The All-weather MUse Supernova Integral-field Nearby Galaxies (AMUSING) survey

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THE AMUSING SURVEY

PIs: Anderson (ESO) & Galbany (UGR)

- **A**ll-weather: using non-optimal weather of Paranal (avg. seeing 1.1", from 0.7" to 1.5").

- **MU**se: very efficient instrument. 3GB per cube, >4800 A. Basis for driving big data spectroscopic astronomy.

- **S**upernova: Overall aim is to further understand supernova progenitors/explosions. Study SN environment and all other regions within the host.

- **I**ntegral-field: 1'x1' FoV, 0.2" pixel scale. Image-like resolution but with 'spaxels'.

- **N**earby: Allows in-depth study of gas and stellar populations.

- **G**alaxies: Allows cross-field collaborations. Galaxy studies: evolution, dynamics, stellar populations…
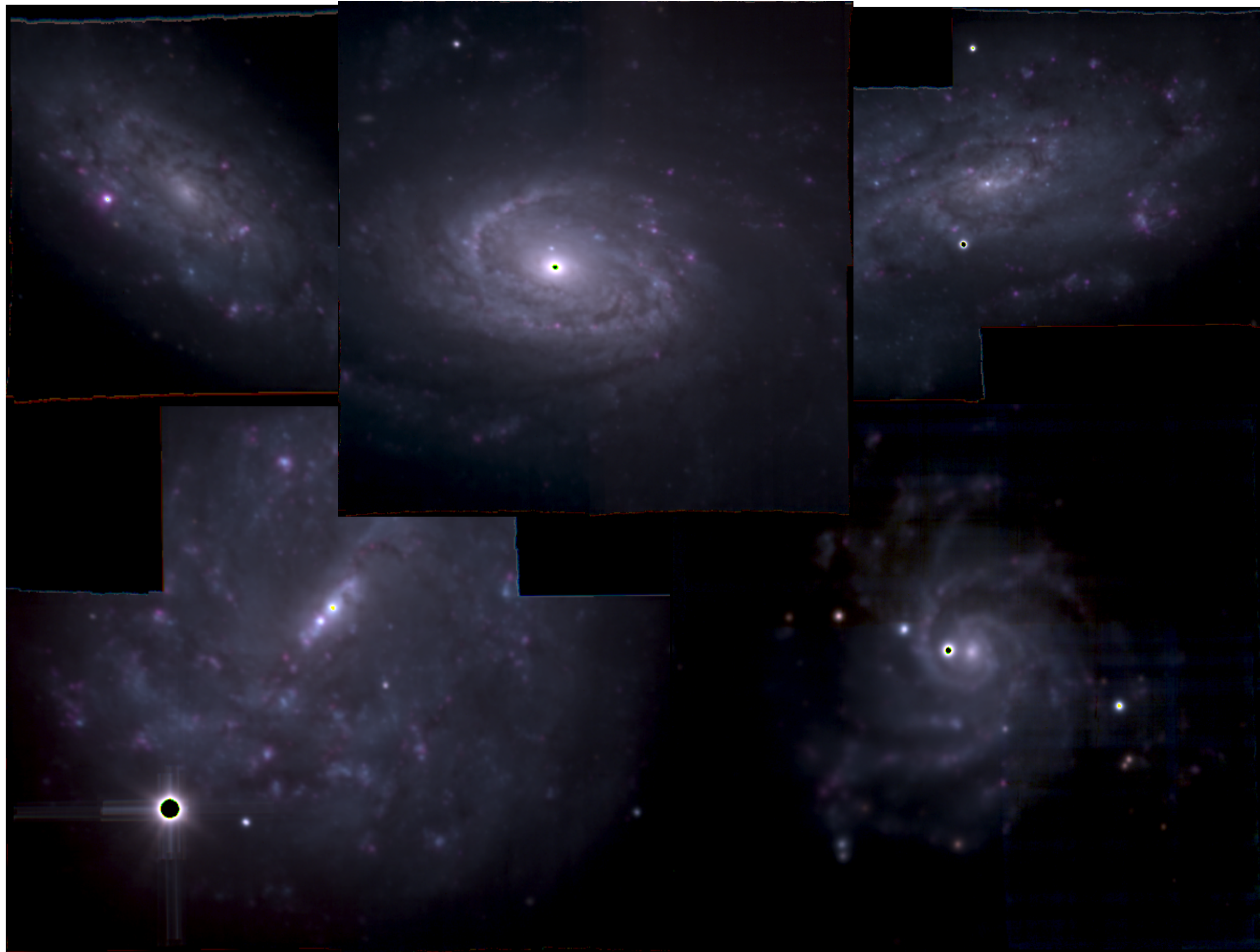
Aimed to be an open collaboration with regular data releases including all kinds of data products

