A Jetted Wandering Massive Black Hole Candidate in a Dwarf Galaxy

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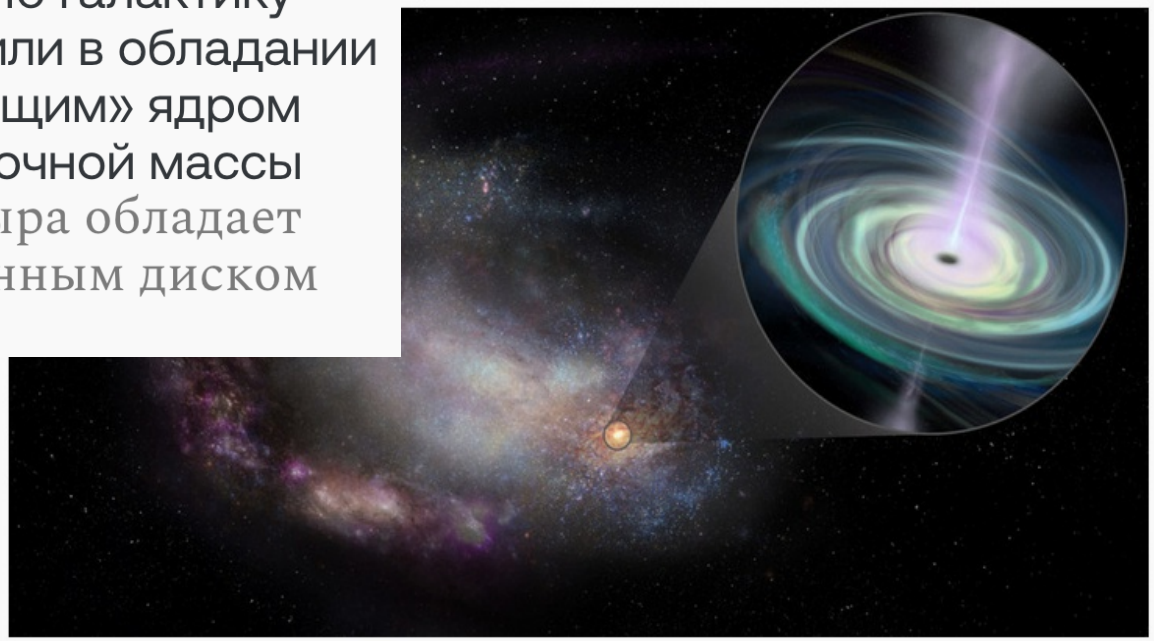
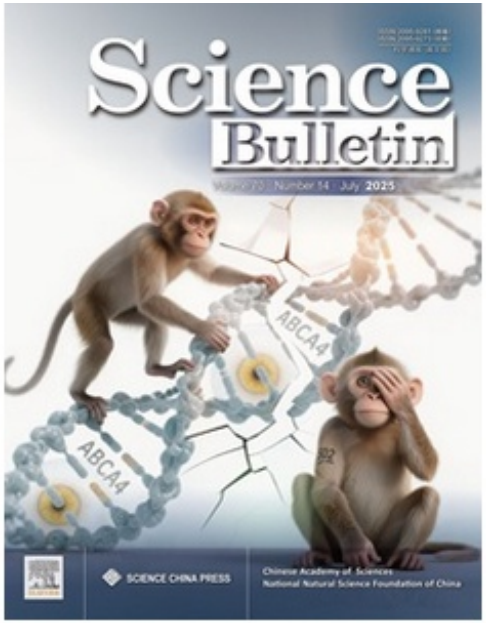
Карликовую галактику заподозрили в обладании «блуждающим» ядром промежуточной массы

Черная дыра обладает аккреционным диском и джетом



Sophia Dagnello; NRAO / AUI / NSF

Астрономы при помощи наземного радиоинтерферометра VLBA обнаружили в карликовой галактике MaNGA 12772-12704 кандидата в «блуждающее» активное ядро с джетом, внутри которого находится черная дыра промежуточной массы. Это открытие может указывать на новый механизм быстрого роста черных дыр в ранней Вселенной и недооценку влияния активных ядер на эволюцию карликовых галактик.



