



Marie
Skłodowska-
Curie Actions



UNIVERSIDAD
DE GRANADA

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

Lluís Galbany (MSCA-IF/U. Grananda), Joseph P. Anderson (ESO/Chile), Sebastián F. Sánchez (UNAM), Hanindyo Kunkarayakti (U. Turku), Josphah Lyman (U. Warwick), Thomas Kruehler (ESO), Erik Aquino (UNAM), Ana S. Afonso (CENTRA), Yago Ascasibar (UAM), Chris Ashall (FSU), Carles Badenes (Pitt), Chris Burns (Carnegie), Luc Dessart (UMI), Inma Dominguez (Granada), Subo Dong (Kavli Institute Beijing U.), Jesús Falcón-Barroso (IAC), Francisco Förster (CMM/UChile), Santiago González-Gaitán (CENTRA), Claudia Gutiérrez (Soton), Mario Hamuy (UChile), Peter Hoeflich (FSU), Tom Holoiien (OSU), Eric Hsiao (FSU), Phil James (ARI, LJMU), Tuomas Kangas (STScI), Erkki Kankare (Turku), Christopher Kochanek (OSU), Seppo Mattila (Turku), Ana Mourão (CENTRA), René Ortega-Minakata (Guanajuato), Enrique Pérez (IAA), Isabel Pérez (U. Granada), Mark Phillips (LCO), Ana Paulina-Afonso (CENTRA), Jose-Luis Prieto (UDP), Alessandro Razza (ESO/UChile), Fabián Rosales-Ortega (INAOE), Tomás Ruiz-Lara (IAC), Patricia Sánchez-Blázquez (UCM), Laura Sánchez-Menguiano (IAC), Patricia Schady (Bath), Ben Shapee (Hawaii), Mat Smith (Soton), Kris Stanek (OSU), Maximilian Stritzinger (Aarhus U.), Mark Sullivan (Soton), Lingzhi Wang (CASSACA/UChile), +



THE AMUSING SURVEY

PIs: Anderson (ESO) & Galbany (UGR)

- **All-weather**: using non-optimal weather of Paranal (avg. seeing 1.1", from 0.7" to 1.5").
- **MUse**: very efficient instrument. 3GB per cube, >4800 Å. Basis for driving big data spectroscopic astronomy.
- **Supernova**: Overall aim is to further understand supernova progenitors/explosions. Study SN environment and all other regions within the host.
- **Integral-field**: 1'x1' FoV, 0.2" pixel scale. Image-like resolution but with 'spaxels'.
- **Nearby**: Allows in-depth study of gas and stellar populations.
- **Galaxies**: Allows cross-field collaborations. Galaxy studies: evolution, dynamics, stellar populations...

