

The extended ionized blob in the merging group of galaxies NGC1143/44

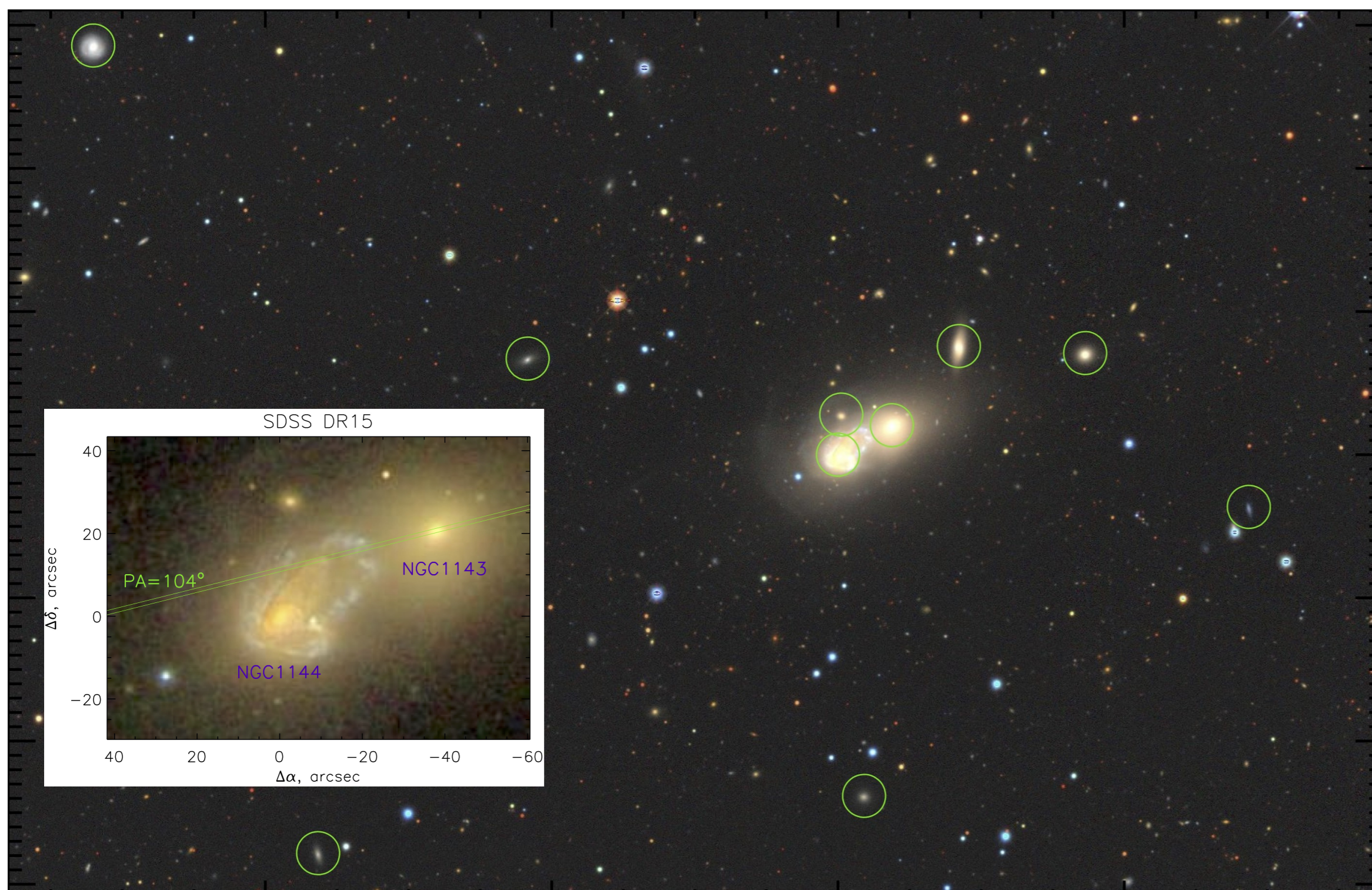
Smirnova A.A., Moiseev A.V., Zasov A.V. (SAO RAS, SAI MSU)

