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VOLGA

View On the Life of GAlaxies

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New Low Surface Brightness Dwarf Galaxies Detected Around Nearby Spirals

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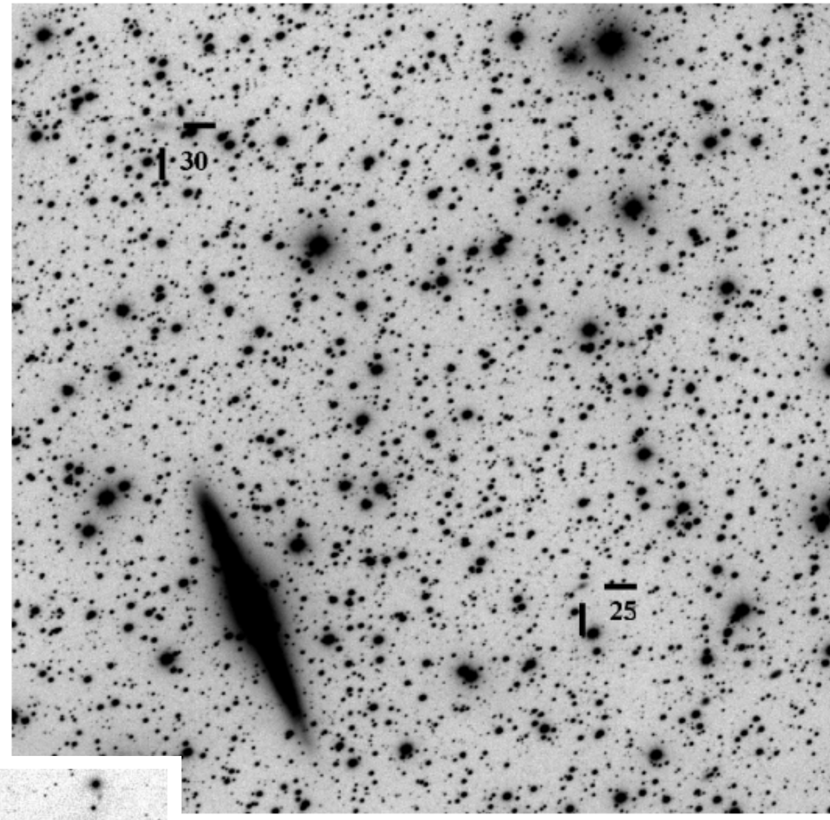
We conduct a survey of low surface brightness (LSB) satellite galaxies around the Local Volume massive spirals using long exposures with small amateur telescopes. We identified 27 low and very low surface brightness objects around the galaxies NGC 672, 891, 1156, 2683, 3344, 4258, 4618, 4631, and 5457 situated within 10 Mpc from us, and found nothing new around NGC 2903, 3239, 4214, and 5585. Assuming that the dwarf candidates are the satellites of the neighboring luminous galaxies, their absolute magnitudes are in the range of $-8.6 > M_B > -13.3$, their effective diameters are 0.4–4.7 kpc, and the average surface brightness is $26\overset{m}{.}1/\square''$. The mean linear projected separation of the satellite candidates from the host galaxies is 73 kpc. Our spectroscopic observations of two LSB dwarfs with the Russian 6-meter telescope confirm their physical connection to the host galaxies NGC 891 and NGC 2683.

The TBG (Tief Belichtete Galaxien) group deals with very long exposure images of galaxies made using amateur telescopes of medium caliber. The group was organized by P. Riepe in January 2012 in the Astrophotography department of the German association VdS (Vereinigung der Sternfreunde e.V.). Now the group consists of about 30 astrophotographers from Germany, Austria, and Switzerland, equipped with 10 to 110 cm diameter telescopes.