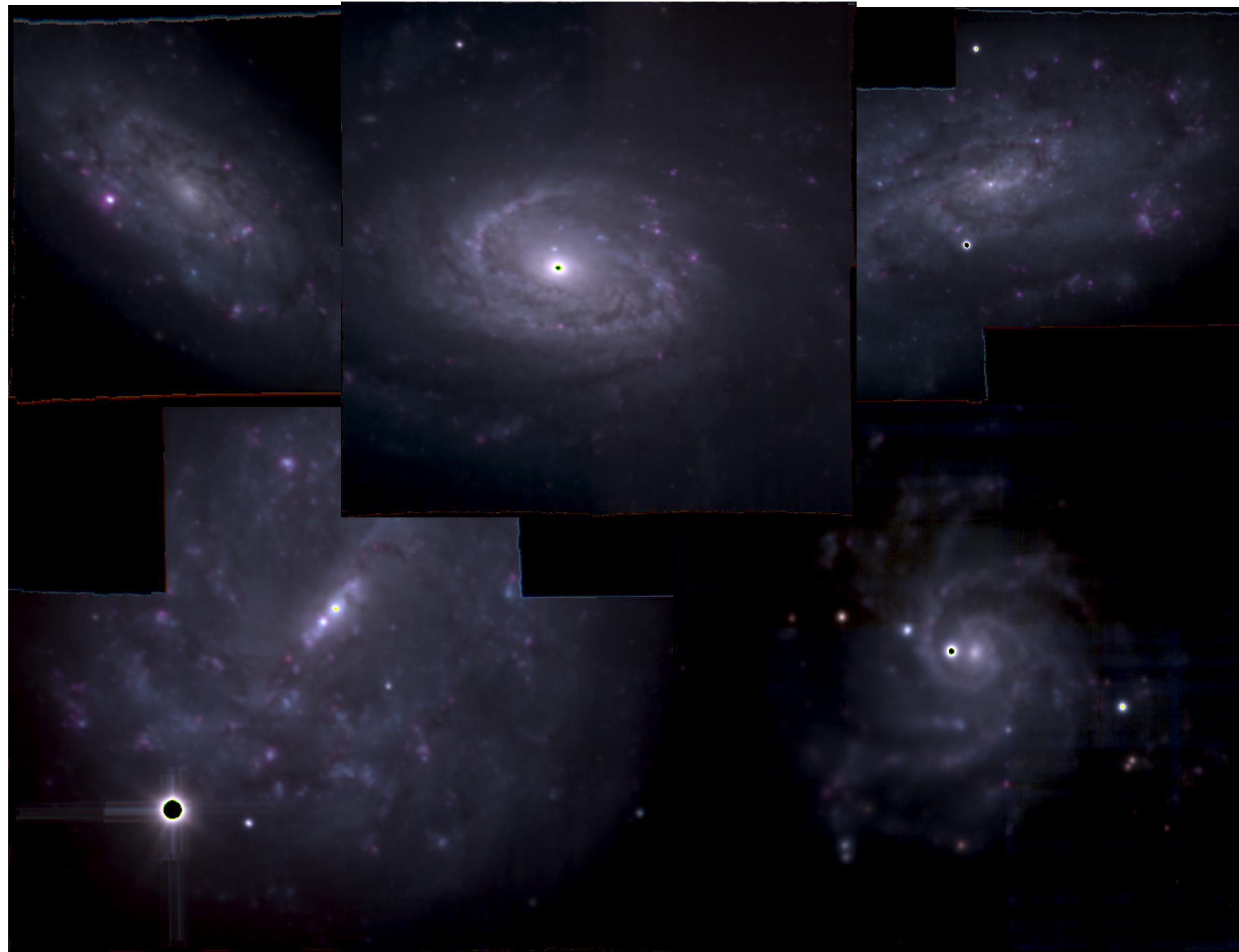
Aimed to be an open collaboration with regular data releases including all kinds of data products

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)