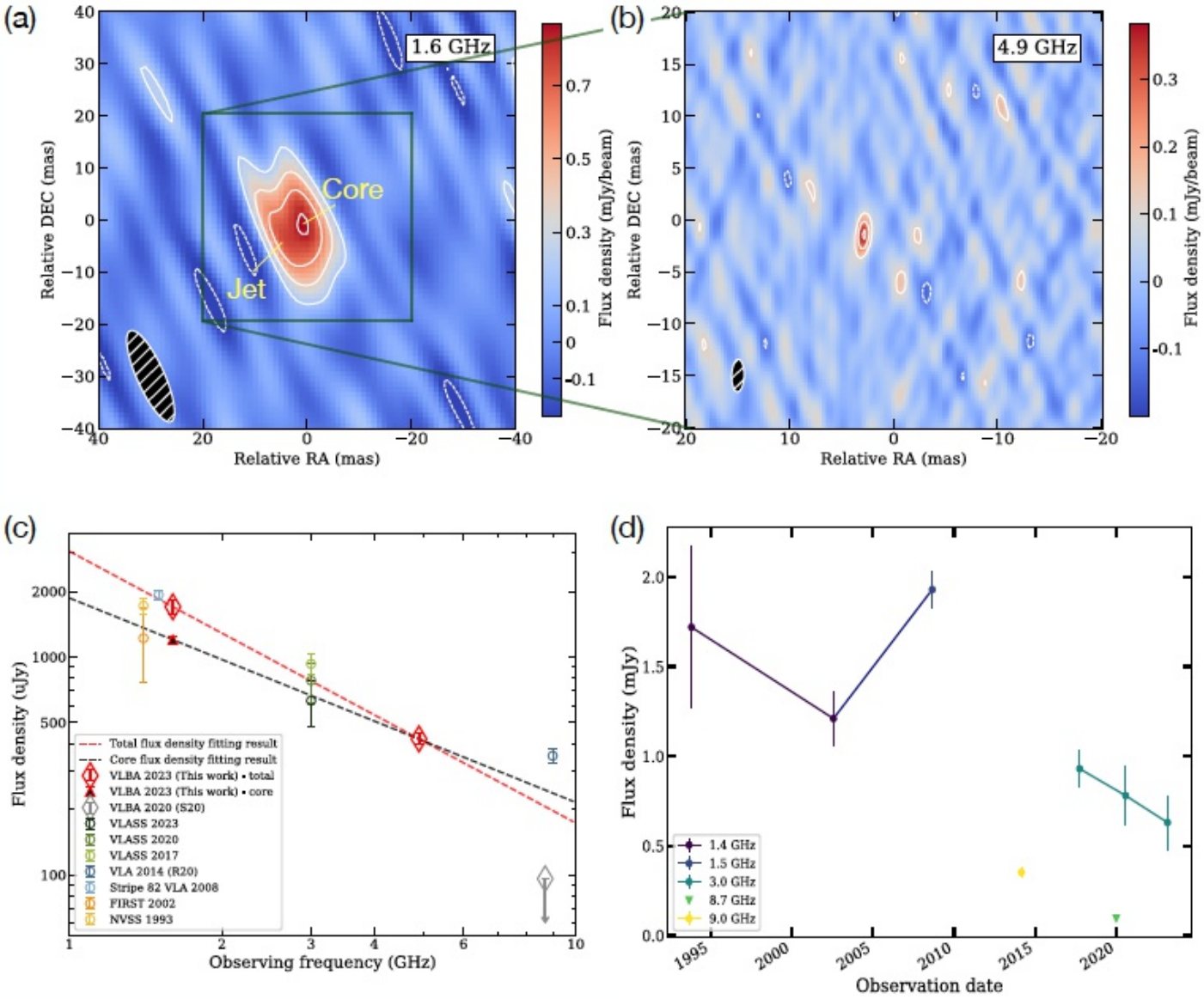
Impact Factor	21.1
Five-year Impact Factor	16.7
CiteScore	20.3