1st data release expected for late 2020! Will include 270 cubes

~600h of ESO VLT UT4 Yepun
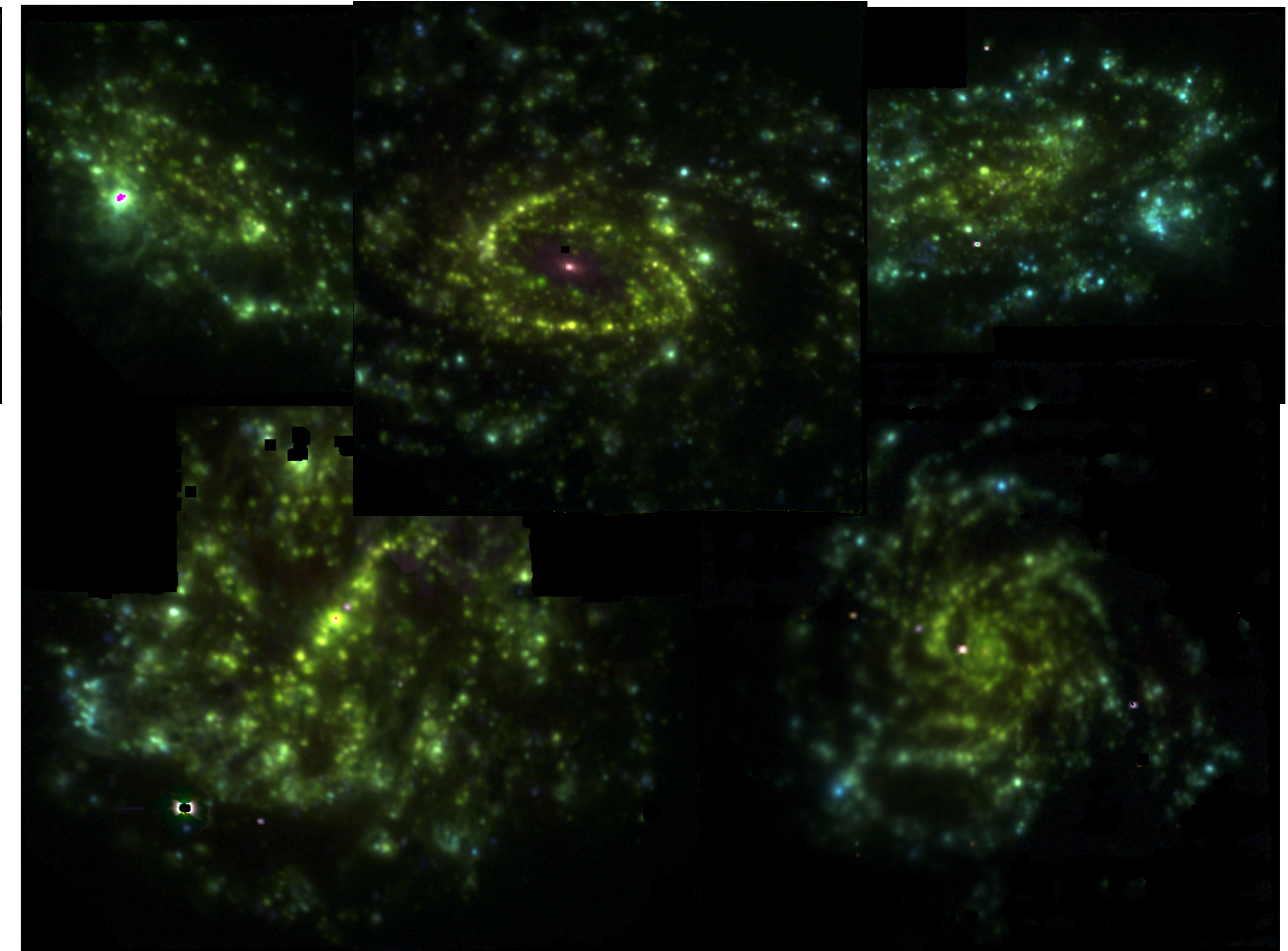10 semesters: P95 to P104
571 SN host galaxies (616 SNe)