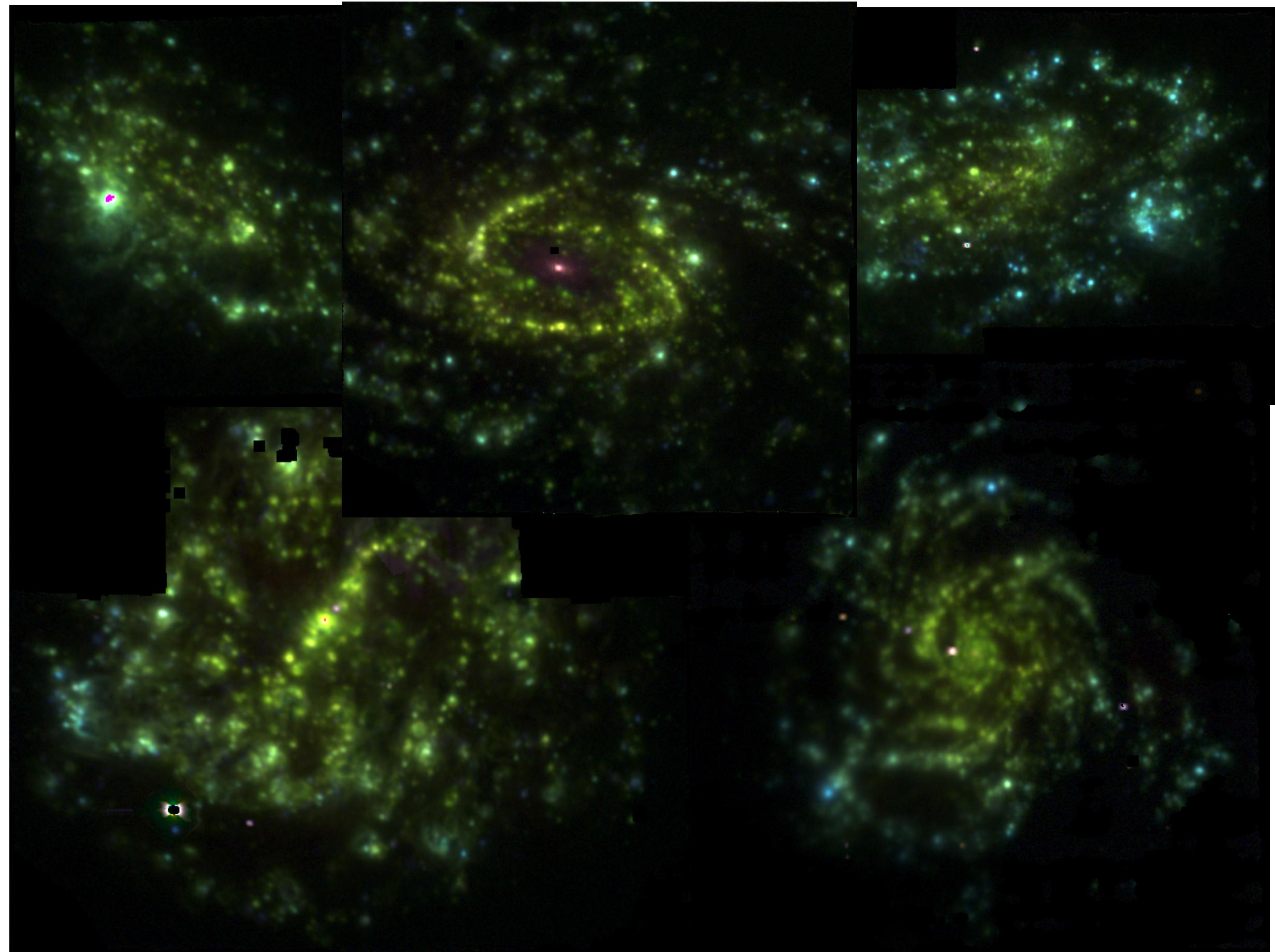


THE AMUSING DATA



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).