using optical spectroscopy, X-ray, and integral field unit (IFU) observations have identified spatially or kinematically offset AGNs in 2%–62% of samples, depending on methodology [3, 4, 5]. Regarding AGNs with offset radio cores, Popkov et al. [6] identified ~ 35 cases where Very Long Baseline Interferometry (VLBI) coordinates are associated with bright jet components separated by several to tens of milliarcseconds (mas) from the radio core. The primary

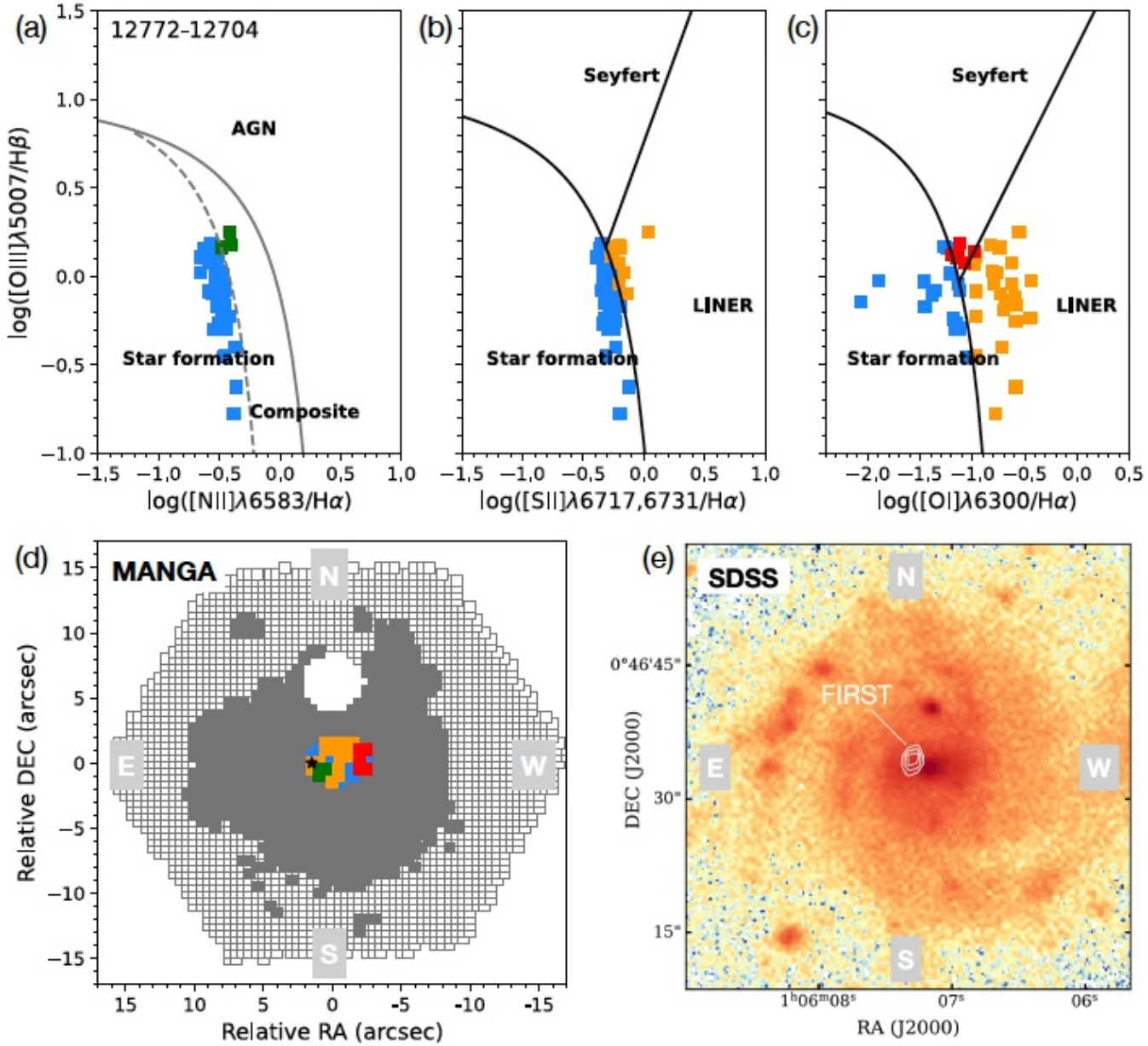
Но сейчас речь о смещениях на ~3 порядка больше