MUSE

Paranal 8.2m

THE AMUSING DATA

Synthetic *gri* images from MUSE observations

Constructed by convolving filter responses to each individual (>100.000) MUSE spectrum, and adding the 3 resulting images

OIII + NII + Halpha emission line maps

Constructed by performing SSP synthesis, gaussian fitting to the gas-phase emission lines, and adding the 3 resulting images
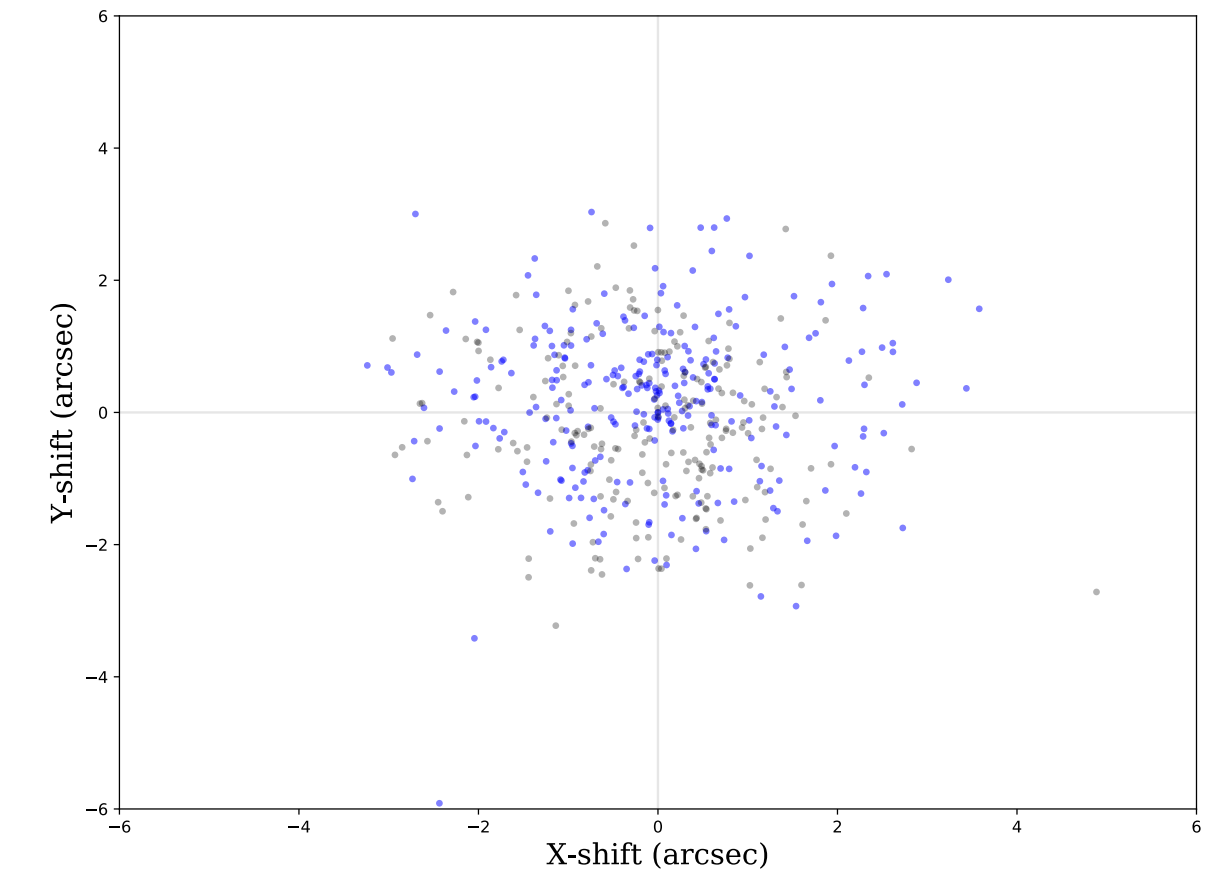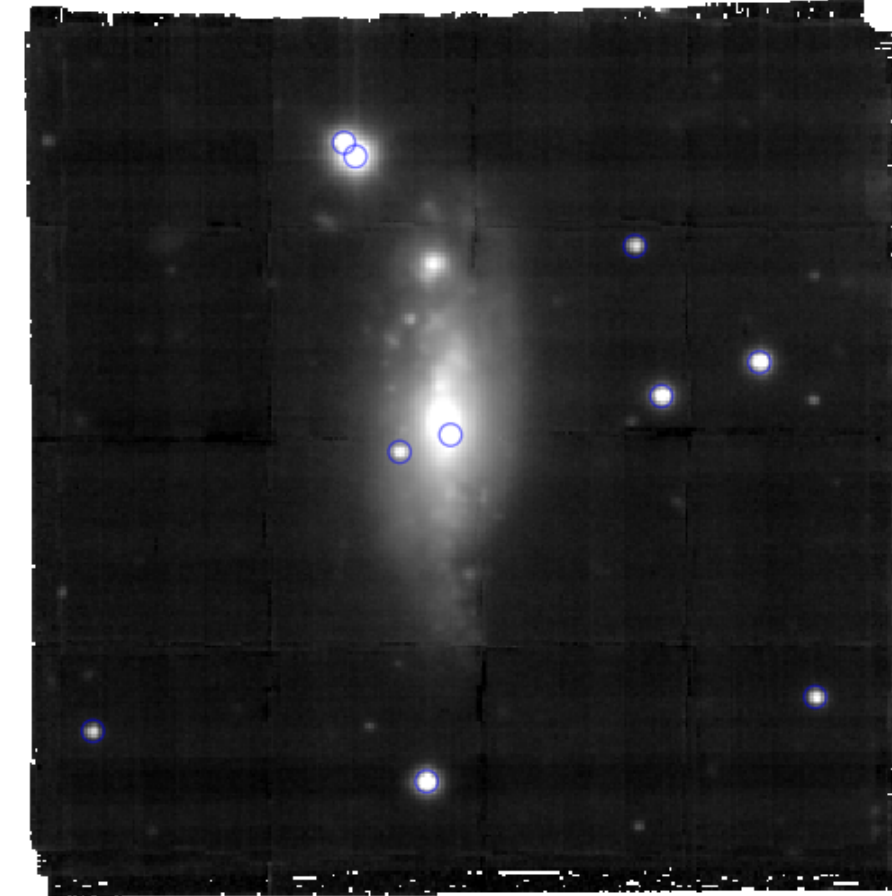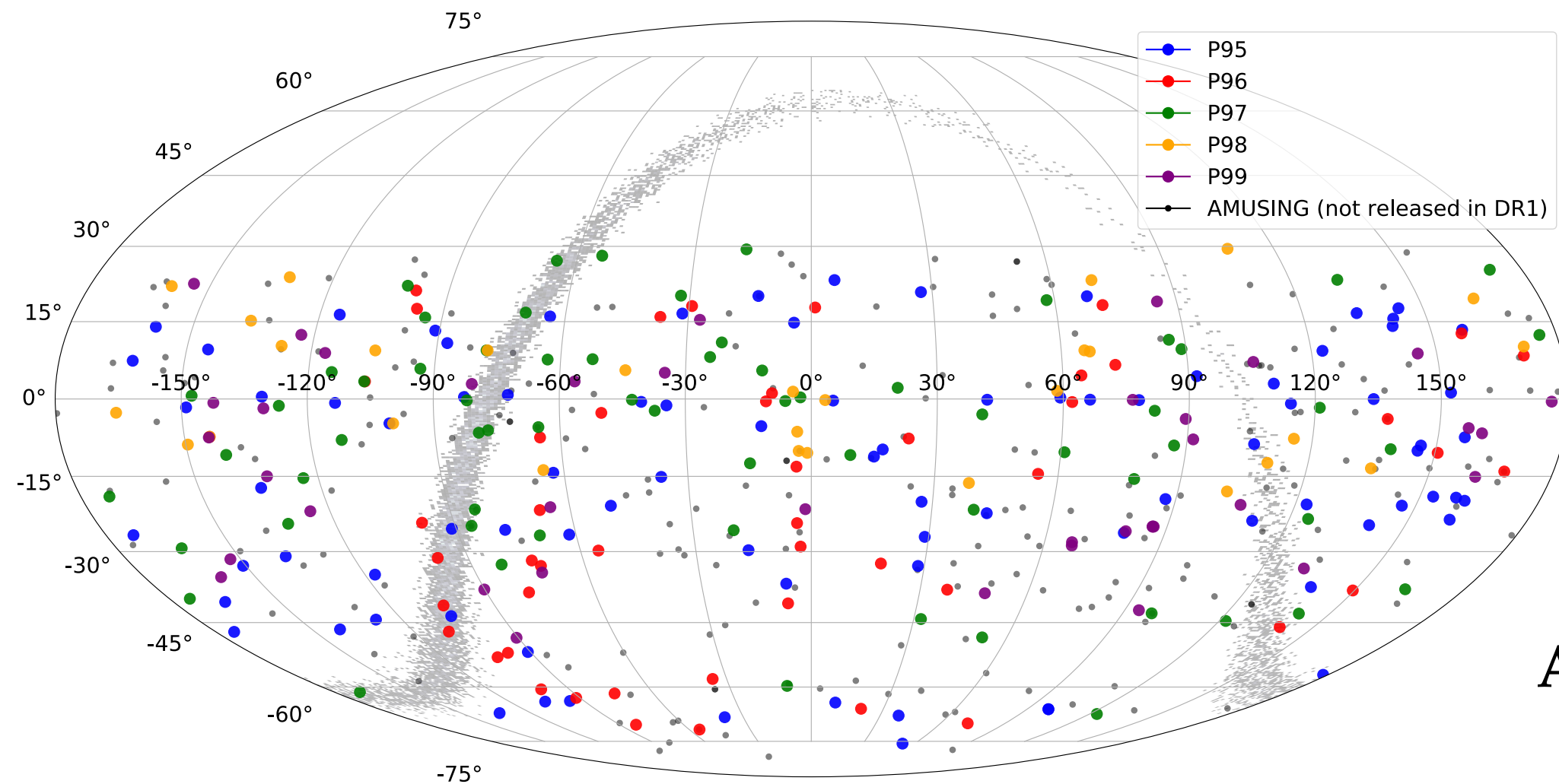
THE AMUSING SCIENCE