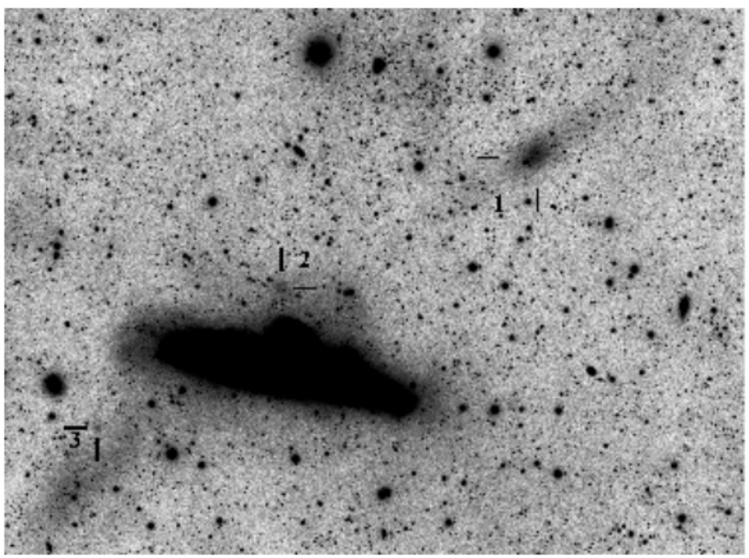


Figure 1. The galaxy NGC 4631 and three of its supposed companions, located along the diagonal tidal stripe. A 45′ × 33′ fragment of an image obtained by F. Neyer with an exposure time of $49^{\rm h}\!.5$. North is at the top, east is to the left.

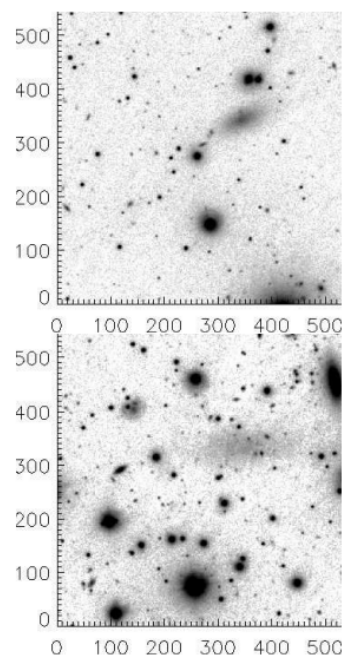


Figure 4. (a) The spiral galaxy NGC 891 and its two dwarf satellites: dwA = [TT 2009] 25 and dwB = [TT 2009] 30. A 33′ × 32′ fragment of an image obtained by M. Elvov with an exposure of $12^{\rm h}$. (b, c) Images of the dwarf galaxies [TT 2009] 25 and [TT 2009] 30, obtained by S. S. Kaisin on the SAO RAS 6-meter telescope with the SED607 filter with 1650-s and 2400-s exposures respectively. In all the images north is at the top, east is to the left.

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EXCITATION OF COUPLED STELLAR MOTIONS IN THE GALACTIC DISK BY ORBITING SATELLITES

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ABSTRACT

We use a set of high-resolution N-body simulations of the Galactic disk to study its interactions with the population of satellites predicted cosmologically. One simulation illustrates that multiple passages of massive satellites with different velocities through the disk generate a wobble, having the appearance of rings in face-on projections of the stellar disk. They also produce flares in the disk outer parts and gradually heat the disk through bending waves. A different numerical experiment shows that an individual satellite as massive as the Sagittarius dwarf galaxy passing through the disk will drive coupled horizontal and vertical oscillations of stars in underdense regions, with no significant associated heating. This experiment shows that vertical excursions of stars in these low-density regions can exceed 1 kpc in the Solar neighborhood, resembling the coherent vertical oscillations recently detected locally. They can also induce non-zero vertical streaming motions as large as 10-20 km s^{-1}, consistent with recent observations in the Galactic disk. This phenomenon appears as a local ring, with no associated disk heating.

Subject headings: Galaxy: disk - Galaxy: evolution - galaxies: kinematics and dynamics - stars: kinematics and dynamics