Радио: а есть ли джет?

VLBI, 0.1 mas, separation radio-optics 2.7"= 0.9 kpc
Jet: 2.2 pc PA=134 a=-1.2 + variable (not SNR)
Tb>2e9 K – exceed value for starburst



this galaxy exhibits AGN-like line ratios, with emission lines falling within the Seyfert and LINER
[по мне – это легкий удар в баре, а широких линий нет...]



Линий HeII не обнаружено, но авторы не переживают:

ratios. This finding further reinforced the off-nuclear AGN scenario over the dual-AGN interpretation. The absence of He II λ4686 emission in the AGN-dominated spaxels is unsurprising, as this line is typically weak and detected in only a small fraction of AGNs, particularly in low-luminosity systems such as the one studied here [13]. Adopting a stellar mass[1] of $M_{\rm stellar} = 1.52 \times 10^9\, M_\odot$, we estimate the black-hole mass $\log_{10}(M_{\rm BH}/M_\odot) = 5.54 \pm 0.45$ utilizing the $M_{\rm BH} - M_{\rm stellar}$ scaling relation [18]. The quoted uncertainty accounts for errors in stellar mass, the scaling relation

и лихо используют масштабные соотношения с полной массой галактик,
а также делают глубокие выводы об эволюции таких систем:

