Star formation and AGN activity in closely interacting galaxies using MUSE, UVIT, and IRSF

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Introduction

- Interactions and mergers of gas rich galaxies can trigger star formation in their nuclear and in disk regions.
- The enhanced star formation will ultimately lead to bulge growth accompanied by starburst/AGN feedback activity.
- Galaxy Interactions can lead to tidal tails which are composed of gas pulled out from the outer disks of the galaxies.
- Galaxy mergers can lead to the formation of supermassive blackhole binaries that may start accreting gas and become single or dual Active Galactic Nuclei (AGN).
- The link between interstellar gas physics, large scale interactions, and active star formation is complex and not fully understood yet.

Observational Data

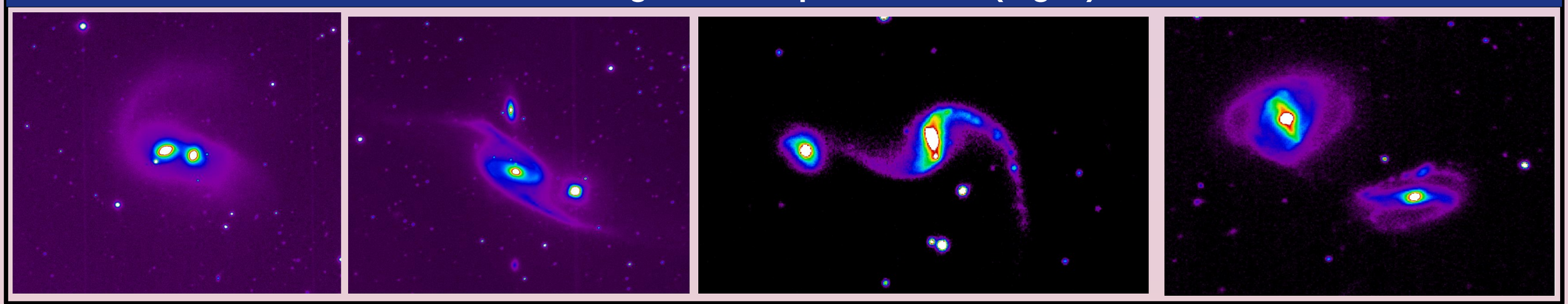
We have a sample of 10 closely interacting, spiral galaxies that show evidence of star formation and AGN activity.

Infrared Survey Facility (IRSF/SAAO)
- 1.4 m telescope
- Simultaneous Imaging in J, H , K band.

Ultraviolet Imaging Telescope(UVIT)
- Far-Ultrviolet (FUV) data ~ 3ks

Multi Unit Spectrsopic Explorer (MUSE)(Archival)
- Intergral Field Spectrograph (IFS) on VLT
- Gives 3D spectroscopic data with high resolution

NIR/IRSF Images of Sample Galaxies (Fig. 1)



NGC646 : Double System. Western arm is knotty. Eastern arm is smooth and diffuse, with a satellite attached. (Distance=115Mpc)
IC5110 : Interacting Spiral galaxy with peculiar arms and with compact companion (Distance=130 Mpc)
NGC 7733 : Barred spiral with knotty arms host seyfert 2 nuclei. (Distance=154 Mpc)
NGC7734: Barred spiral with peculiar arms.