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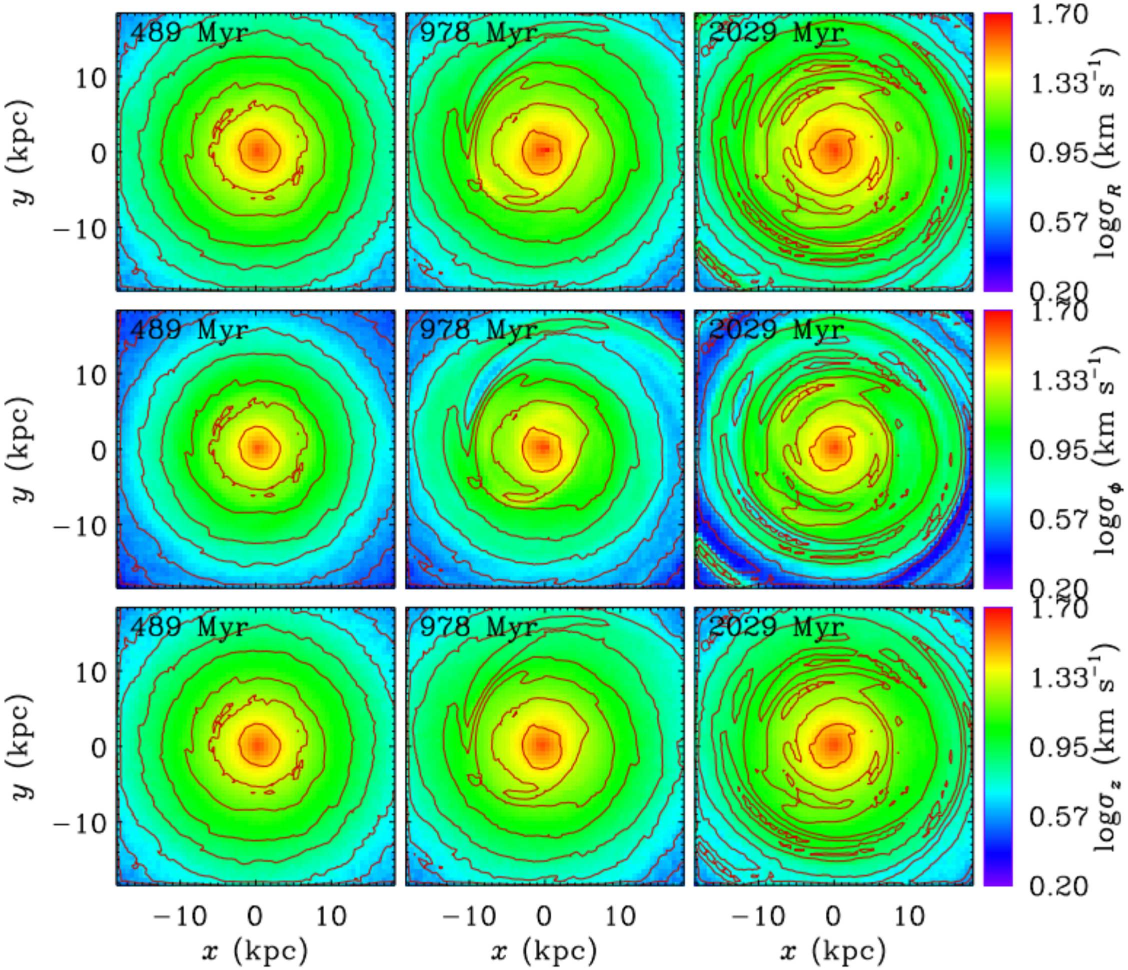

FIG. 2.— Time sequence of the stellar velocity dispersion: radial (top panels), tangential (middle panels), and vertical (lower panels) of the stellar disk as perturbed by a satellite as massive as $2{\cdot}10^{10}$ $M_\odot$ (first numerical experiment). There is a negligible increase of random motions in the in-plane motion of stars or vertical heating of the disk, even after more than 2.5 Gyrs.

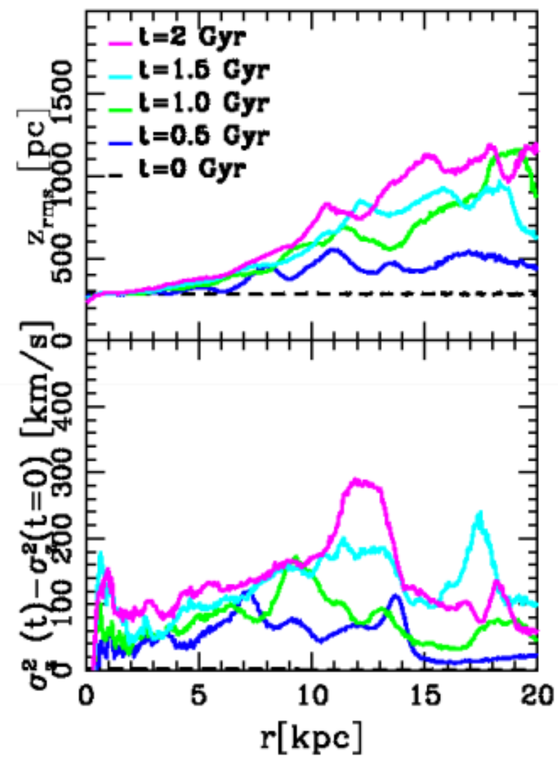

FIG. 6.— *Top Panel*: Time sequence of the first moment of the z-component of stars as a function of radius for the experiment with several satellites hitting the disk (third numerical experiment). *Bottom Panel*: The change of the vertical random energy from the initial time.