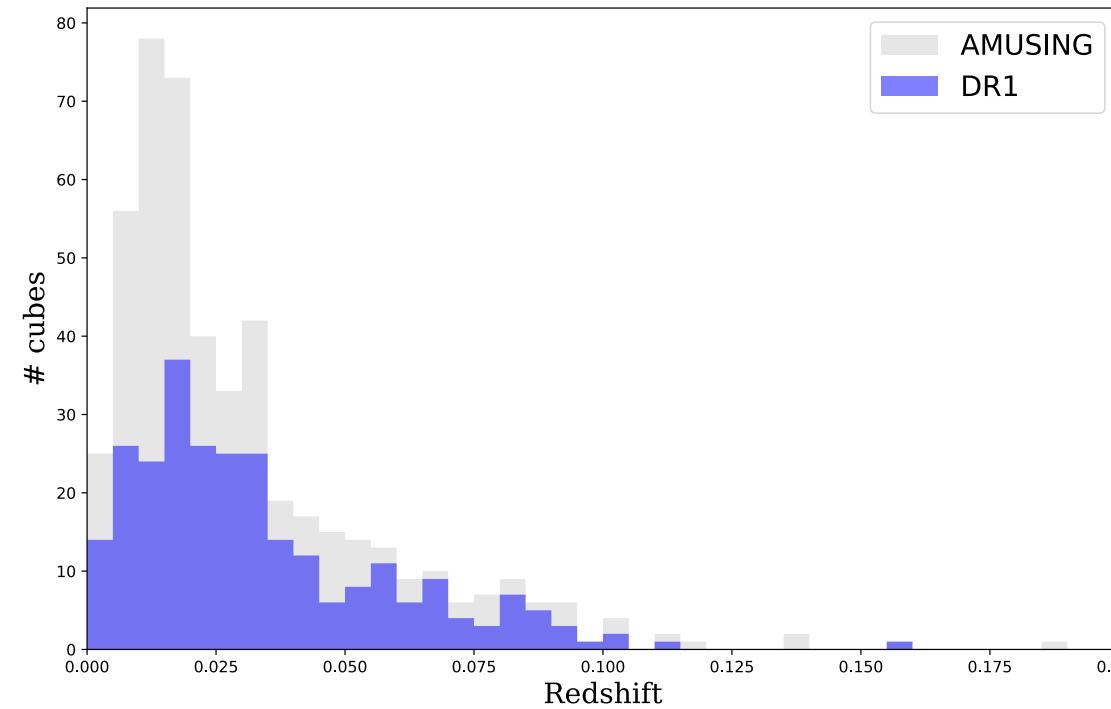
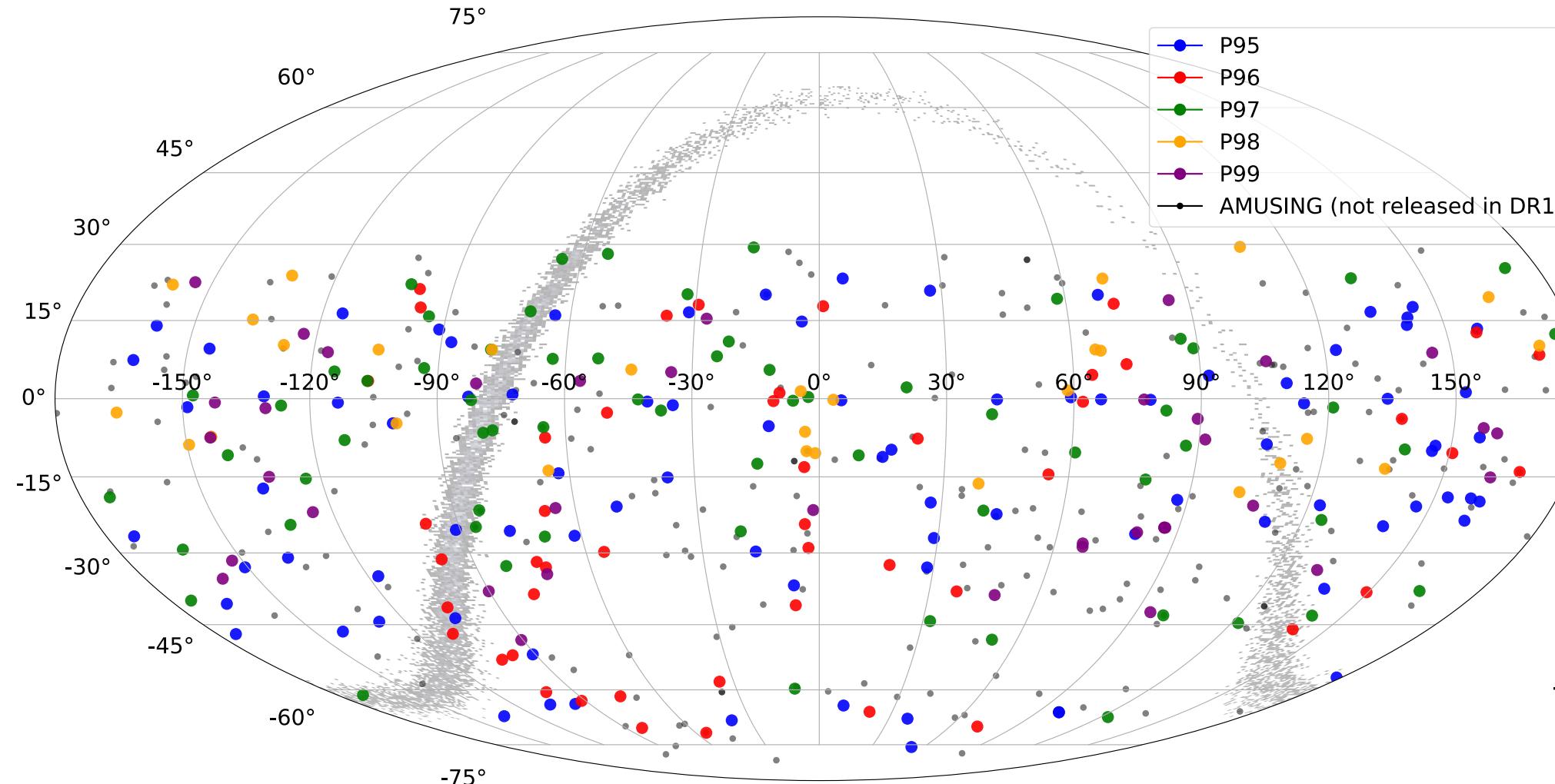
Total 713 galaxies, 796 SNe in AMUSING+