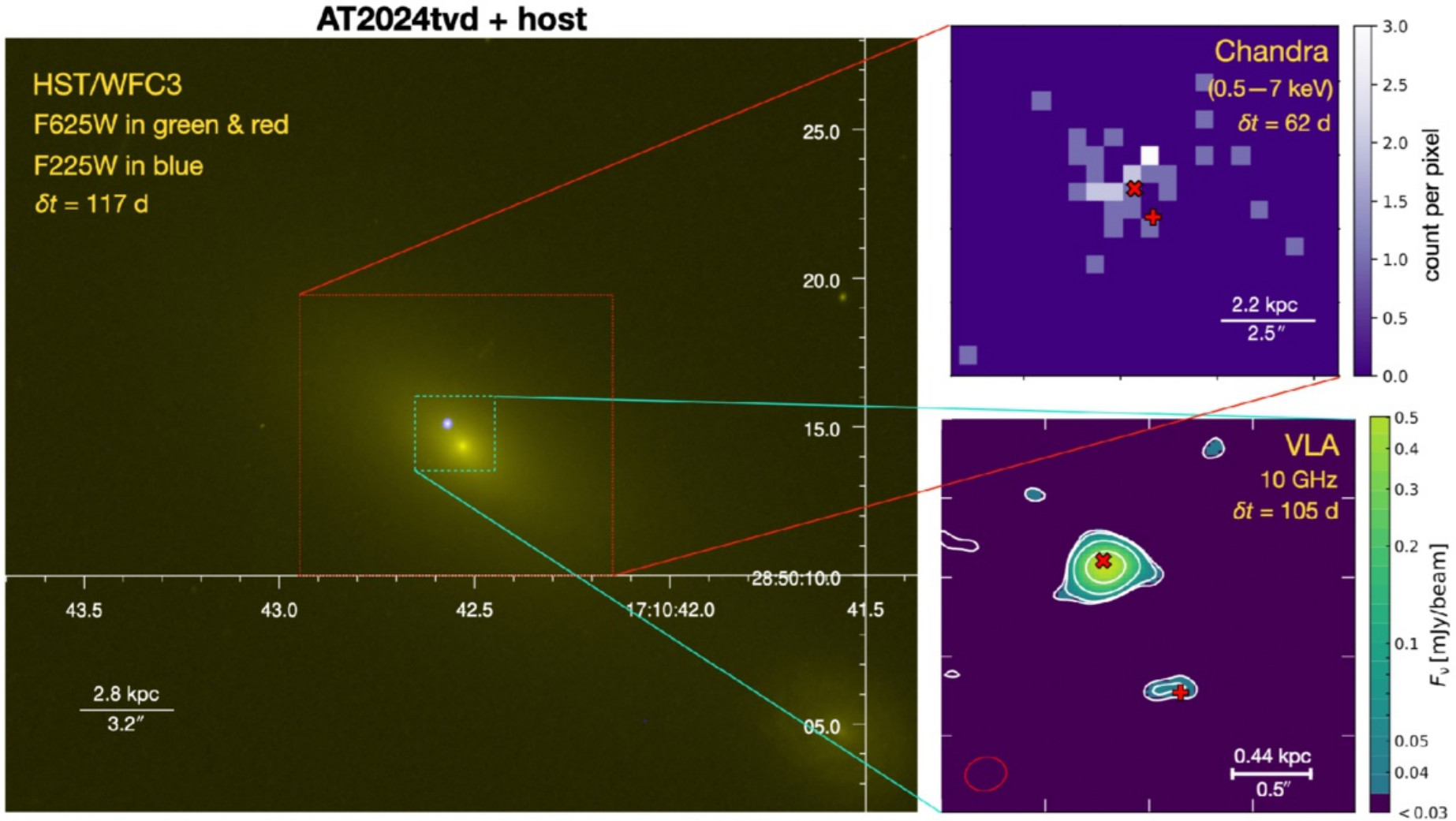
The identification of an actively accreting, off-nuclear MBH candidate in the dwarf galaxy MaNGA 12772-12704 challenges conventional black-hole growth models in low-mass galaxies, providing robust observational support for alternative accretion pathways. This has profound implications for early-Universe SMBH formation, AGN feedback, and black-hole demographics.

The ≈0.94 kpc offset of this accreting MBH challenges conventional black-hole growth models. Theory predicts that such wandering MBHs may arise from gravitational-wave recoil or asymmetric gas accretion [8]. Our VLBI detection of MaNGA 12772–12704 provides direct evidence that an intermediate-mass black hole can be spatially displaced from its host's centre.

Дополнительные материалы – только про радио

А какие еще есть наблюдательные примеры?

=> A Massive Black Hole 0.8 kpc from the Host Nucleus
Revealed by the Offset Tidal Disruption Event AT2024tvd (Yai + 2025ApJ...985L..48Y)