- **SV**: 6 galaxies with 11 SNe. HII region parameter statistics for different SN types.

- **P95**: 88 galaxies, 91 SNe. CSP SNe Ia environments and dependence with Hubble residuals.

- **P96**: 49 galaxies, 55 SNe. SN rates w.r.t. environmental parameters of transients discovered by ASASSN hosts:.

- **P97**: 66 galaxies, 76 SNe. Hosts of SNe that have been observed with high-res. spectra and showed strong NaD absorptions.

- **P98**: 28 galaxies, 31 SNe. SweetSpot SNe Ia observed in the NIR, to study Hubble residual dependences.

- **P99**: 39 galaxies, 41 SNe. SweetSpot SNe Ia observed in the NIR, to study Hubble residual dependences.

- **P100**: 25 galaxies, 27 SNe. Late-time CC and Ia SN nebular spectra + host.

- **P101**: 84 SNe. (A; 80%) 56 late-time CC and Ia SN nebular spectra + host. + (B; 20%) 17 CSP I+II host galaxies

- **P102**: 47 galaxies, 47 SNe. Continuing CSP I+II host galaxies

- **P103**: 85 galaxies, 93 SNe. ASAS-SN CCSN hosts + TDE hosts

- **P104**: 71 galaxies, 71 SNe. low-mass CCSN hosts and GRB host analogues

- **OTHER**: 135 galaxies, 169 SNe from other projects (+1 DDT).

