Connection between phenomenon of active nucleus and disk dynamics in Sy galaxies

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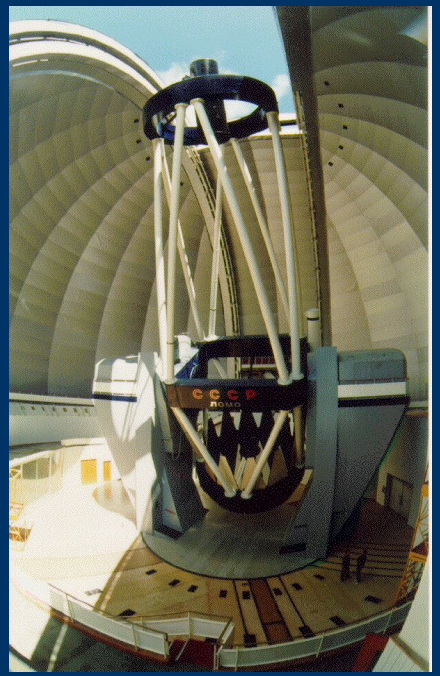


SAO RAS
6-m telescope

6m telescope 3D instruments

MPFS=MultiPupil Fiber Spectrograph
Spatial sampling: 0.5", 0.75", 1.0"
Field of view: 16 x 16 spaxels
Spectral range: 3600-9600 ÅÅ
• Velocity fields and velocity dispersion of stars
• Velocity fields in emission lines of the ionized gas:
(Hα, Hβ, [OI],[OIII], [NI],[NII], [SII] etc.)
• Continuum and emission lines flux maps

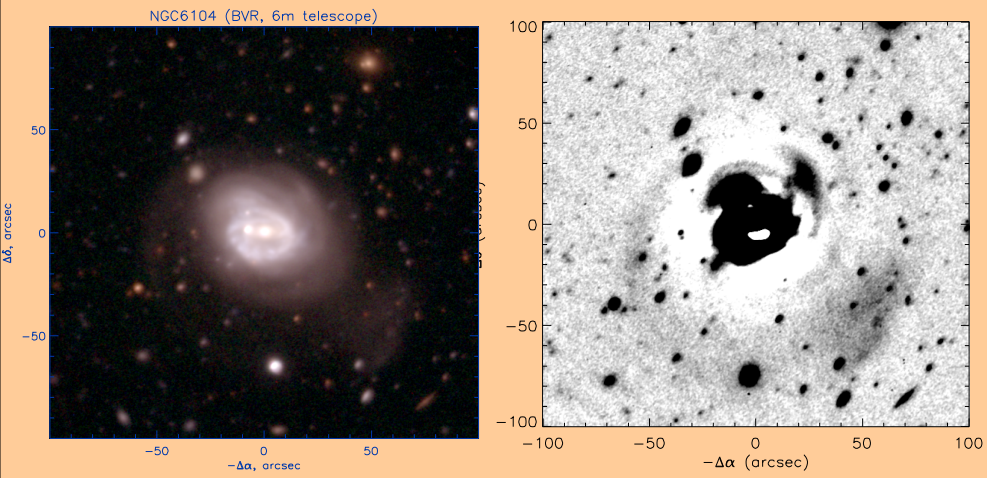
SCORPIO = Spectral Camera with Optical Reducer for Photometric and Interferometrical Observations

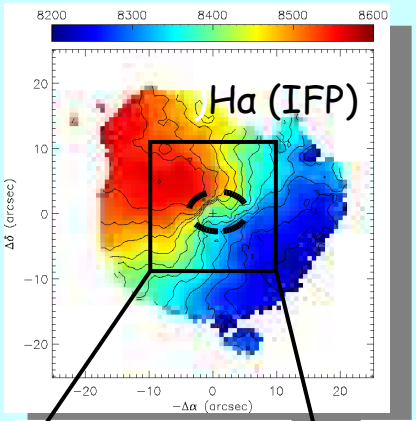
Afanasiev & Moiseev (2005)

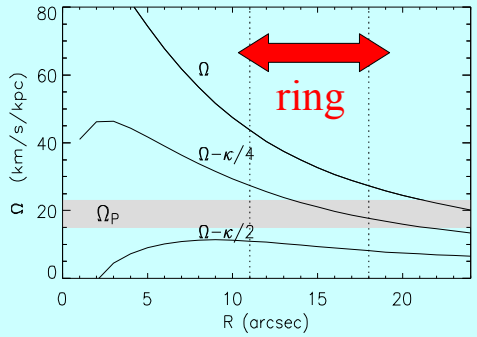
• 3D spectroscopy with the scanning Fabry-Perot Interferometer
• Broad-, medium- and narrow-band direct imaging
• Long-slit and multi-slit spectroscopy