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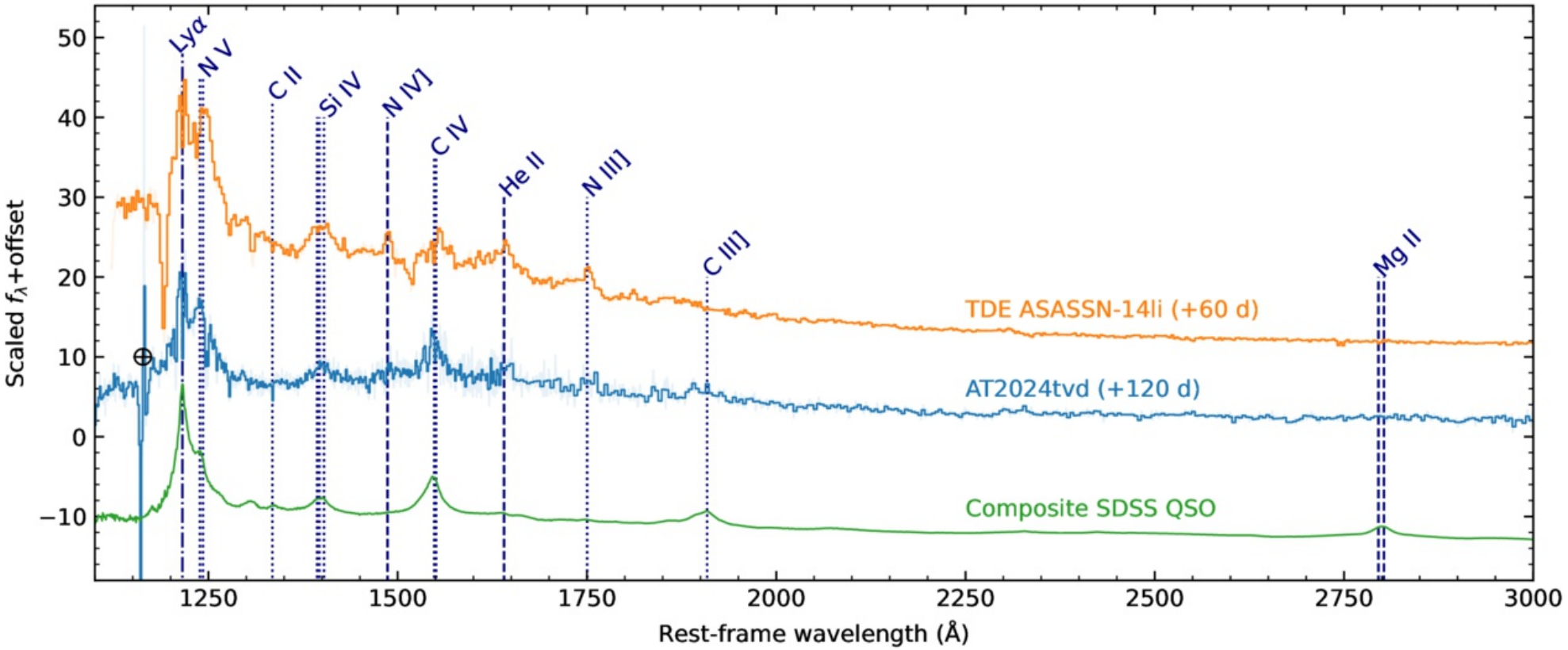
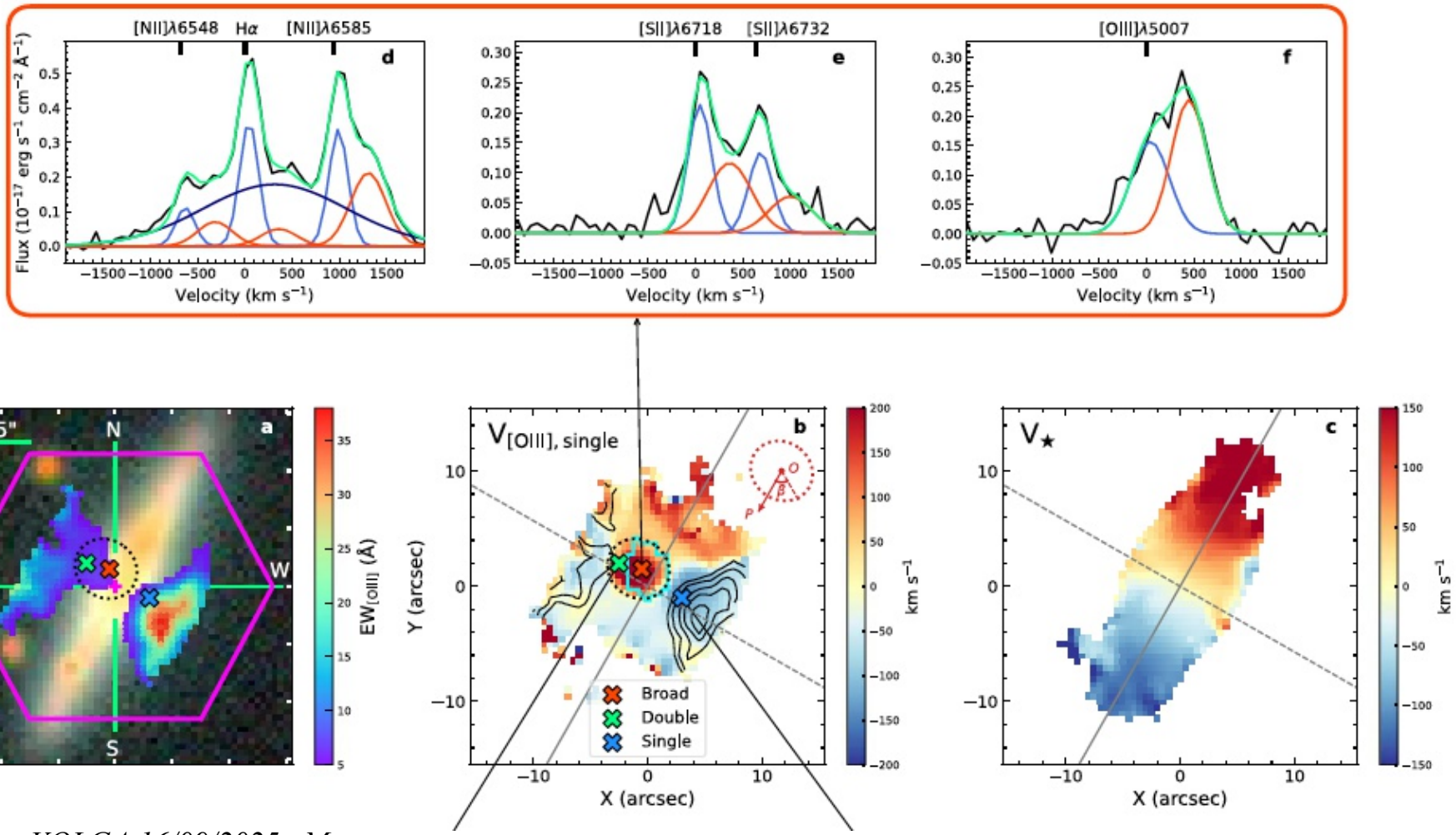