Arp 118 is a spectacular collisional system comprising of a distorted disk galaxy NGC 1144 and a lenticular galaxy NGC 1143 located at the 40" to the NW. The adopted redshift is $z = 0.0288$ that gives in the standard Λ CDM cosmology ($H_0 = 68$ km/s Mpc/s, $\Omega_m = 0.31$, $\Omega_b = 0.044$) the luminosity distance 118 Mpc and the scale 0.542 kpc/". NGC 1144 is classified as a Seyfert 2 and as a Luminous IR galaxy (Appleton & Struck-Marcell 1987). This galaxy is a rare example of a very luminous, extended starburst. Kinematical properties of this galaxy are also quite unusual: NGC 1144 rotates extremely rapidly (Hippelein 1989), showing an amplitude of line-of-sight velocities of over 1200 km/s across its disk (Bransford et al. 1999). NGC 1144 has been studied in detail in molecular and neutral gas (Appleton et al. 2003), but the distribution and kinematics of the ionized gas remained unknown for a long time.

Using observations at the 2.5-m CMO SAI MSU telescope with MaNGaL instrument (Moiseev et al. 2020) we have mapped the line-of-sight velocity and brightness distribution in the H α and [NII] λ 6583 emission lines. In addition to the regularly rotating gas disk, which coincides with what was previously known from radio data in HI and CO, our new images in different emission lines reveal, for the first time, the extended emission knots and filaments near the central galaxies of the system - an ionized gas envelope. It extends up to 22 kpc in projection from the NGC 1144 active nucleus.