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Characterising the environments of supernovae with MUSE

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ABSTRACT

We present a statistical analysis of the environments of 11 supernovae (SNe) which occurred in 6 nearby galaxies (z $\lesssim$ 0.016). All galaxies were observed with MUSE, the high spatial resolution integral field spectrograph mounted to the 8m VLT UT4. These data enable us to map the full spatial extent of host galaxies up to ∼3 effective radii. In this way, not only can one characterise the specific host environment of each SN, one can compare their properties with stellar populations within the full range of other environments within the host. We present a method that consists of selecting all HII regions found within host galaxies from 2D extinction-corrected Hα emission maps. These regions are then characterised in terms of their Hα equivalent widths, star formation rates, and oxygen abundances. Identifying HII regions spatially coincident with SN explosion sites, we are thus able to determine where within the distributions of host galaxy e.g. metallicities and ages each SN is found, thus providing new constraints on SN progenitor properties. This initial pilot study using MUSE opens the way for a revolution in SN environment studies where we are now able to study multiple environment SN progenitor dependencies using a single instrument and single pointing.

Key words: Galaxies: general – (ISM:) H II regions – (Stars:) supernovae: general - Methods: statistical – Techniques: spectroscopic

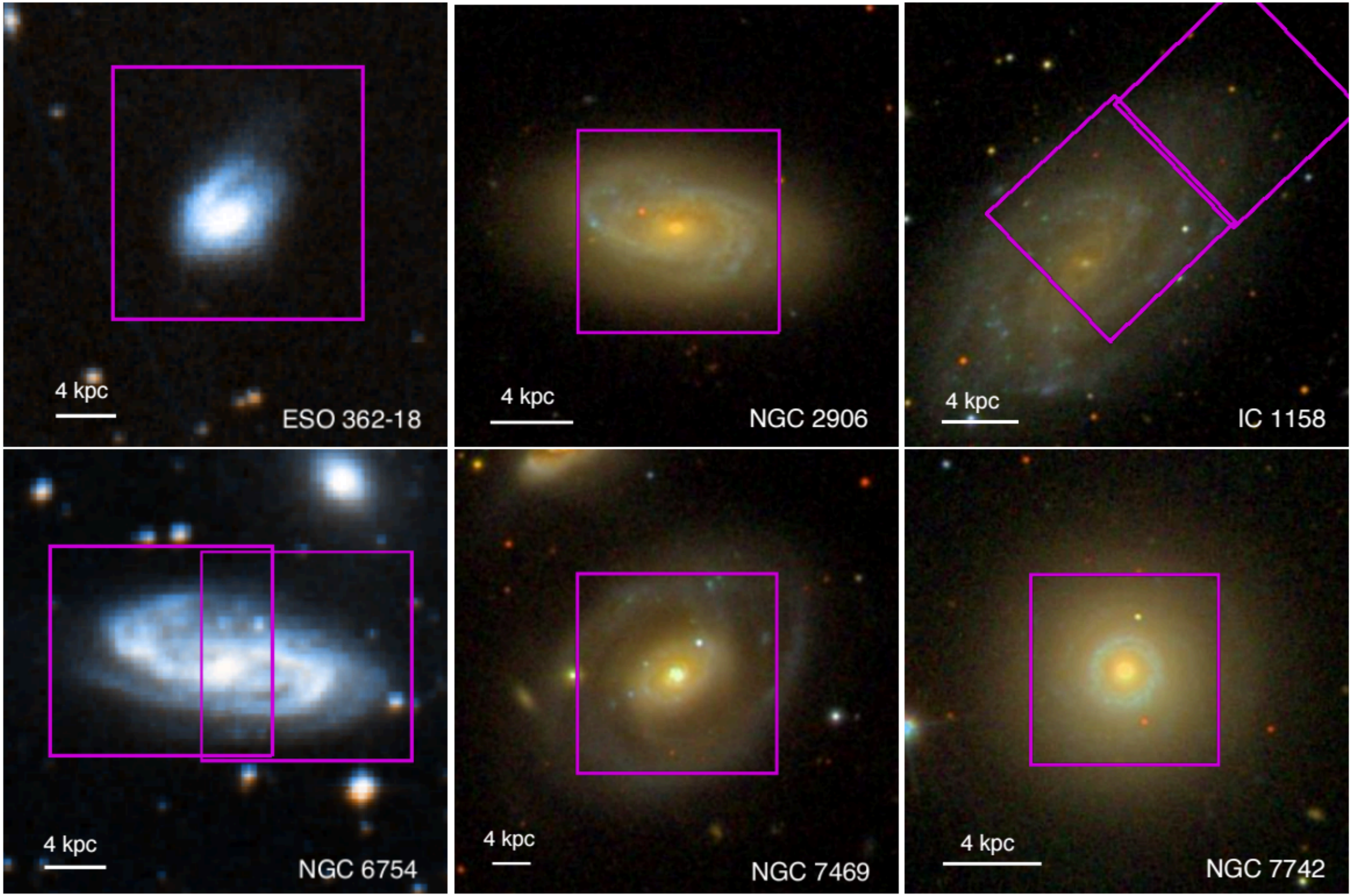


Figure 1. Images of the galaxies obtained from the SDSS when available, and DSS when not. The MUSE field of view is over plotted.

