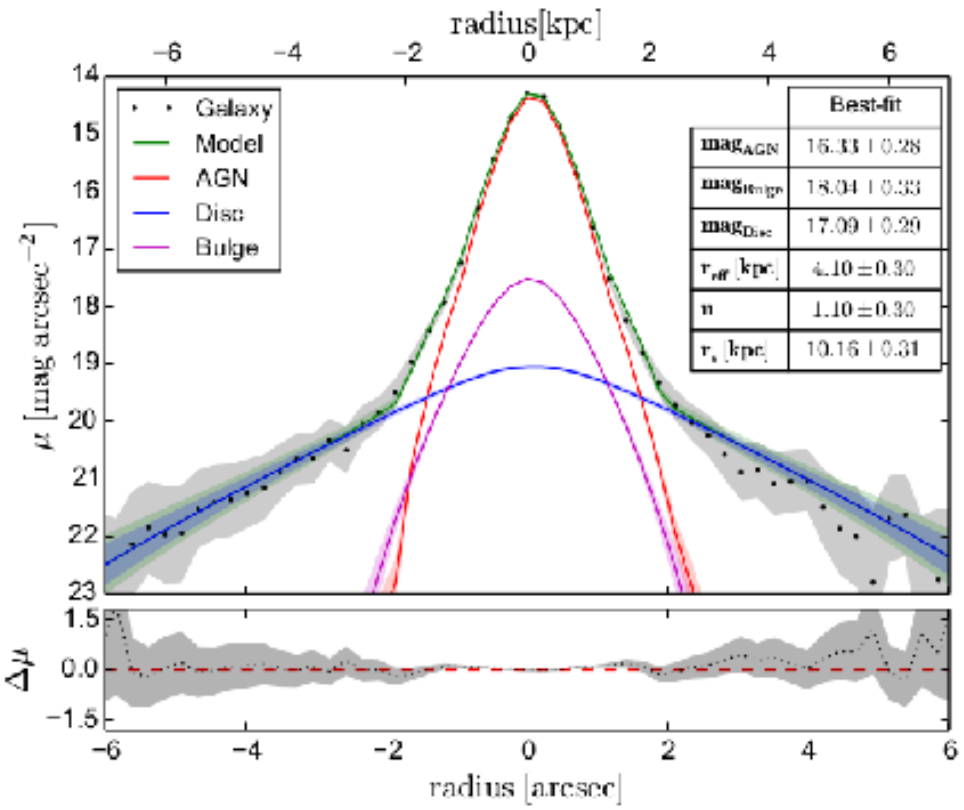
	Ring	Bar	Pseudobulge
FBQS J164442.5+261913	X	X	X
PKS 2004-447	?	X	X
1H 0323+342	X	-	-

iv) rotation–supported kinematics (pseudobulge built from disc) ?
v) young stellar population (similar to disc) ? **=> (VLT/MUSE) IFS**

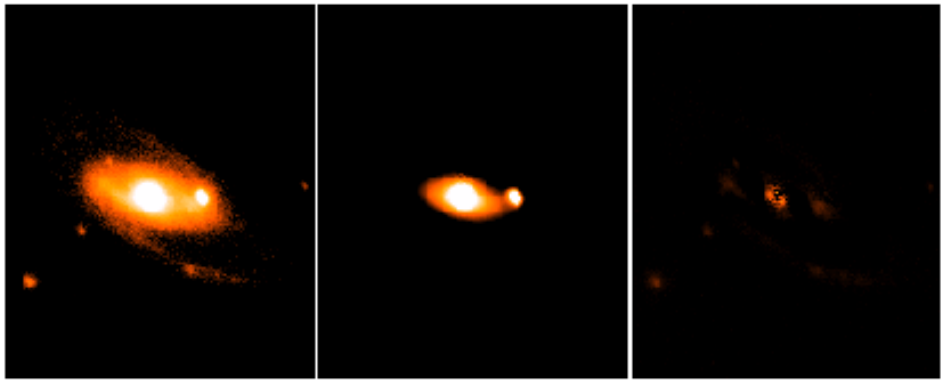
Radio-loud (but gamma-silent) NLSy1s (in prep.)