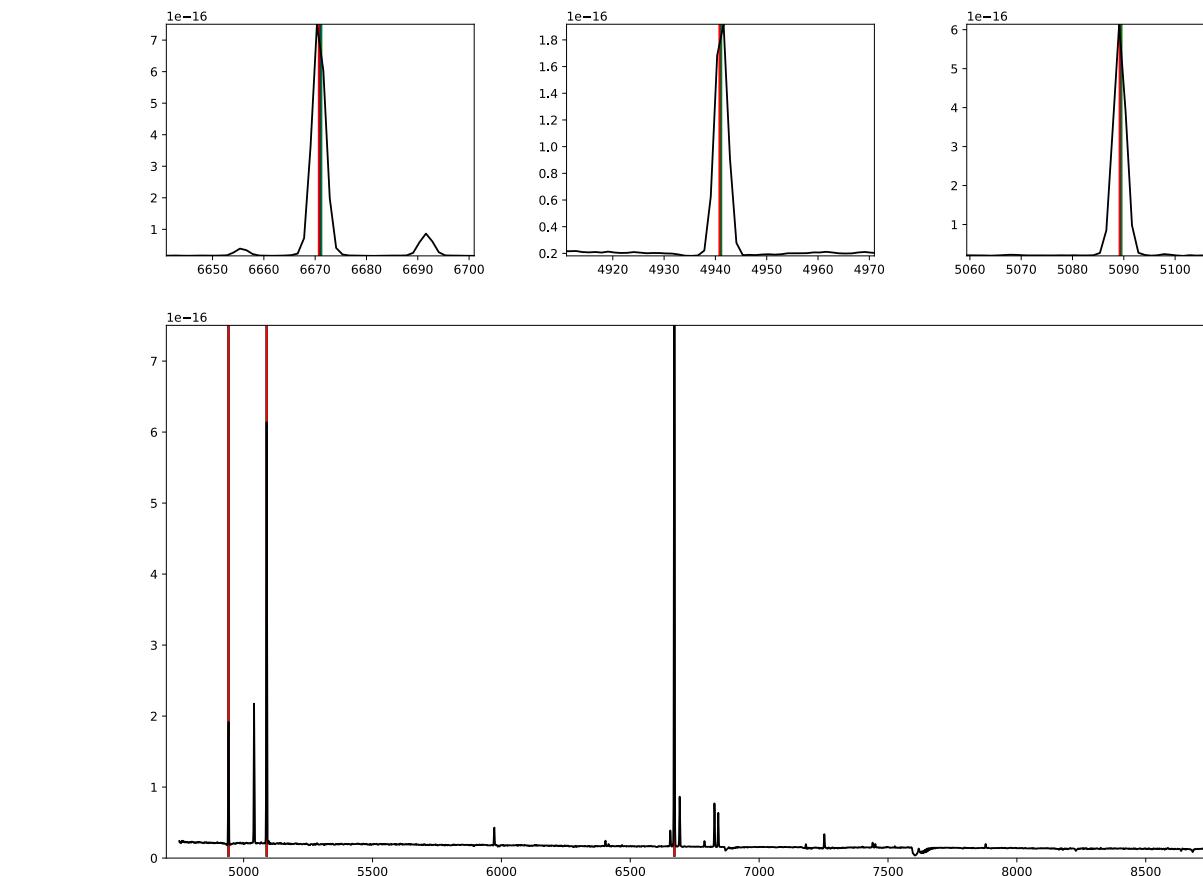
24
refereed
papers
3
submitted



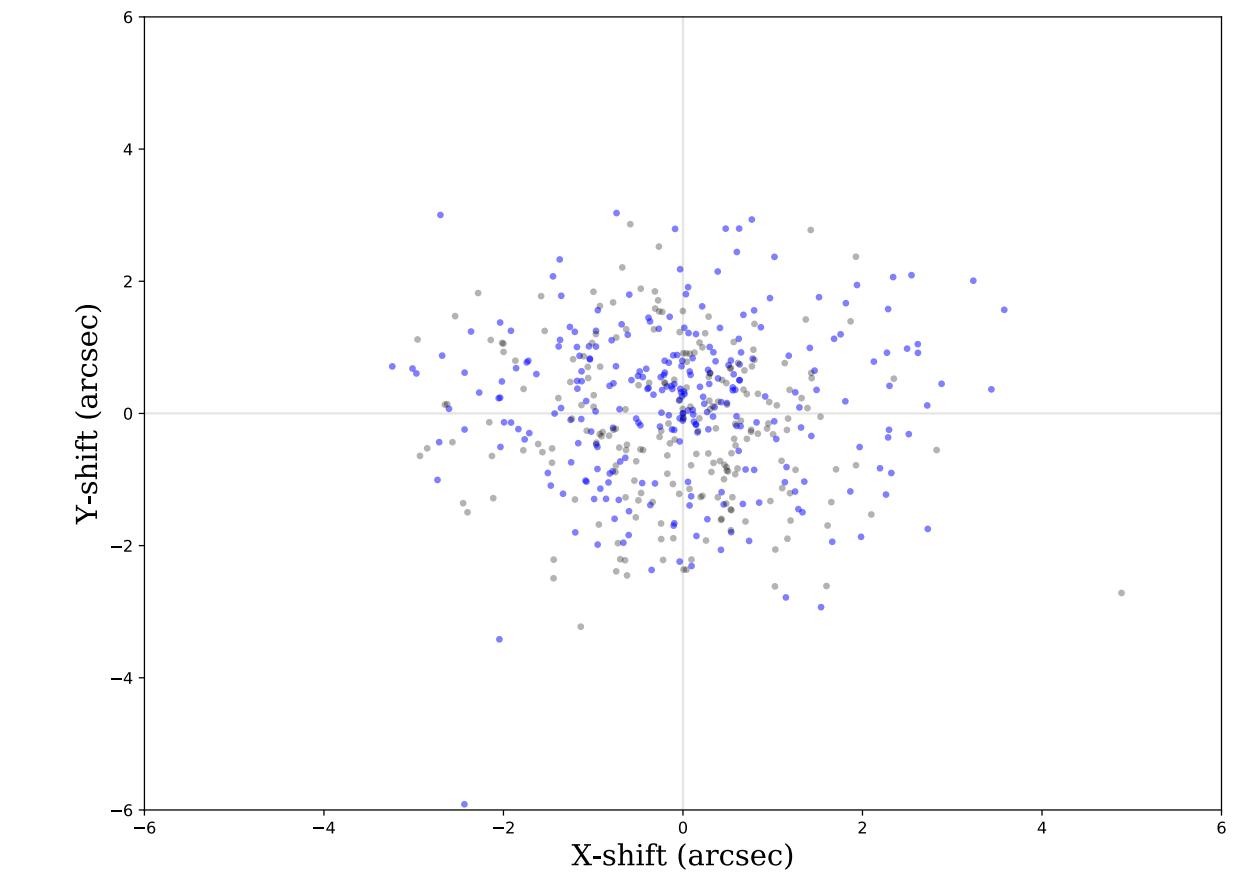