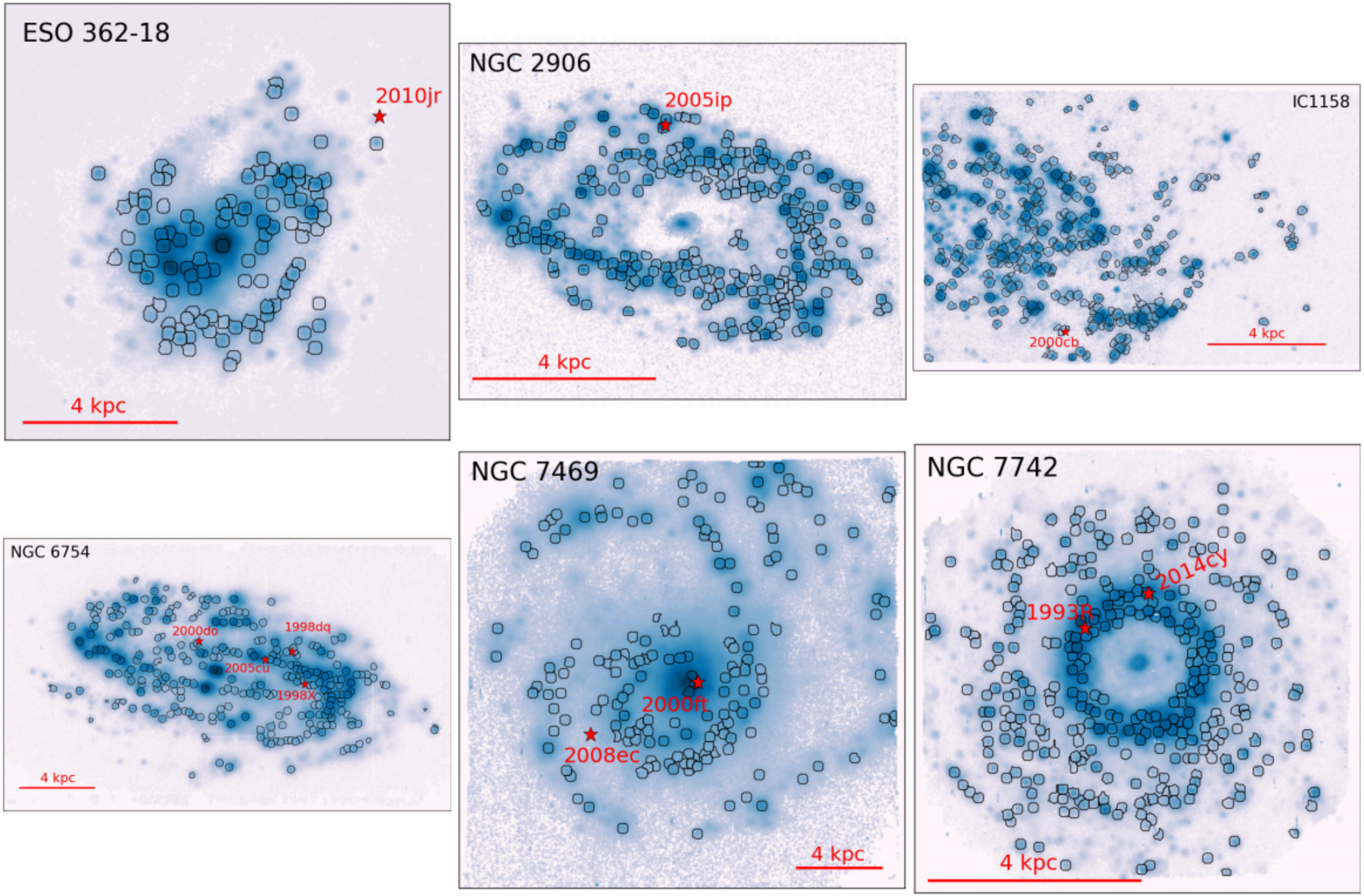