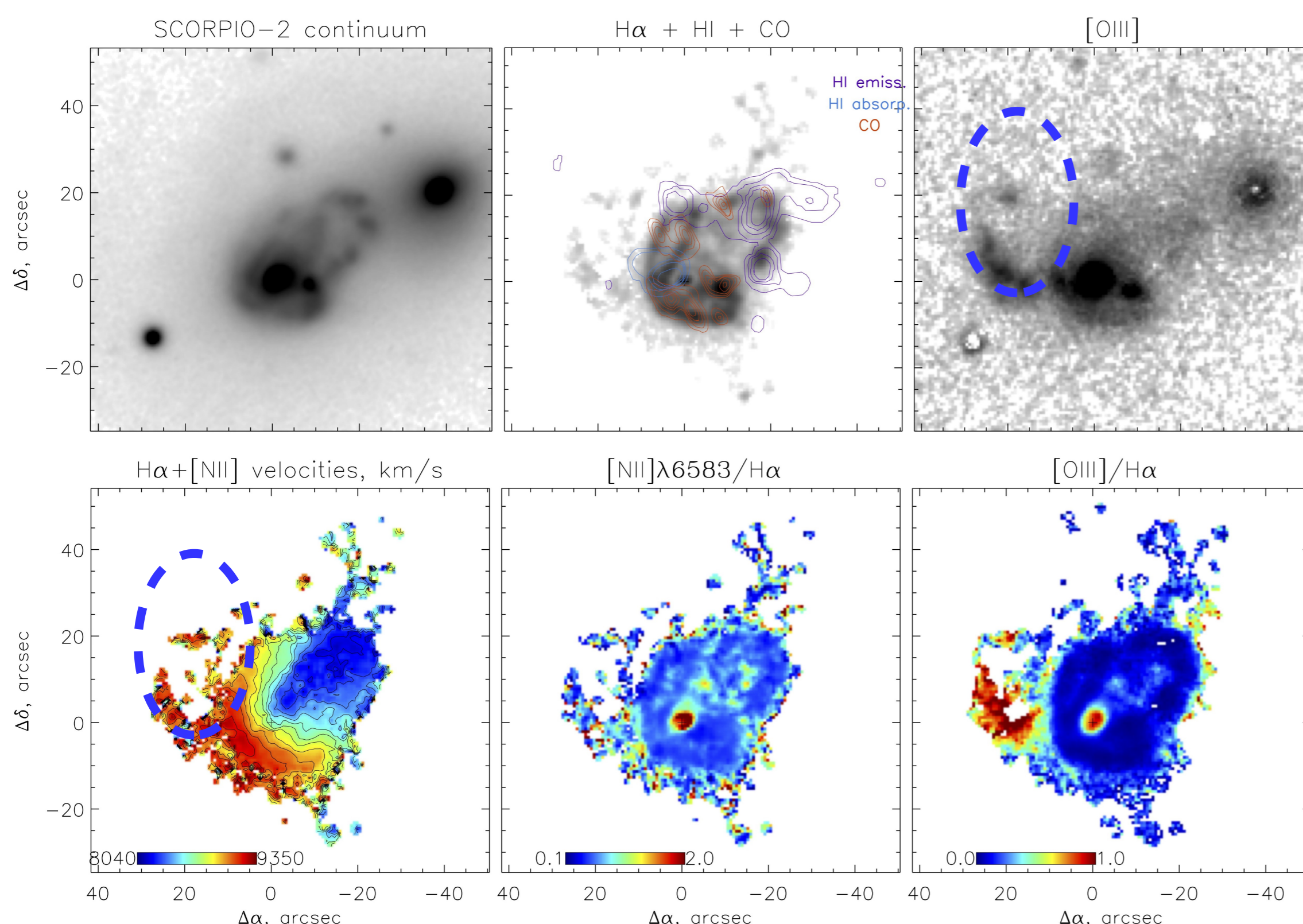
In the [O III] λ 5007 image, obtained by using the SAO RAS 6-m telescope observations, this system of filaments looks more contrasting. We used this image to accurately point the slit of the SCORPIO-2 (Afanasiev & Moiseev 2011) spectrograph at the bright parts of the emission structure. To understand the ionized gas properties, diagnostic diagrams of the emission-line ratios were constructed (BPT-diagrams). The spectral observations show good agreement with the data of narrow band photometry performed using the SCORPIO-2 and MaNGaL instruments. The ratio of the lines in the emission filaments corresponds to ionization by the active nucleus. At the same time, the gas is characterized by relatively quiet dynamics: the radial velocities do not differ from the rotation curve by more than 50 km/s, the velocity dispersion is 50-150 km/s. Therefore, **the detected filaments are most likely a part of the tidal structure illuminated by the ionization cone from the active nucleus of NGC 1144.**

Using SDSS data, we have studied the surroundings of merging galaxies NGC 1143/1144 and have found 10 galaxies inside 400 kpc projected radius, whose measured spectral redshifts coincide with the central galaxies NGC 1143/1144 within the radial velocities of 500 km/s. **Thus, Arp 118 can be considered as a group of galaxies in the process of merging its two most massive members.**