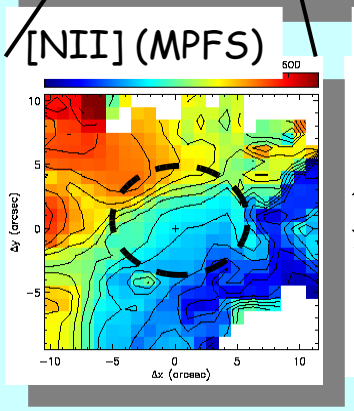
• Large-scale (~6 arcmin) velocity fields of the ionized gas in the Hα , [NII] or [OIII] emission lines
• Continuum and emission lines flux maps
• BVRI deep images

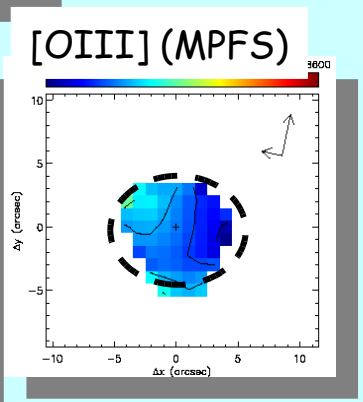
NGC 6104 (Sy 1.5)











In the outermost regions of the galaxy at r=25-45kpc, we detected extended asymmetric filaments low surface brightness. It is a single structure that resembles a companion disrupted by tidal forces of NGC 6104.

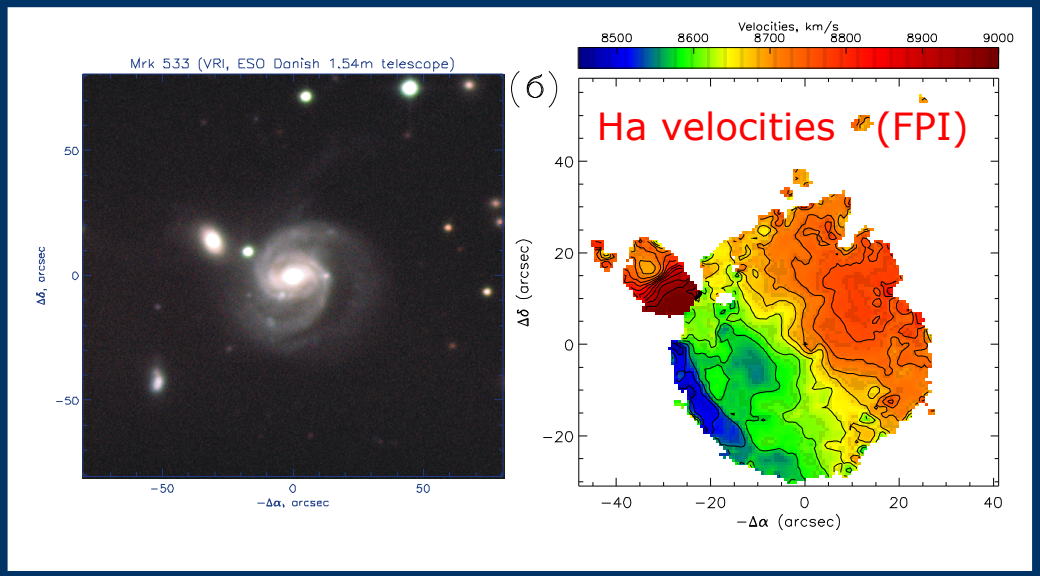
At r= 1-5 kpc, we found radial motions of ionized gas along the bar toward the nucleus with velocities of ~50km/s.

The inner Lindblad resonance is absent in the bar, the radial gas motions can reach the AGN, fueling its central engine. The circumnuclear ring corresponds at ultraharmonic (1:4) resonance of the bar.

In the innermost region of the galaxy, we detected ionized gas outflow. We observed not the high-velocity jet itself emerging from the AGN, but the result of the interaction between the radio jet and interstellar clouds