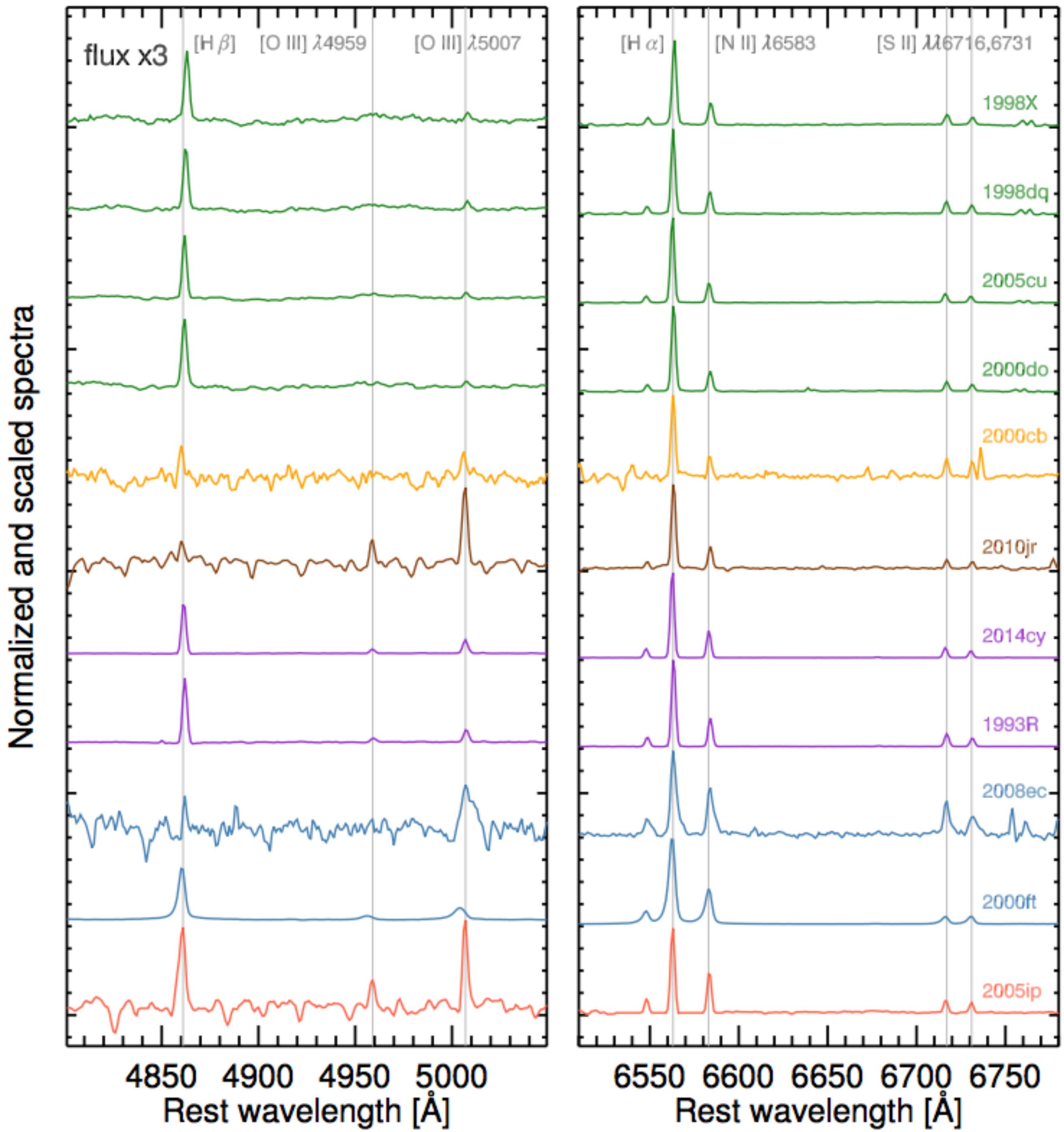