Star Forming Regions in UVIT

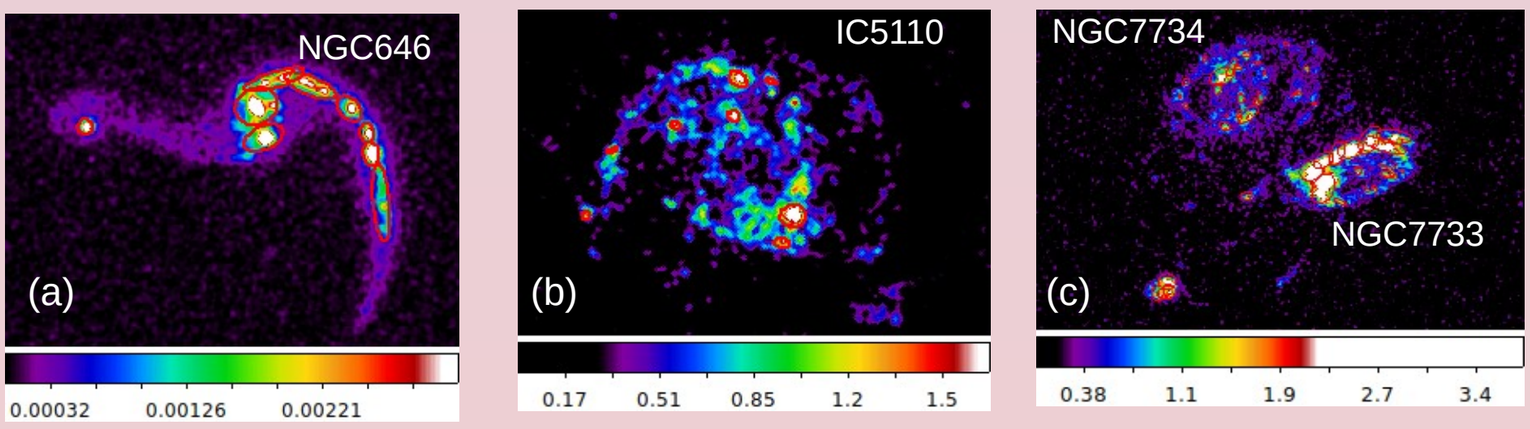


Fig. 2: Star forming regions extracted in UVIT FUV Data using Source Extractor

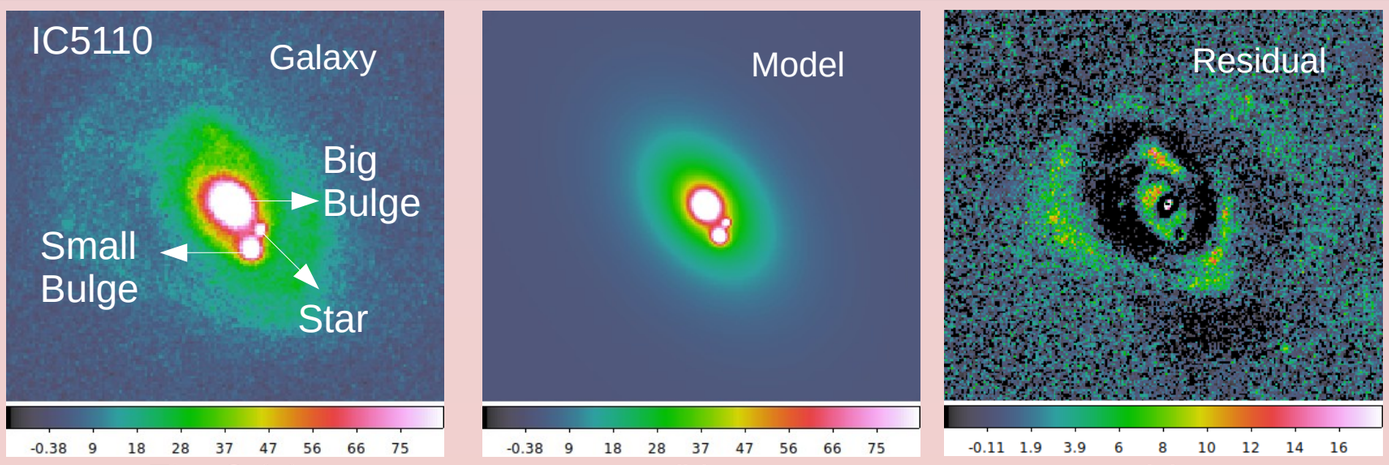


Fig. 3 (a) (b) (c)

Bulge Morphology Using NIR Data

We fitted sersic and exponential disc profile using Galfit.

Fig 3(a) shows the galaxy (b) shows the model and (c) shows the residual.

	Sersic Index	Effective Radius
Big Bulge	1.03	1.29”
Small Bulge	0.87	0.80”