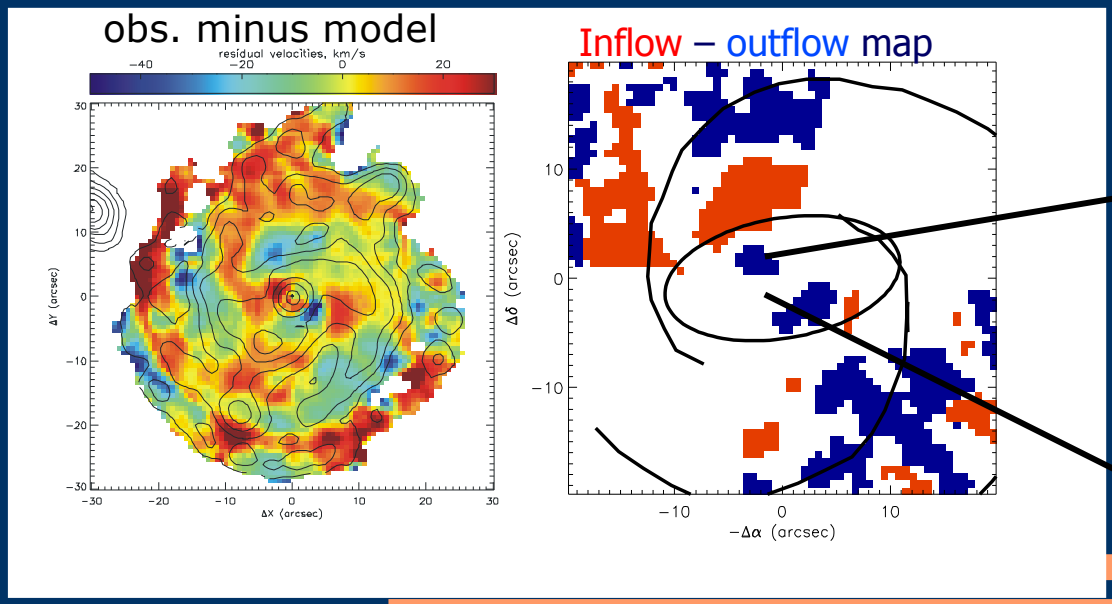
Smirnova, Moiseev & Afanasiev (2006)
Astron. Letters, 32, 520; astro-ph/0607163

Mrk 533 (Sy2)

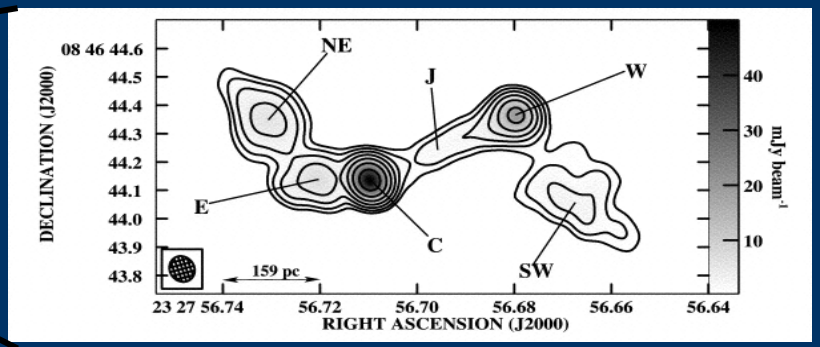


- The outer warping gaseous disc was caused by an interaction with the companions.
- The streaming motions along the bar were found.
- The map of radial motions in the disc shows the circum nuclear outflow in r<5" along galactic minor axis
- The presence of high-velocity clouds, located close to the passage of the radio jet, shows that the effects of jet-induced shocks are still important in the nuclear regions.

Smirnova et al. (2007, MNRAS, 377, 480)