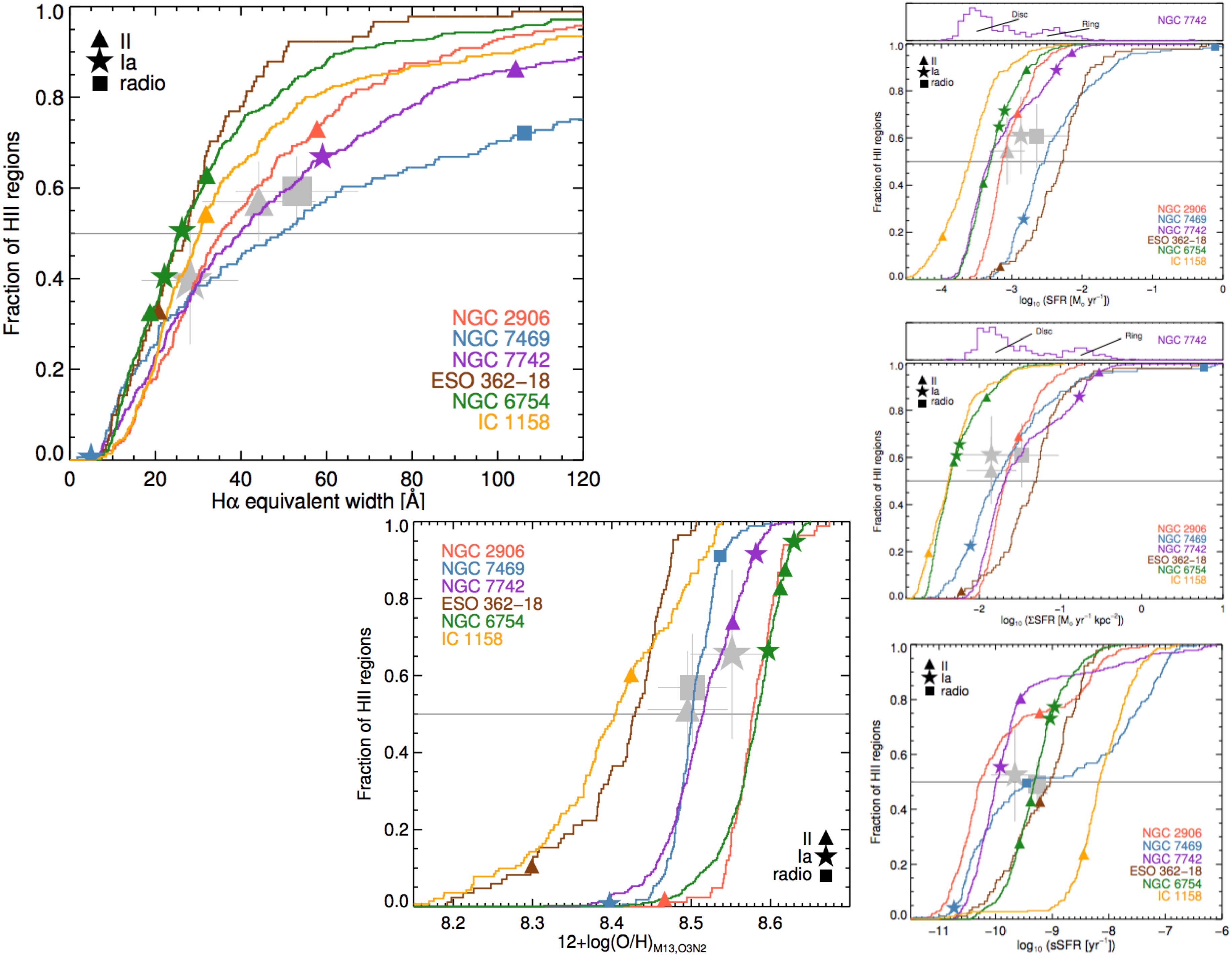


