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Studying of some Seyfert galaxies by means of panoramic spectroscopy

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Abstract. We have studied several galaxies with active nuclei using method of panoramic spectroscopy. The results of observations at the SAO RAS 6-m telescope are presented: the circumnuclear regions were studied with integral-field spectrograph MPFS, the large-scale velocity fields of the ionized gas were constructed from observations with scanning Fabry-Perot interferometer (IFP).

1. Observations

In order to investigate gas and stellar kinematics in Seyfert galaxies, we carried out observations at 6-m telescope of the SAO RAS with two panoramic spectrographs: MPFS and SCORPIO multimode spectrograph (Afanasiev & Moiseev 2005). MPFS takes simultaneous spectra from 256 spatial elements constructed in the form of square, that form an array of $16'' \times 16''$ on the sky. We used SCORPIO in the following modes: broad-band direct imaging, panoramic spectroscopy with the scanning Interferometer Fabry-Perot in H_α line and long-slit spectroscopy.

Based on these data we have constructed intensity maps and velocity fields in different emission lines of the ionizing gas as well as velocity fields of stars. On the MPFS maps we can see how gas and stars are distributed and move in a circumnuclear region. On the SCORPIO maps we observed gas behaviour on larger scales. In order to define what is a source of gas ionization we have constructed diagnostic diagrams based of the method by Veilleux & Osterbrock (1987).

2. NGC 6104

This barred galaxy possesses a high-contrast star-forming ring with a radius of $12''$ (6 kpc). The IFP velocity field shows almost regular rotation, except for the central region ($r < 9''$) where significant turn of a kinematic axis occurs. This feature is caused by radial inflow motions along the bar. The velocities of stars agree with the kinematics of ionized gas at least in the central region (in the MPFS field of view). Spectroscopic diagnostics revealed that gas in the central region has been excited by the radiation of the active nucleus. Gas in the ring is ionized by the radiation of hot stars, implying that massive burst of star formation is going on. On our deep B, V, R images we have detected arc-like structures in the outer parts of the galaxy located at distances 38-50 kpc from the center. Subtraction of the 2D model (bulge+disc) from the original images increases the contrast of this structure. The residual images (Fig. 2) support the hypothe-

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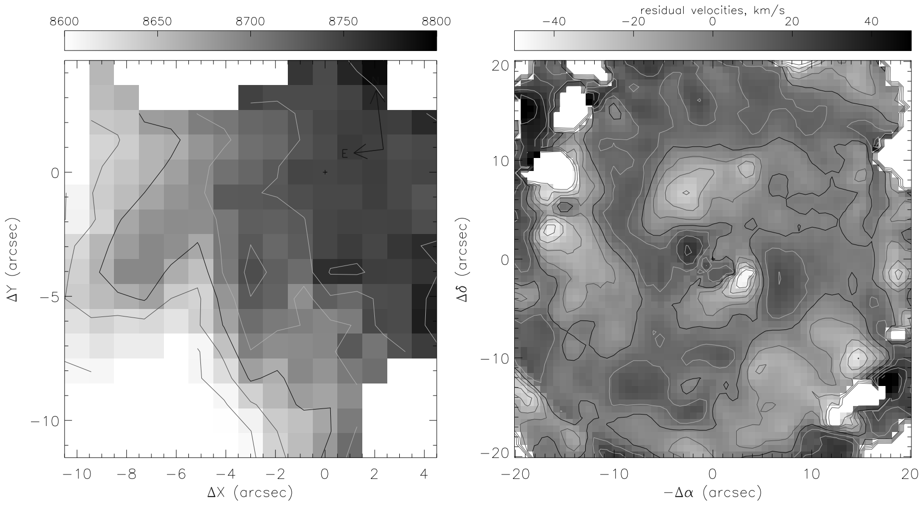

Fig. 1. Mrk 533: MPFS velocity field in H_α line (left) and IFP map of residual velocities after the subtraction of purely circular motions.

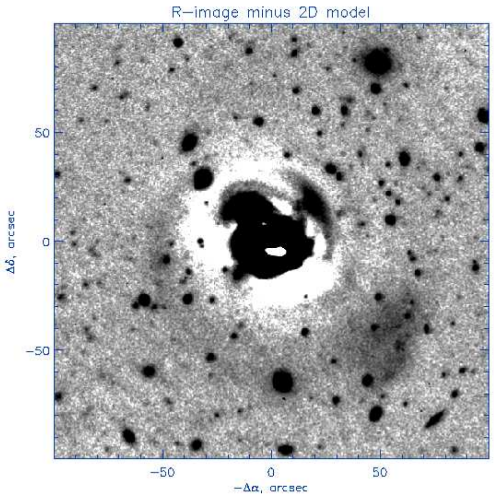

Fig. 2. NGC 6104: residual R-band image.

sis of a single merging event (destruction of a satellite galaxy). Therefore in the case of NGC 6104 we see a possible mechanism of AGN fueling: tidal interaction + radial motions in the bar, which carry gas into the central engine.

3. Mrk 533 (NGC 7674)

Mrk 533 is a part of interacting system and the main member of the Hicson compact group HCG96. Amram et al. (2003) have published the H_α velocity field and mentioned an asymmetry between the receding and approaching sides of the rotation curve at $r > 20''$ (11 kpc). We have undertaken a more careful analysis of our IFP velocity field and have found numerous peculiarities. The map of residual velocities (after the subtraction of purely circular rotations) reveals strong inflow motions in the spiral arms ($20\,\mathrm{km\,s^{-1}}$ along the line-of-sight or about $40\,\mathrm{km\,s^{-1}}$ in the galactic plane). Besides this inflow, the radial outflow motions are probably due to the central radio structure observed at the distance of $r = 4''$ (line-of-sight velocities $40 - 50\,\mathrm{km\,s^{-1}}$). The MPFS spectra reveal a multicomponent structure of the forbidden [OIII] emission line which is also associated with the nuclear gas outflow.

References

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