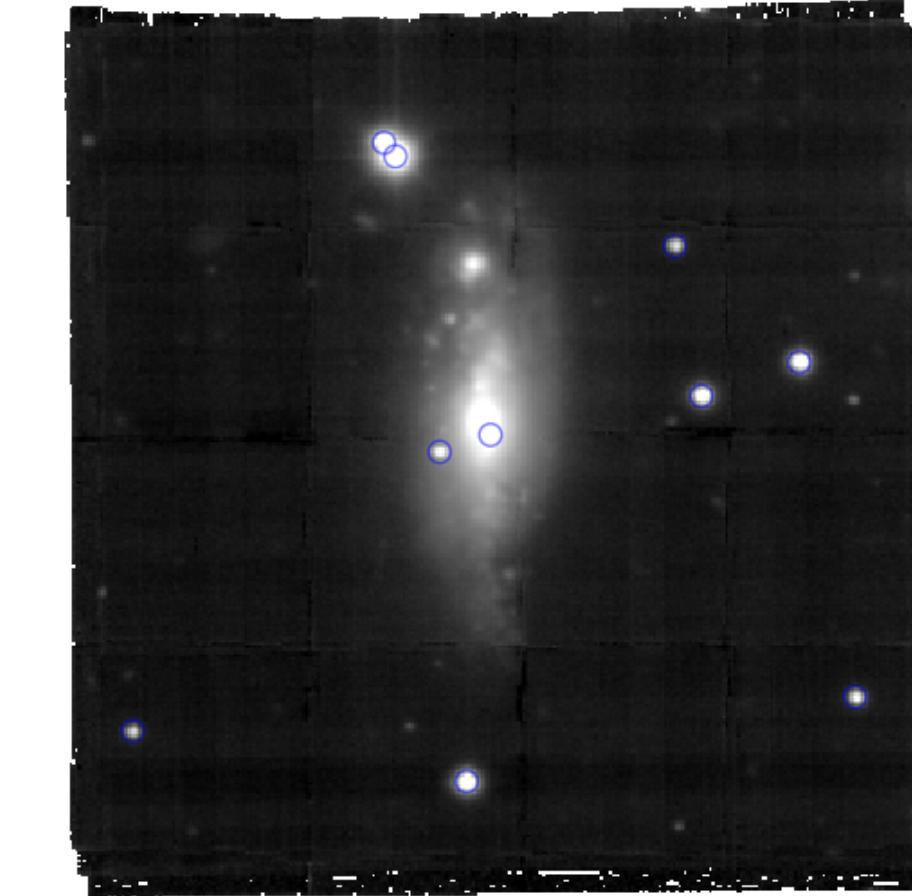
THE AMUSING FIRST DATA RELEASE