Figure 2. Resulting HII regions using HIIEXPLORER and after applying the *cleaning* procedure described in §3.3.



flux x3
[H β]
[O III] λ4959
[O III] λ5007
[H α]
[N II] λ6583
[S II] λλ6716,6731
1998X
1998dq
2005cu
2000do
2000cb
2010jr
2014cy
1993R
2008ec
2000ft
2005ip
Normalized and scaled spectra
4850
4900
4950
5000
6550
6600
6650
6700
6750
Rest wavelength [Å]
Rest wavelength [Å]



Fraction of HII regions
Hα equivalent width [Å]
II
Ia
radio
NGC 2906
NGC 7469
NGC 7742
ESO 362−18
NGC 6754
IC 1158
12+log(O/H)M13,O3N2
log10 (SFR [M⊙ yr−1])
log10 (ΣSFR [M⊙ yr−1 kpc−2])
log10 (sSFR [yr−1])
Disc
Ring

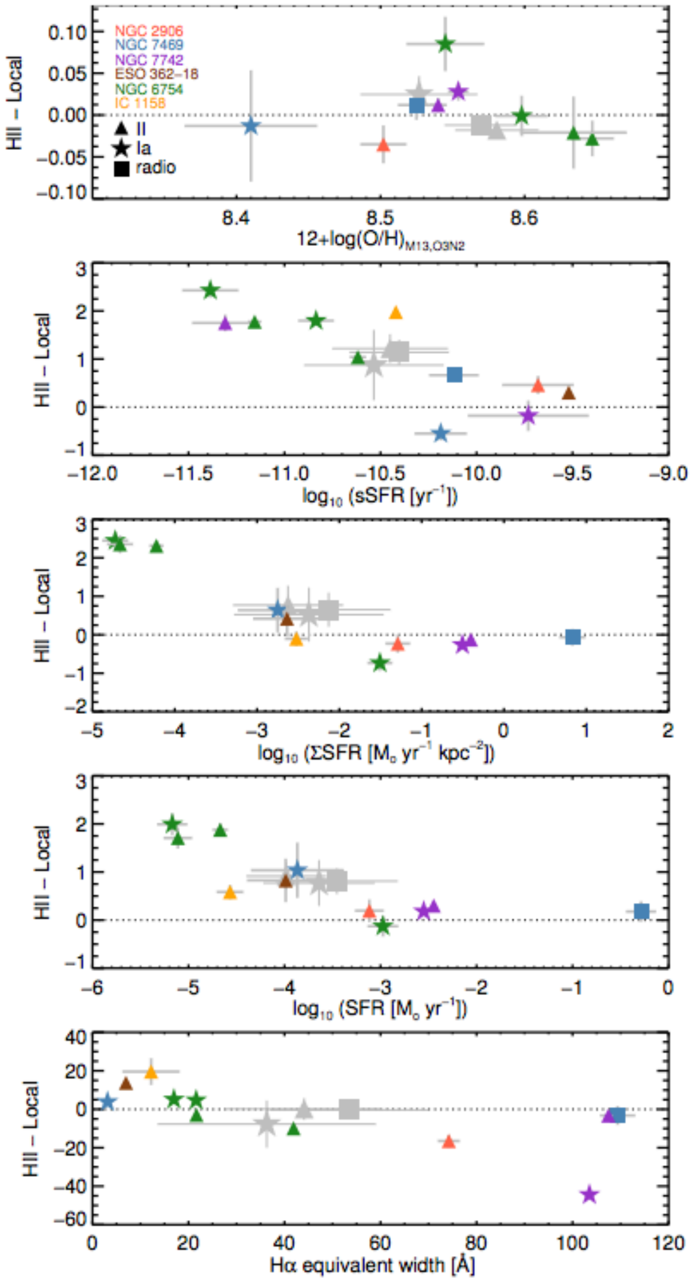


Figure 7. Difference between the measurement of the parameters at the nearest HII region and at the SN position, with respect the value at the SN position.

- To our knowledge, this is the first time that such an approach has been used for the study of SN host galaxies.
- The low numbers of SNe included in this exploratory work do not allow to make any concrete conclusions on SN progenitor properties, however the novel techniques used and presented in e.g. Figs 4, 5 and 6 motivate further work on large samples (such as those which will be enabled by the AMUSING project).
- In conclusion, MUSE promises to be a powerful instrument in the field of SN environment studies for years to come.