VLBI data: Momjian et al., 2003



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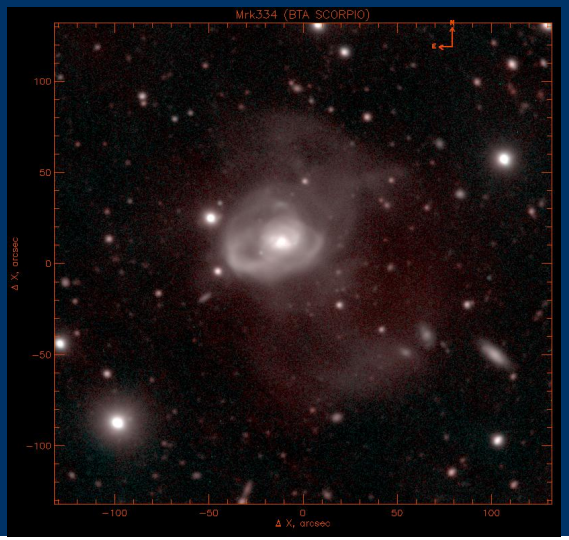
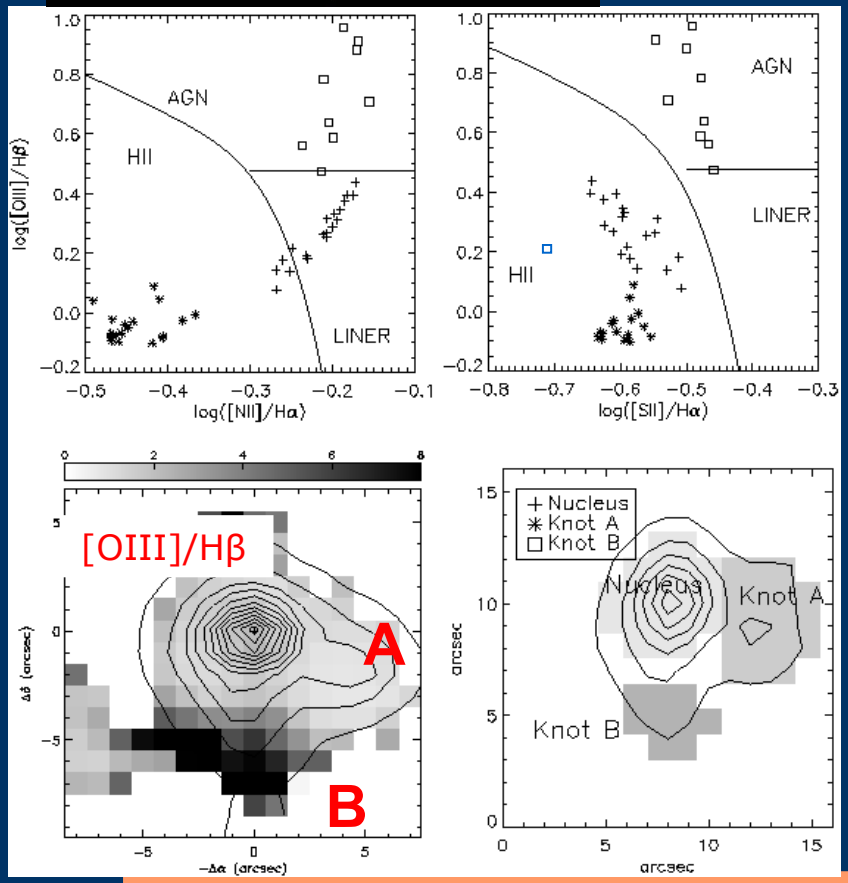
Deep V+R image (6m telescope)

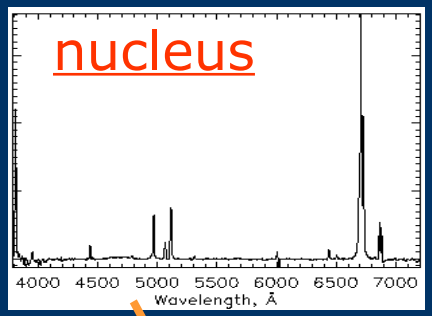


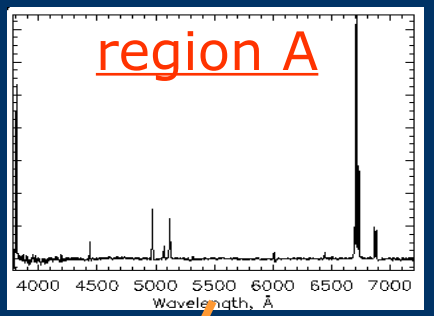
Mrk 334 (Sy 1.8)

We find numerous faint elongated structures (tidal debris) on the spatial scales 1-45 kpc

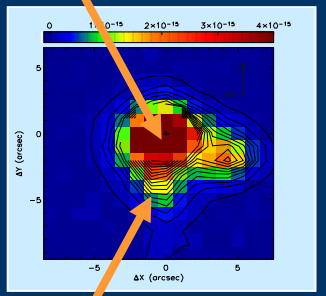
On MPFS maps we distinguish four bright regions with different type of optical spectra. The gas ionization properties differs dramatically between A,B,C regions and nucleus

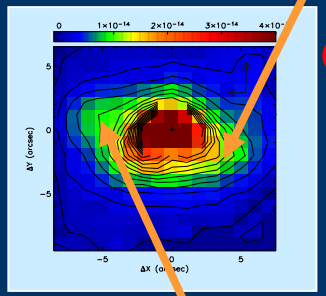




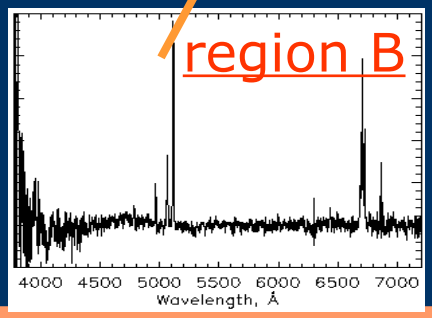


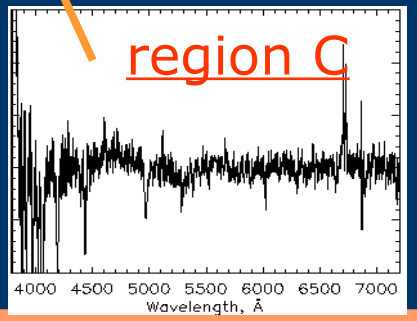
[OIII]