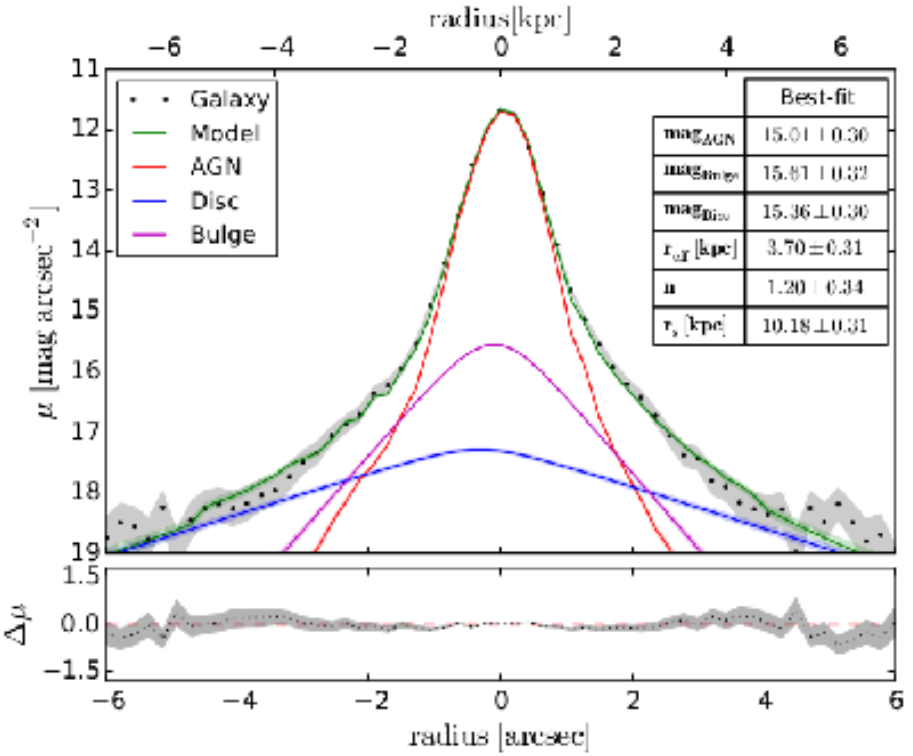
B3 1702+457 Ks band



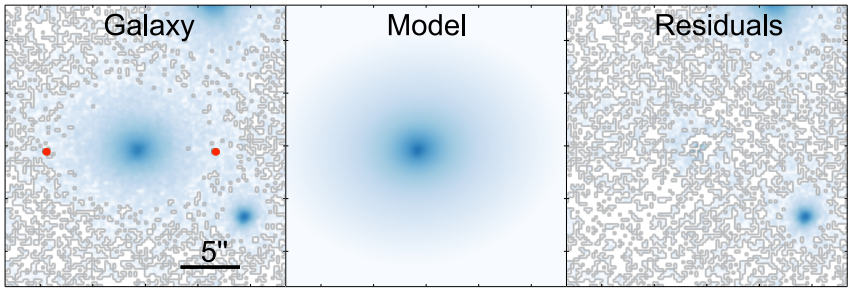