Total 713 galaxies, 796 SNe in AMUSING+

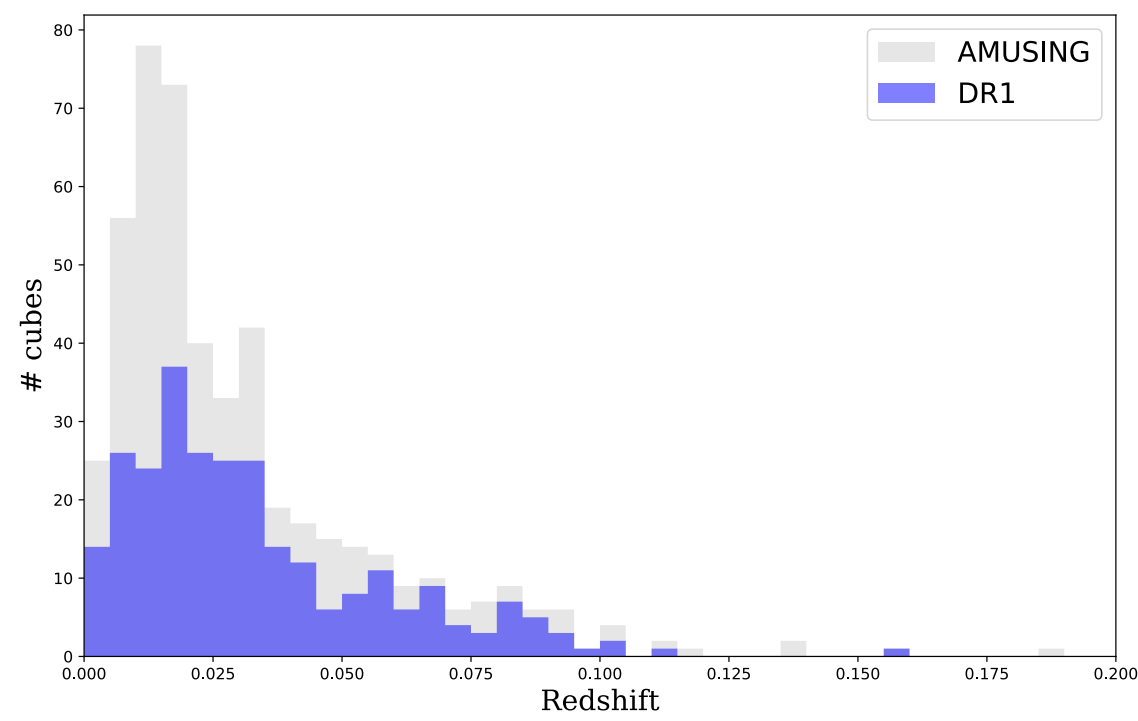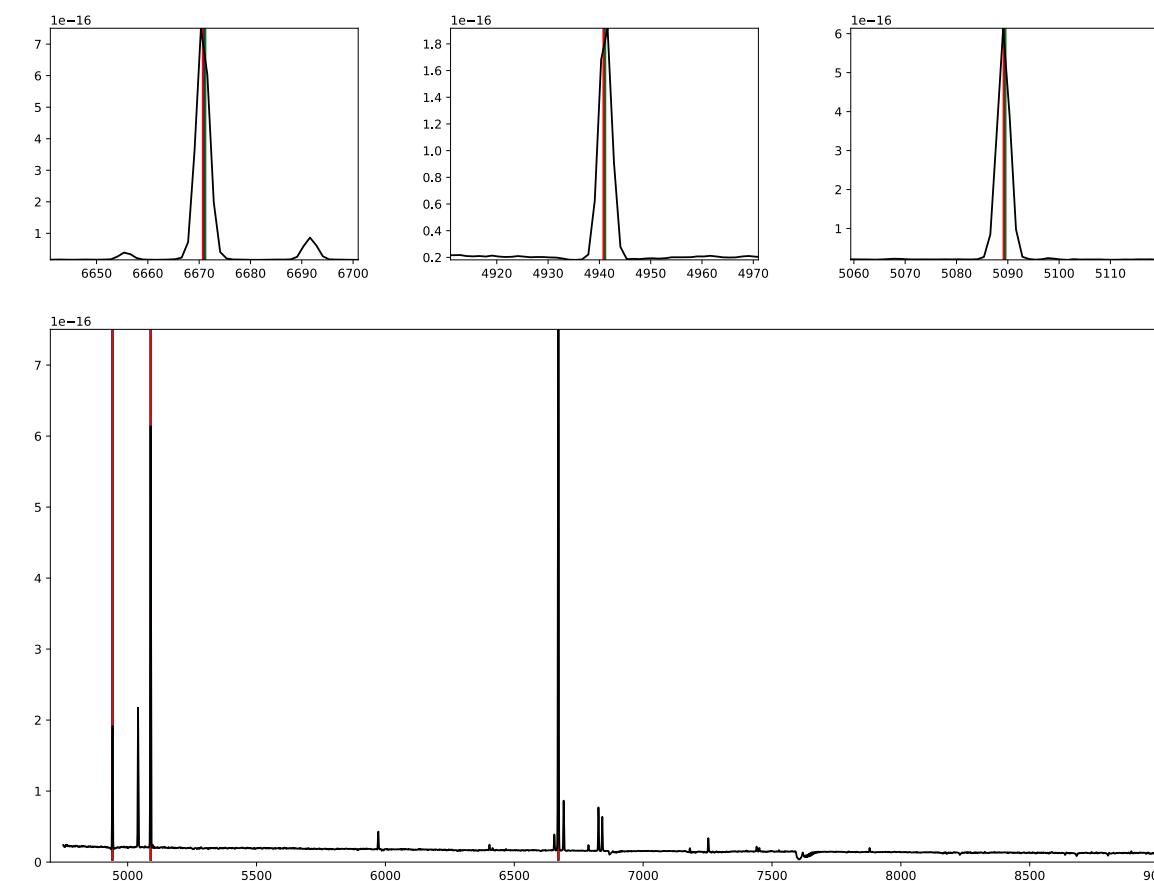|				
A&A 573:105	MNRAS 455:4087	A&A 593:A78	ApJL 830:L32	ApJL 830:L40
A&A 602:A85	ApJL 850:L17	A&A 609:A119	A&A 613:A35	Nature A 2:574
MNRAS 479:917	A&A 620:164	PASP 131:a4001	A&A 625:A83	A&A 629:A57
MNRAS 490:4515	MNRAS 493:1044	AJ 159:167	ApJ 895:31	MNRAS 495:992
A&A Accepted	A&A Accepted	MNRAS Accepted	ApJ Accepted	24 refereed papers 3 submitted