HST спектр – широкие эмиссии на красном смещении галактики, т.е. аккреционная машина имеет место именно там

Пример из MaNGA (на него они не ссылаются)

A Dual Active Black Hole Candidate with Mass Ratio ∼7:1 in a Disk Galaxy

Xiao Cao[1,2], Yan-Mei Chen[1,2], Yong Shi[1,2], Junfeng Wang[3], Zhijie Zhou[1,2], Min Bao[1,2], Qiusheng Gu[1,2],
Alexei Moiseev[4,5], Luis C. Ho[6,7], Lan Wang[8,9], and Guangquan Zeng[8,9]



Пример из MaNGA (на него они не ссылаются)

ЧД в ядре – биполярное истечение + радио
ЧД в 1 кпк – широкая компонента

Спорно, но здесь все, хотя бы в галактике

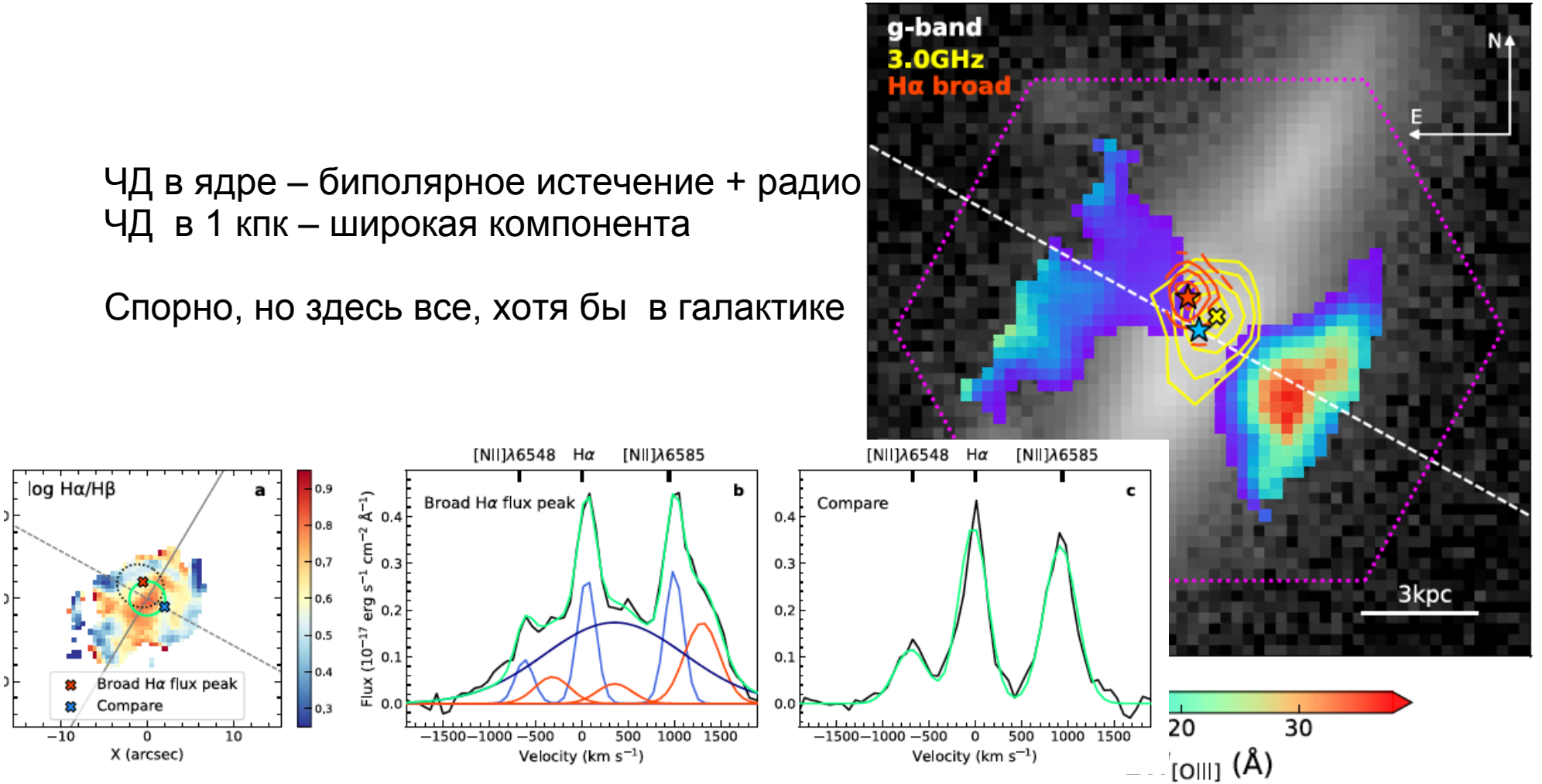


Figure 6. Distribution of *g*-band flux and [O III]λ5007 biconical ionized structure. The purple hexagon represents the MaNGA bundle. The 3.0 GHz VLASS radio continuum is overlaid as yellow contours, and its flux peak is marked as a yellow cross. The VLASS beam size displayed in the lower-left corner is $2''.84 \times 2''.28$, and it has a position angle of 44° (east from north). The flux of the Hα broad component within Region A is shown as red contours, and the flux peak is marked as a red star. The overlaid color map shows $EW_{[O\ III]}$. The white dashed line is the photometric minor axis, and the blue star marks the photometric center of this galaxy.