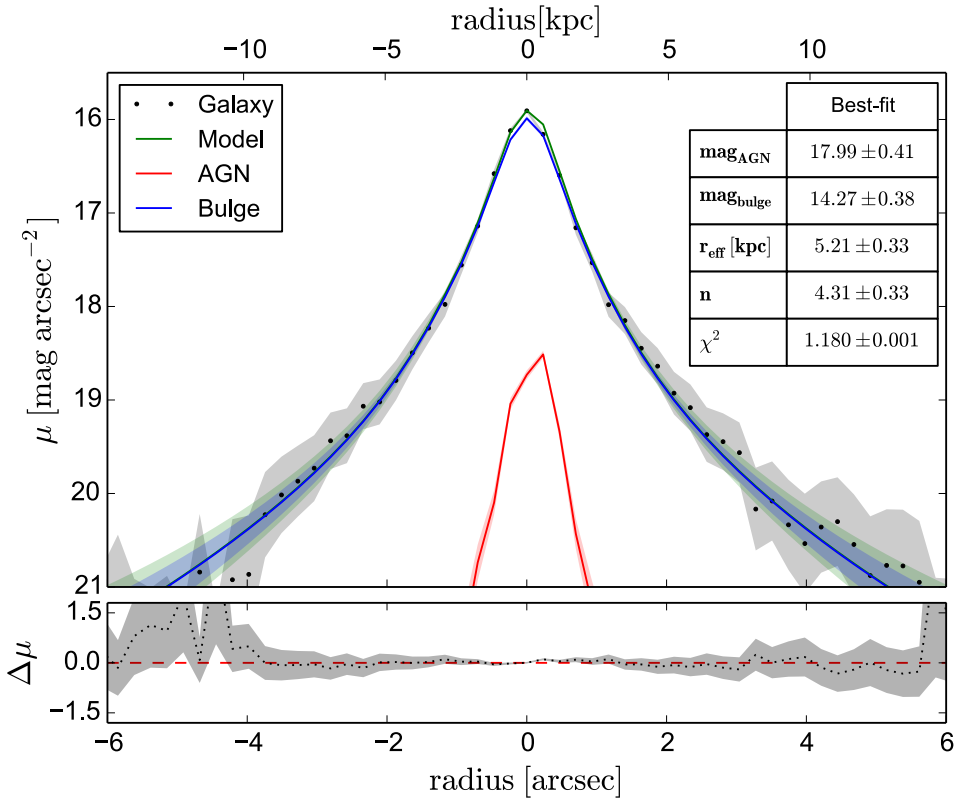
B3 1702+457 R band

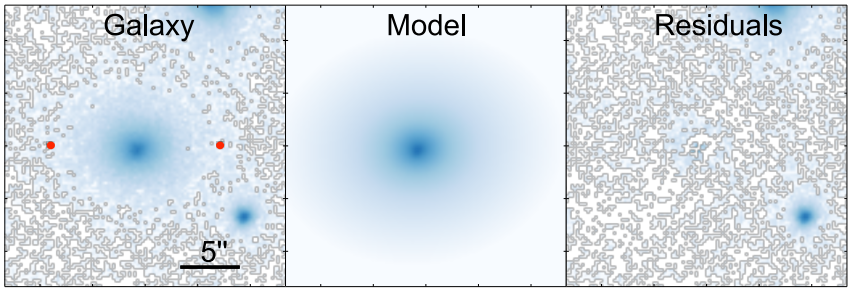


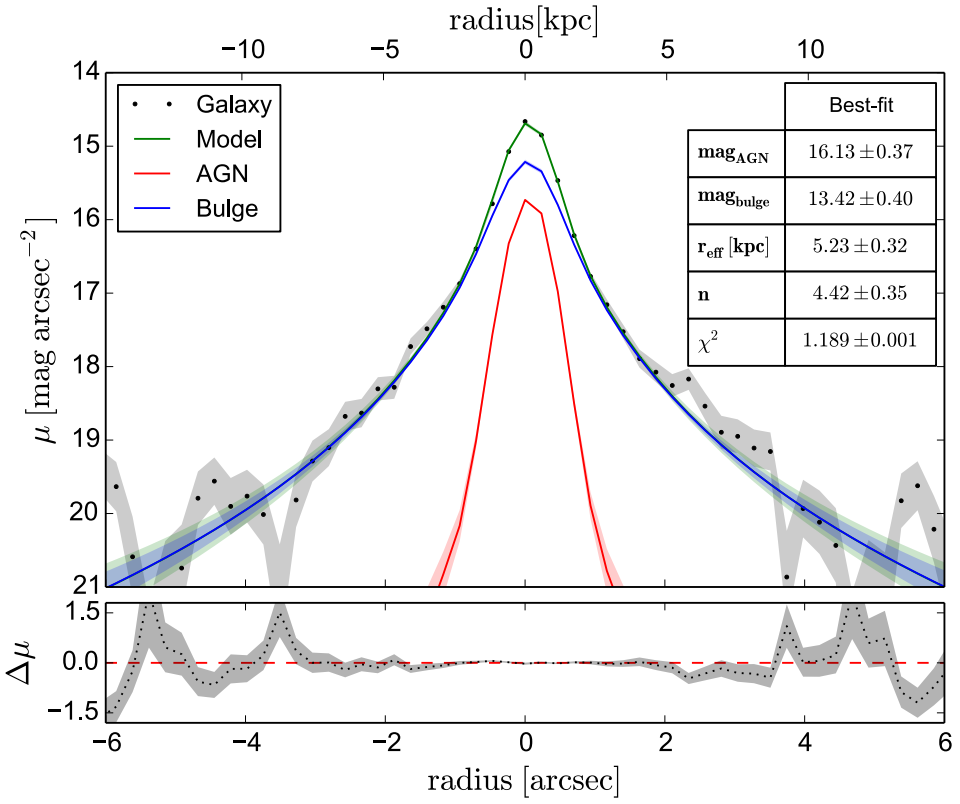


