Henize 2-10

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1 Introduction

Henize 2-10 is a nearby (d = 9Mpc) dwarf starburst galaxy, which host a massive black hole ($M_{BH} = 10^6$) in the center. The luminosity of center black hole is extremely low ($L_{radio} \sim 4 \times 10^{35}$erg/s, $L_{X-ray} \sim 10^{38}$erg/s), which indicates the BH is accreting at a very low Eddington ratio. However, a recent study using HST revealed that the central BH can driving an outflow of ionized gas, which is triggering the star formation in two regions located about 70 pc from the BH. This is the first case of positive AGN feedback found in a dwarf galaxy.

2 Observations

Henize 2-10 is an irregular dwarf galaxy. Figure 1 shows Hubble Space Telescope (HST) images of Henize 2-10 using two distinct filters, F555W and F187N, which are quite different. The galaxy structure shown in F555W filter is more compact than that in F187N filter. The F555W filter on the HST corresponds to a broad visual band filter centered around 555 nm, which primarily captures starlight and stellar continuum emission. The F187N filter on the Hubble Space Telescope is a narrow-band filter centered around 1.87 µm. This wavelength range is sensitive to emission lines from ionized gas, particularly the [FeII] emission line, which is often associated with star-forming regions or active galactic nuclei (AGN). Therefore, the left picture of Figure 1 primarily shows the distribution of star clusters, while the right picture of Figure 1 mainly illustrates the ionized gas distribution.

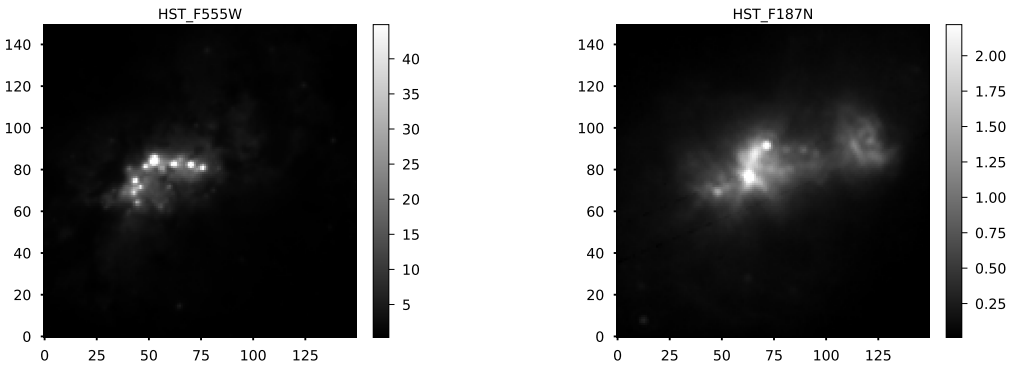
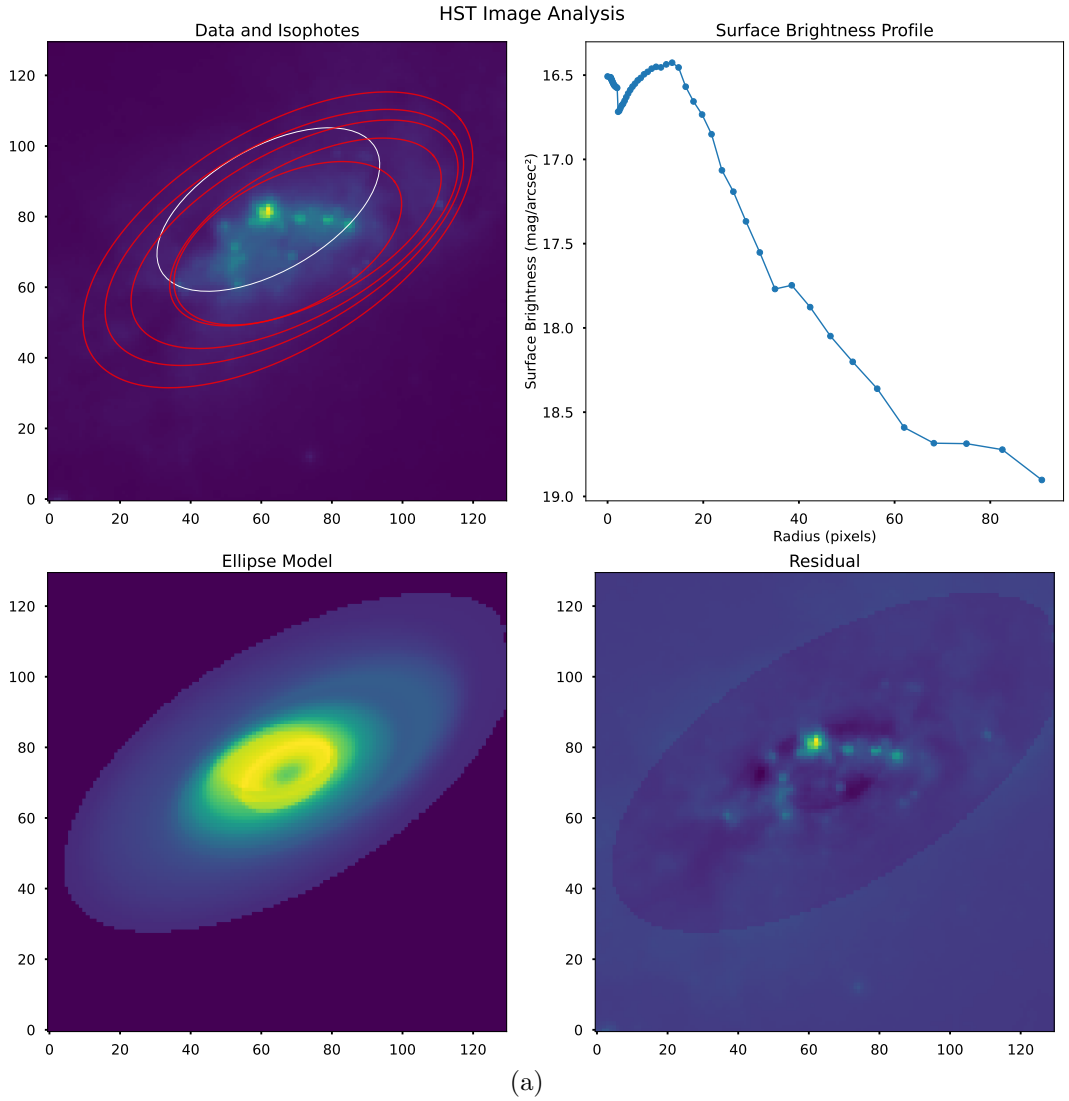