THE AMUSING FIRST DATA RELEASE

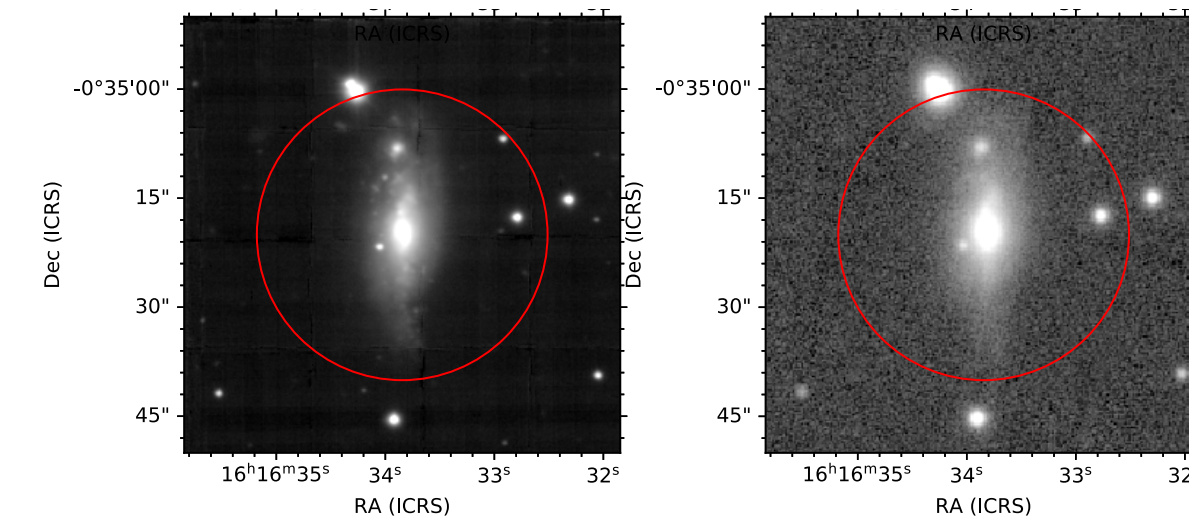Astrometric matching of AMUSING cubes to Gaia/SDSS/PS/2MASS catalogues. Distribution of the astrometric correction for the DR1/full AMUSING sample.