2E 1640+5345, z=0.164

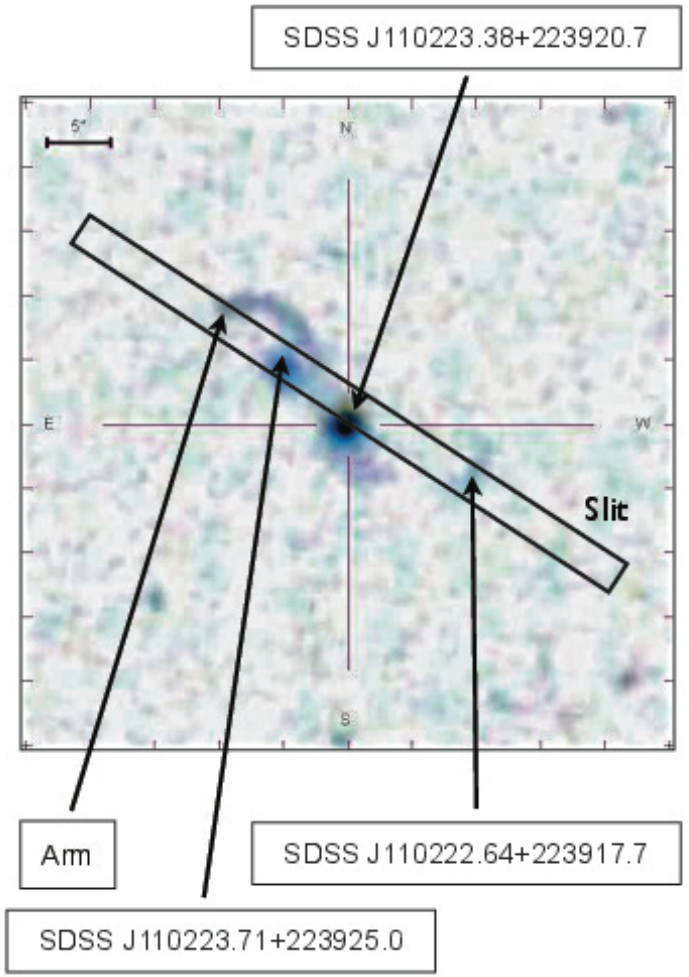








FBQS J1102+2239
NLSy1



GTC/OSIRIS; in prep.