Figure 1: HST images

The ionized gas distribution reveals two lobes at the eastern and western ends of Henize 2-10, connected by a gas filament. These lobes correspond to the two starburst regions of the galaxy. The massive black hole is located at the center of the filament. Previous works have estimated the age of those very luminous stars shown in the left picture of Figure 1, which are very young. The irregular arrangement of these star clusters is due to the influence of feedback from the central black hole on the gas that forms the stars. No obvious stars are seen in the western starburst region, as the star clusters here are just forming and have not had enough time to clear away their birth material, leading to high levels of extinction.

Figure 2 shows the surface brightness profile of Henize 2-10. Since Henize 2-10 is a highly irregular dwarf galaxy, the one-dimensional surface brightness curve is not very flat and even concave in the center.



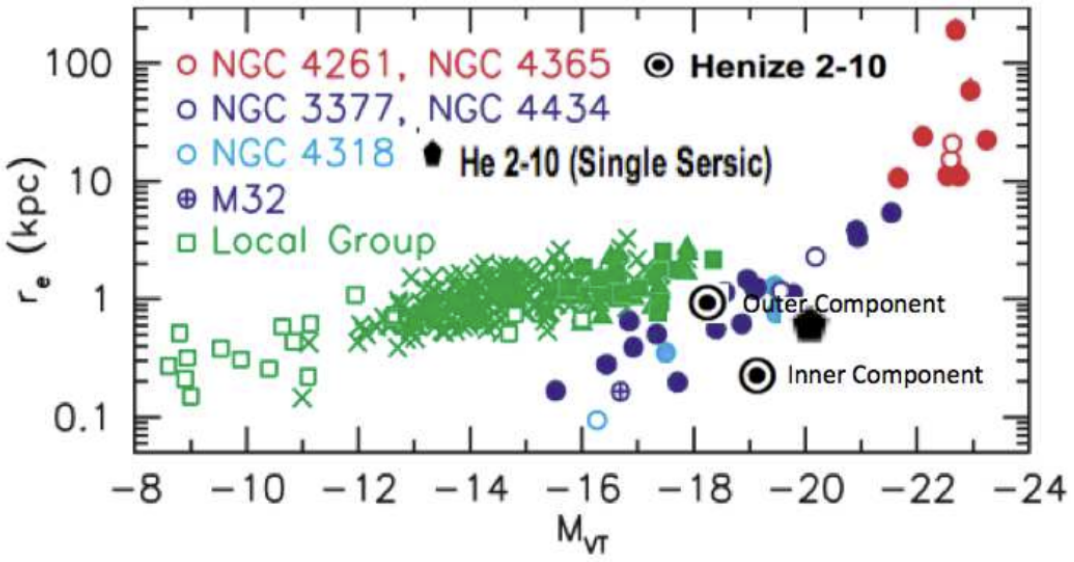
(a)

Figure 2: Surface brightness of Henize 2-10.

The surface brightness profile of Henize 2-10 can be fitted with both double and single Sersic profiles. We can better understand its nature by comparing the morphology and luminosity of Henize 2-10 to other early-type galaxies. Each component of double-Sersic fits and single component are ploted on Figure 3 of absolute magnitude vs. effective

radius; Both in the one-component model and in the two-component model, Henize 2-10 is a typical early-type galaxy. In two component model, the outer component is typical of an old early-type galaxy. The inner component, with its varying M/L, represents more recent star formation , and thus its position off the early-type galaxy locus is unsurprising.

Henize 2-10 appears to be very isolated, with no known companions within 2 degrees ($\sim$ 0.3 Mpc) of the galaxy. Thus the most plausible explanation for Henize 2-10's relatively steep Sersic index and current starburst is that it is a late stage merger of two other smaller galaxies.



(a)

Figure 3: The correlation of the effective radius, r_e, and M_{VT} (Nguyen et al. 2014).

3 References

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