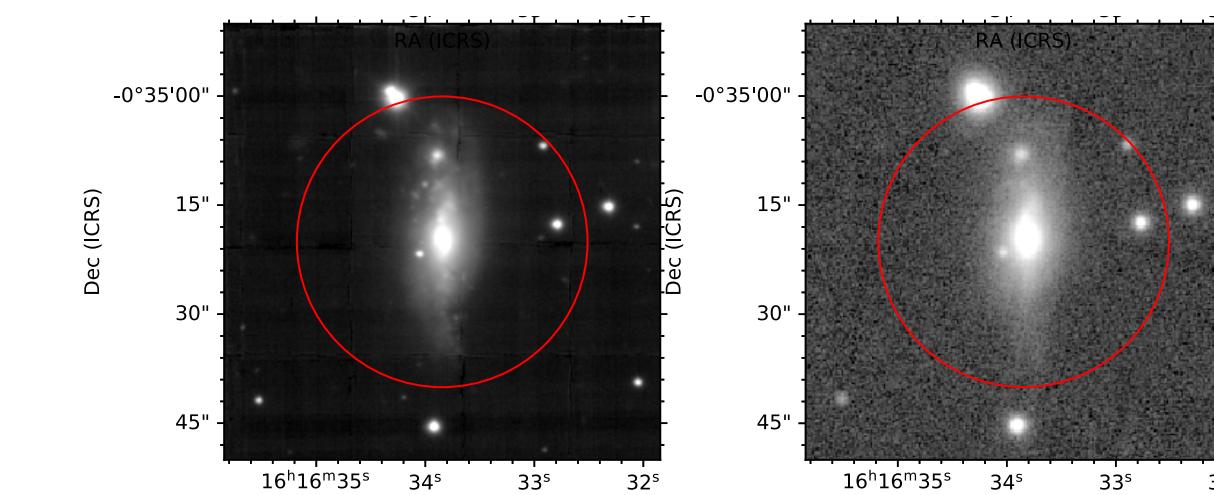
Sky and redshift distribution of galaxies included in the DR1 (271) and other galaxies included in AMUSING.