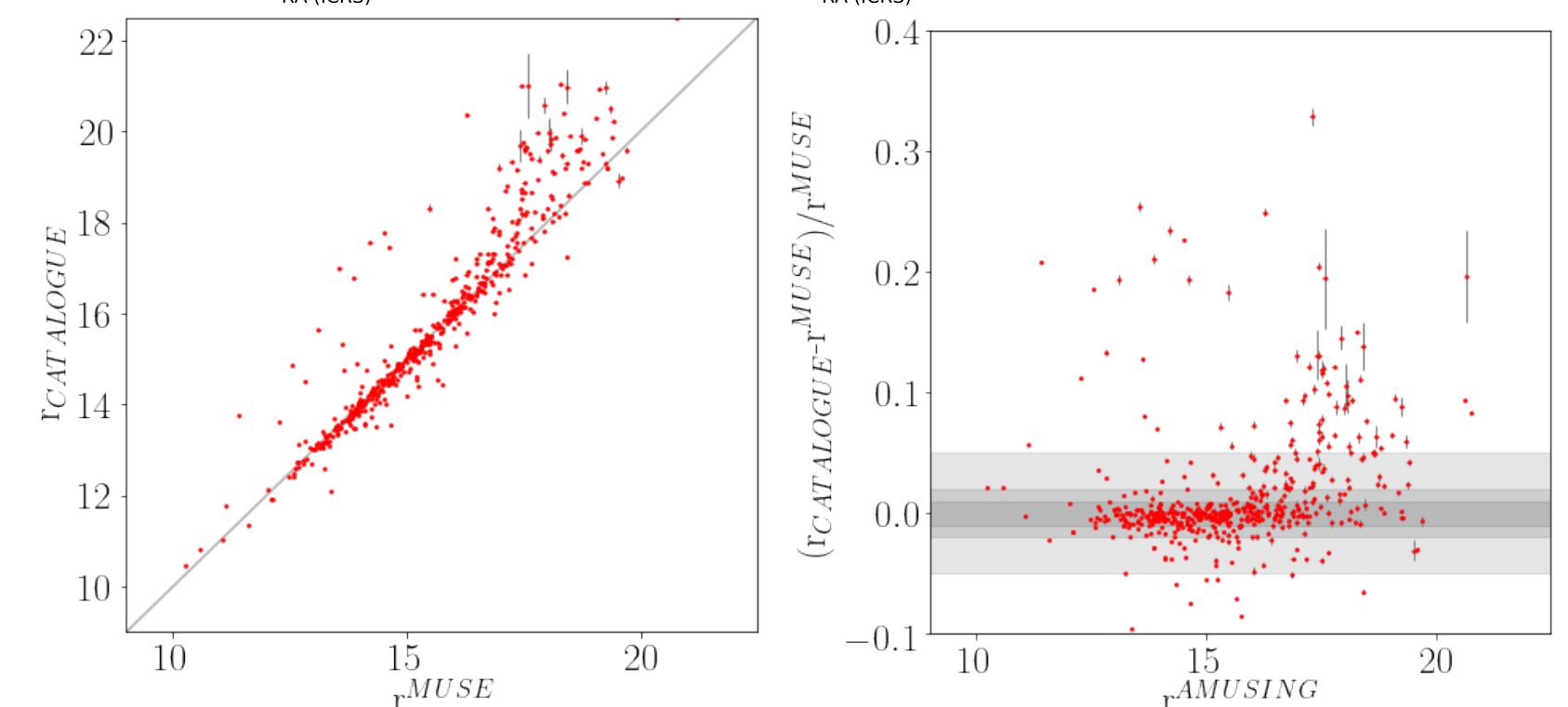Flux recalibration matching *gri* bands to PS/SDSS/DES imaging

Sky and redshift distribution of galaxies included in the DR1 (271) and other galaxies included in AMUSING.

Improved redshift estimation from a 3 arcsec spectrum extracted at the core of the galaxy

AMUSING DESCIPHERING SN ENVIRONMENT RELATIONS

One of the main goals of the AMUSING survey is the characterisation of the local environment of type Ia supernovae (SNe Ia) to explore SN light-curve parameters and distance estimation correlations that in turn can help improving SN peak magnitude standardisation.

MSCA-IF 839090 SNDTD, funded project to perform this study, together with the delay time distribution of SN progenitors.

We extract 1 to 5 kpc² aperture spectra at the location of the SN and perform SSP synthesis to study the stellar continuum properties. By subtracting the stellar component we estimate the properties of the ionised gas at those locations.

We find a number of correlations between light-curve stretch, peak colour, and Hubble diagram residuals with several host galaxy properties. Final results in *Galbany et al. in prep. 2021!*

ASASSN-13ch MUSE synthetic image