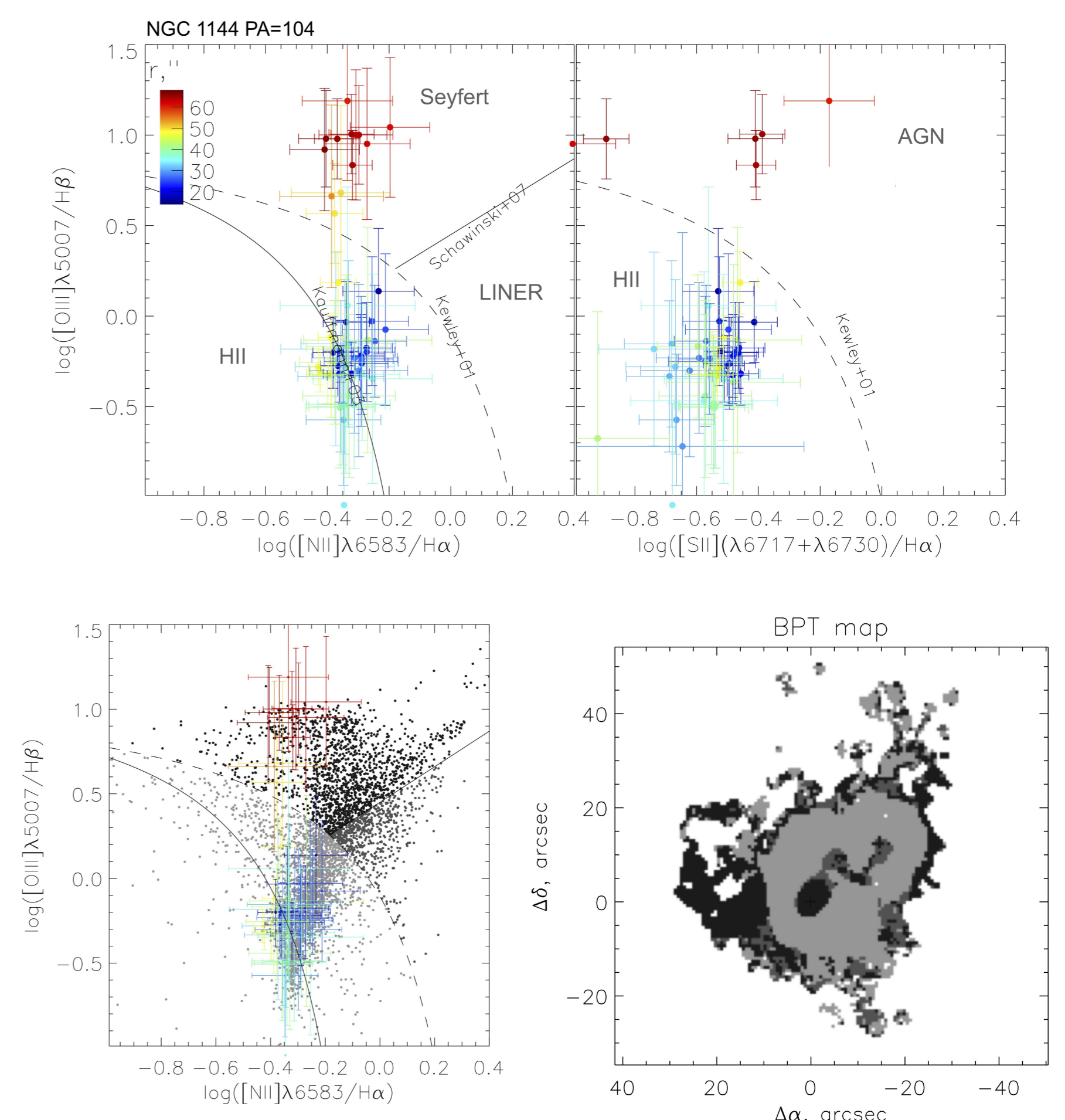
Optical image of the region around Arp 118 with size 520x330kpc according to the DESI Legacy survey. Members of the galaxy group confirmed by spectra from SDSS DR16 are marked by the green circles. At the left bottom corner - zoomed image of the central galaxies in SDSS DR16 with location of the SCORPIO-2 slit in the 6-m telescope observations. The slit width was 1", the spectral range was 3650-7200Å with resolution 5Å.

The results of observations on the 2.5-m and 6-m telescopes: images in the continuum and the emission lines, comparison with the HI and CO distribution, velocity fields and maps of the emission lines ratio. An external system of ionized gas filaments is marked with a dotted oval.



Afanasiev V.L., Moiseev A.V., 2011BaltA...20..363A
 Appleton P.N. & Struck-Marcell C. 1987ApJ...312..566A
 Appleton P.N. et al. 2003ApJ...586..112A
 Bransford M.A. et al. 1999ApJ...525..153B
 Moiseev A.V. et al 2020ExA....50..199M

The study of the gas ionization state.
 Top row: The results of SCORPIO-2 spectroscopy, the color of the symbols corresponds to the distance from the NGC 1143 nucleus.
 Bottom row: BPT diagram based on emission line maps (gray gradations), color shows spectroscopy data from the upper left diagram.



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