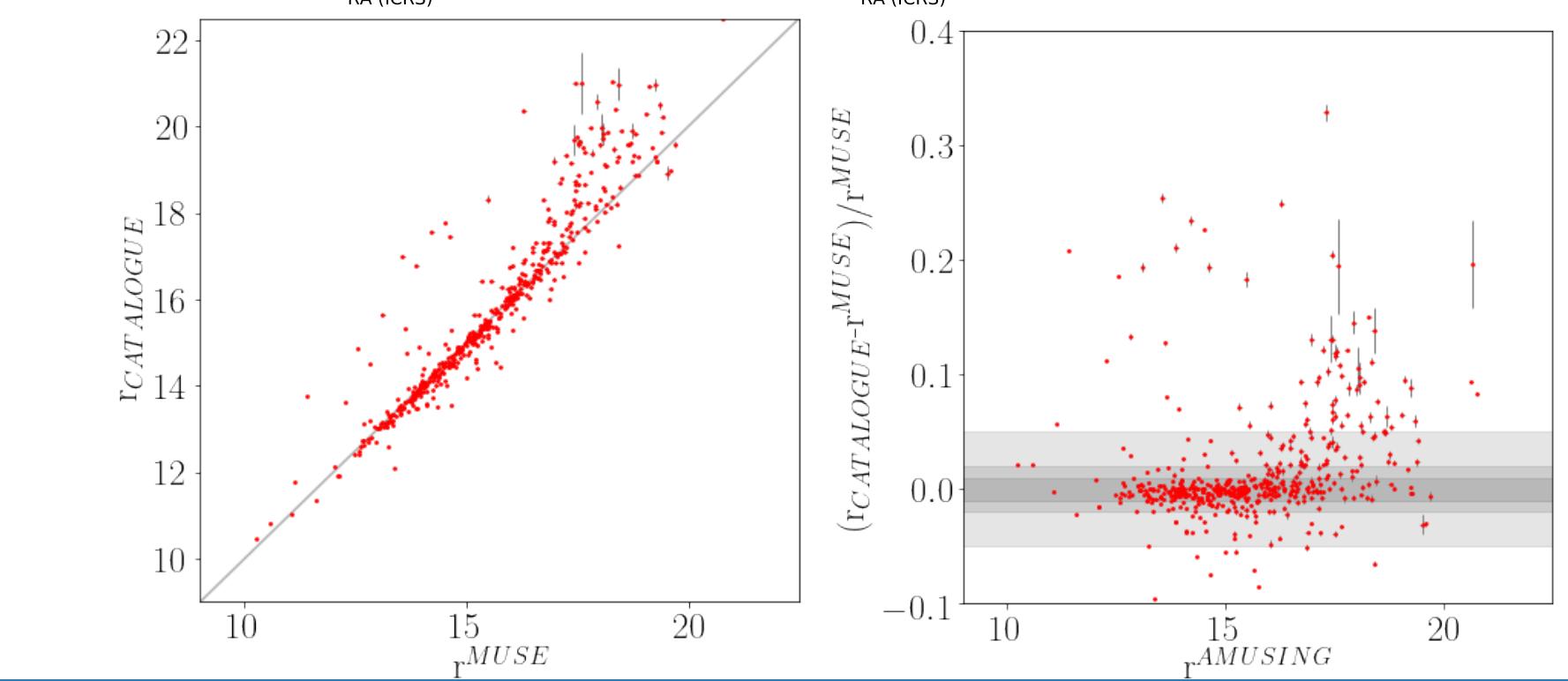
Improved redshift estimation from a 3 arcsec spectrum extracted at the core of the galaxy



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



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!*