Outflow in NGC 7734

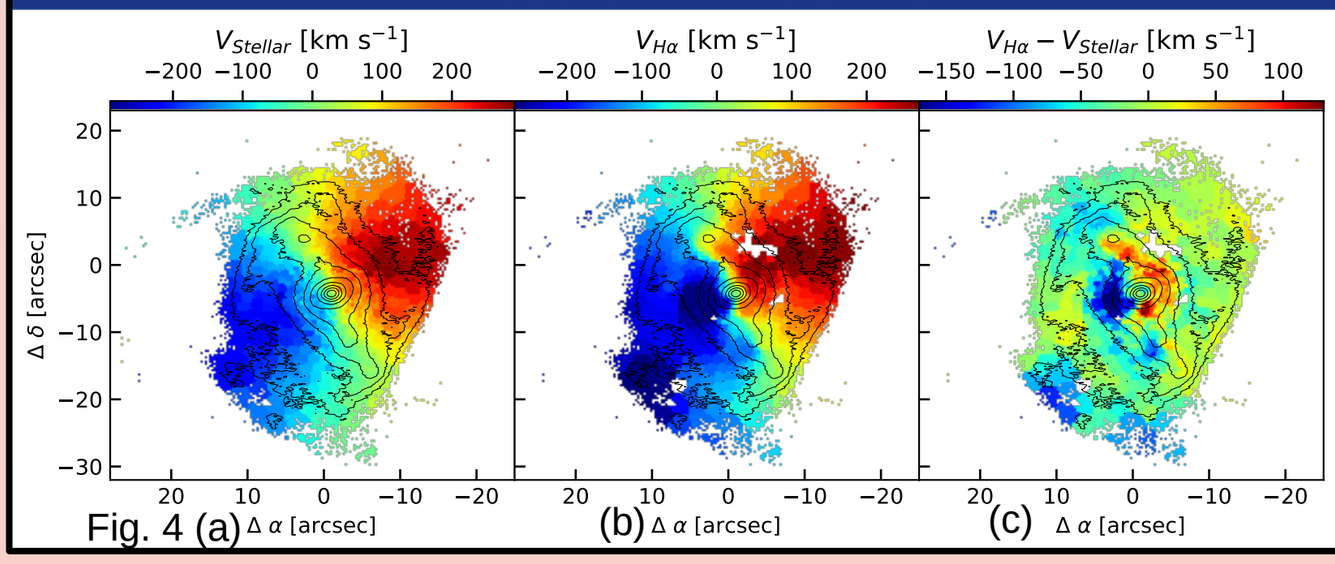


Fig. 4 (a) (b) (c)

Fig 4 (a) shows the rotation curve of galaxy (b) shows the Hα velocity map and (c) shows the stellar veocity subtracted from the Hα

- MUSE data reveals that **gas is moving with higher velocity in center than stellar velocity.**
- After subtracting the stellar velocity from gas velocity we see **conical structure in west side** and an irregular structure in east side which could be due to ouflow.
- NGC7734 shows **star formation in Bar**(UVIT map) and signatures of outflows.
- Bar is acting like a channel of gas inflow and the gas then triggers star formation and AGN activity.

AGN or Retired?

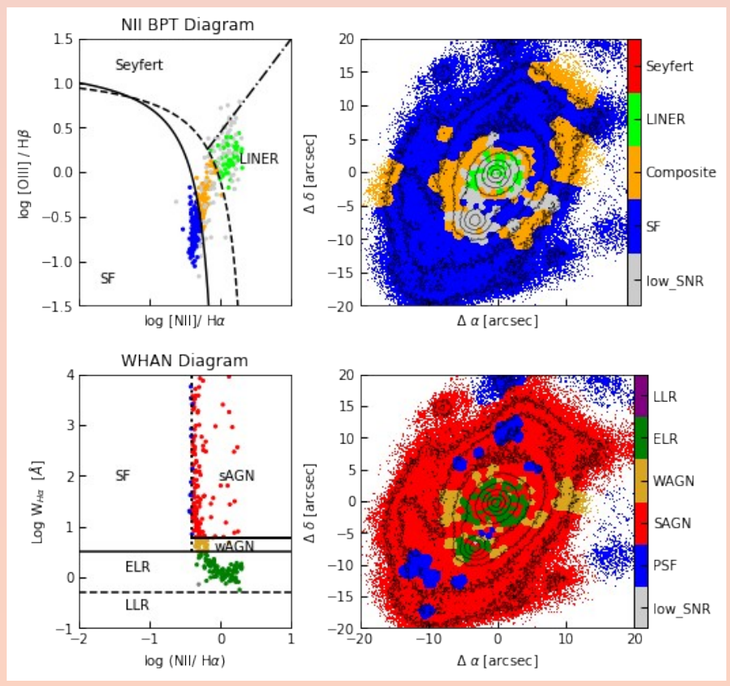


Fig. 5

➢ BPT Daigram shows that emission from central region lie in LINER region.

➢ WHAN Daigram shows that the emission which is classified as LINER in BPT is coming from Retired Galaxy which have similar line ratio as that of LINER.

Results and Conclusions

- We identified Star forming regions in UVIT and MUSE Hα and both shows the evidence of ongoing recent star formation in our sample galaxies.
- MUSE BPT plot shows Retired Galaxy can have similar line ratio as that of LINER.
- MUSE velocity maps shows outflow signatures associated with central part of NGC 7734.
- UVIT FUV data shows Bar effects on central star formation and AGN activity in NGC 7734.
- NIR images reveal the presence of pseudo bulges in IC5110.
- During Interactions gas becomes shock heated and can mimick the AGN like Emission in the outer part of galaxy.

References

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