



The beauty of resolution: The „SN-Ib factory“ NGC 2770 in 3D (and tuneable filters)

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NGC 2770 – the host of three Ib SNe

This formerly neglected galaxy got some attention after the serendipitous discovery of an X-ray outburst connected to and marking the very onset of SN 2008D [1]. The outburst was discovered while observing the only 2 weeks older SN 2007uy in the same galaxy, and in fact the galaxy had hosted a third SN Type Ib, SN 1999eh. All three SNe were classified as Type Ib^[1,2,3,4] although 2007uy was reclassified as Ib-pec^[5]. NGC 2770 is a late-type spiral at $D_L \sim 30$ Mpc with $\log M^* = 10.3 M_\odot$ and $SFR = 1.1 M_\odot/\text{yr}$. With the goal to infer properties of the SN progenitors from their galactic environments we studied NGC 2770 in ever increasing spatial resolution and present for the first time *images of metallicity and shocks* obtained from OSIRIS/GTC tuneable narrowband filters.

The data

IFU VIMOS/VLT
0.66" lenslets, 4 pointings
HR red grism (6300-8700Å)

Narrowband tuneable filters (TF)
OSIRIS/GTC
8 steps of 12Å around [NII]+H α ,
8 steps of 20Å around [SII]
→ disentangle [NII] and H α ! [6]

LS spectra from ALFOSC/
NOT [7] covering [OII] to [SII]

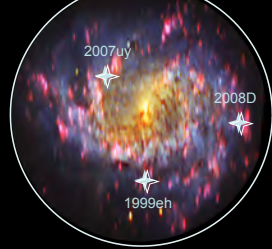
Morphology

NGC 2770 is classified as „SAS5*“ (RC3).
TF data suggest the presence of a **bar**, confirmed by 2MASS images. There are also indications for a warp. Possible small disturbances might exist in the S-E half of the disk.



Two gas clouds walk into a bar... soon they see stars (credit: A. Kann)

NGC 2770 deprojected
g'r'i' H α



Kinematics (VIMOS/H α)

Mostly regular velocity field. The SF regions have higher dispersions probably due to turbulences

Metallicity ([NII]/H α) [8]

All datasets show the usual **negative gradient** for spiral galaxies.

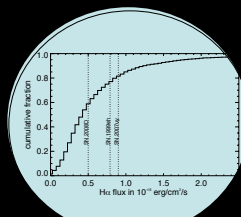
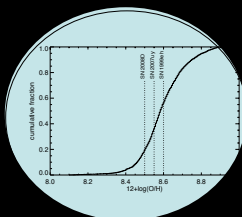
The TF data reveal gradients within the SF regions where the outskirts are more metal poor. Some projection effects might play a role if the SF regions are not transparent. Only the very nucleus is metal rich whereas the SF regions in the bar have a lower metallicity.

Shocks (traced by [SII]/H α)

IFU and TFs show more shocked material at the edge of the major SF regions. The bar SF regions have low [SII]/H α .

SN progenitors

SNe Ib (no H in the spectra) are suggested to come from single stars of $M > 35 M_\odot$ a difference in metallicity to other SN types is still debated. [9,10] The Ib SNe in NGC 2770 have H α EWs of $< 100 \text{Å}$ ($< 25 M_\odot$ progenitors), are not connected to the most SF places (all lie on the edge of SF regions) and have metallicities of $\sim 1/2$ solar. The high progenitor age might suggest a **binary instead of a single star**, similar to findings in another IFU study of SN Ib/c sites. [11]



The beauty of resolution

IFU
0.66"–100pc
4 pointings
(~1/4 of the galaxy)

Longslit [7]
1x3"–0.4pc
Spatial resolution only along slit

TF
0.25"–35 pc
Full FOV coverage

References:

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