continuum





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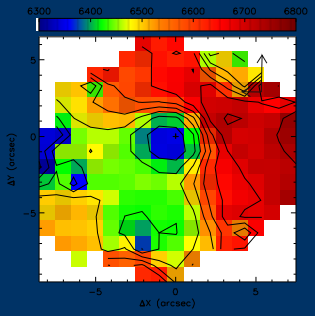
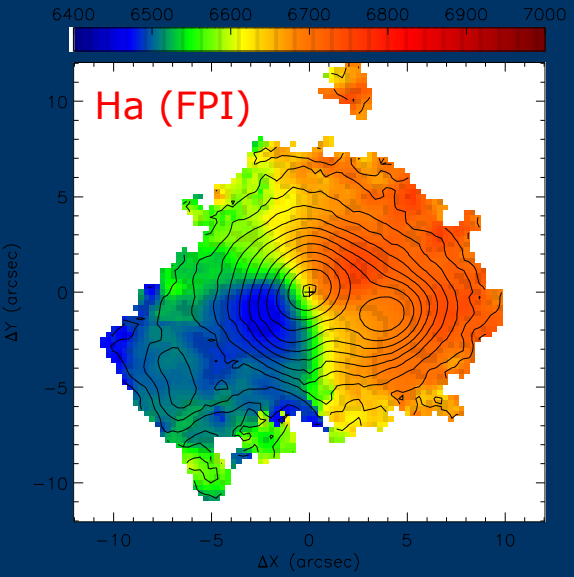
The gas kinematics

[OIII] (MPFS)

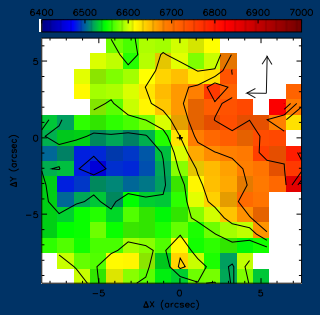


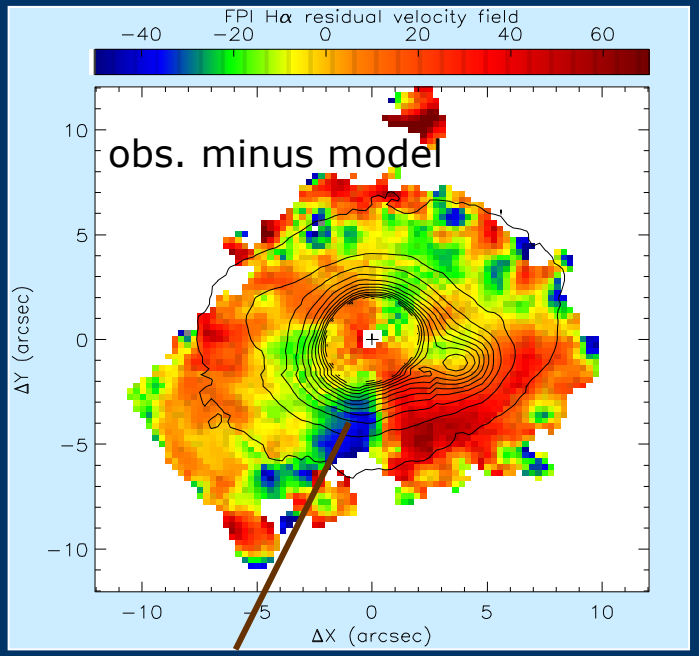
Rotation + outflow from the nucleus (excess of blue-shifted velocities) in [OIII] velocity field.

Mainly circular rotation in Balmer (Hα, Hβ,) and low-ionization lines ([SII], [OI]).



[SII] (MPFS)





Strong non-circular velocity perturbations in the region B (±50 km/s)

The origin of region B:

- High ionization (larger than in nucleus!)
- Significant contribution of shocks
- Line-of-sight velocity gradient along tidal feature

On the distances ~2 kpc from the active nucleus we found an unusual region ("B") in the disk of Mrk334. Here satellite debris fly through the disk of the galaxy. The merging of Mrk334 and its companion can be a trigger of AGN fueling.

Smirnova & Moiseev, in prep.