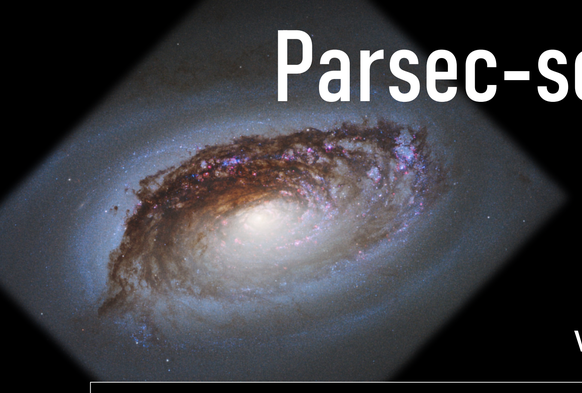
Parsec-scale star formation and dust with JWST NIRCam/MIRI in the "Evil Eye" Galaxy (M 64)



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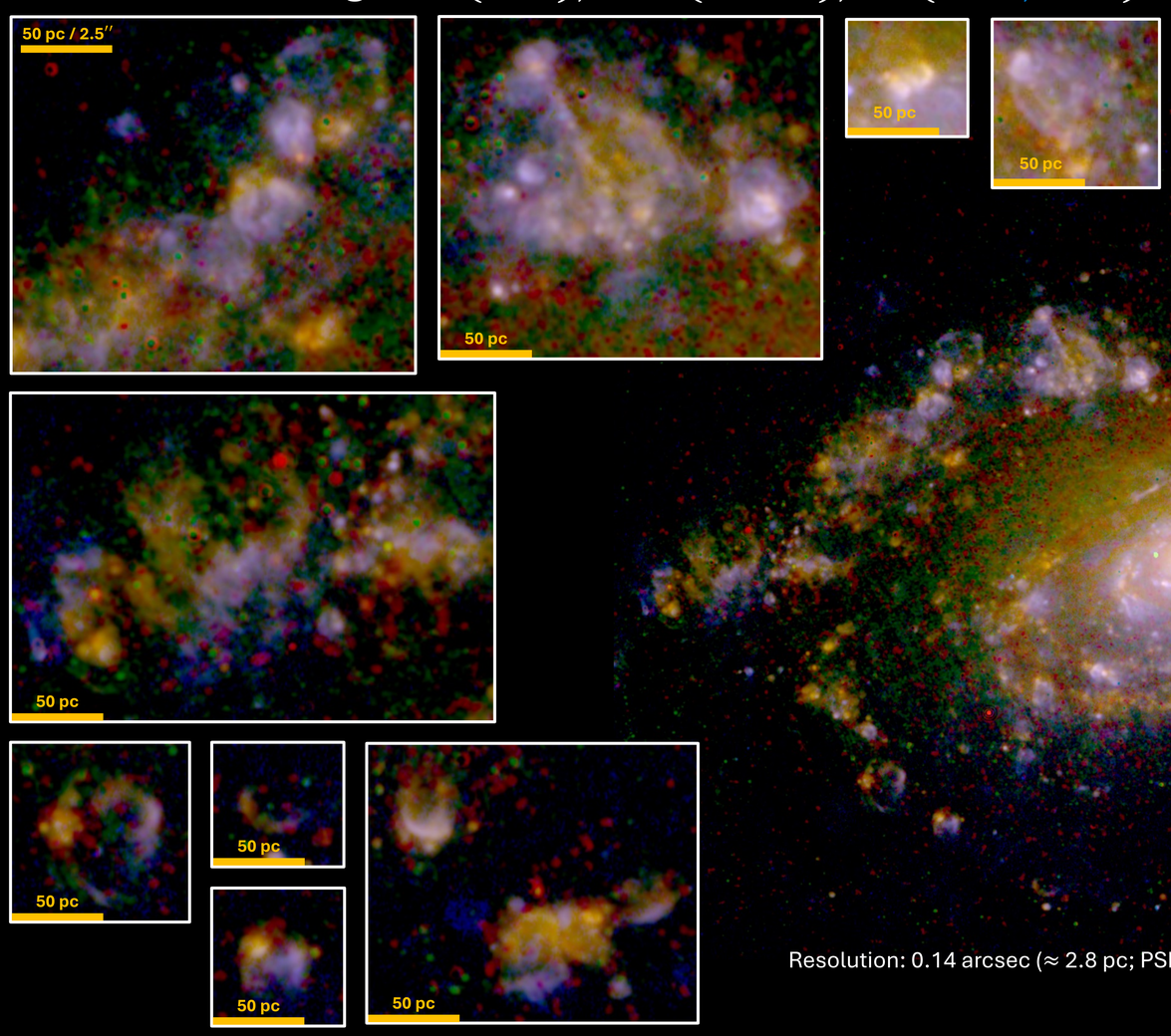
Who am I?

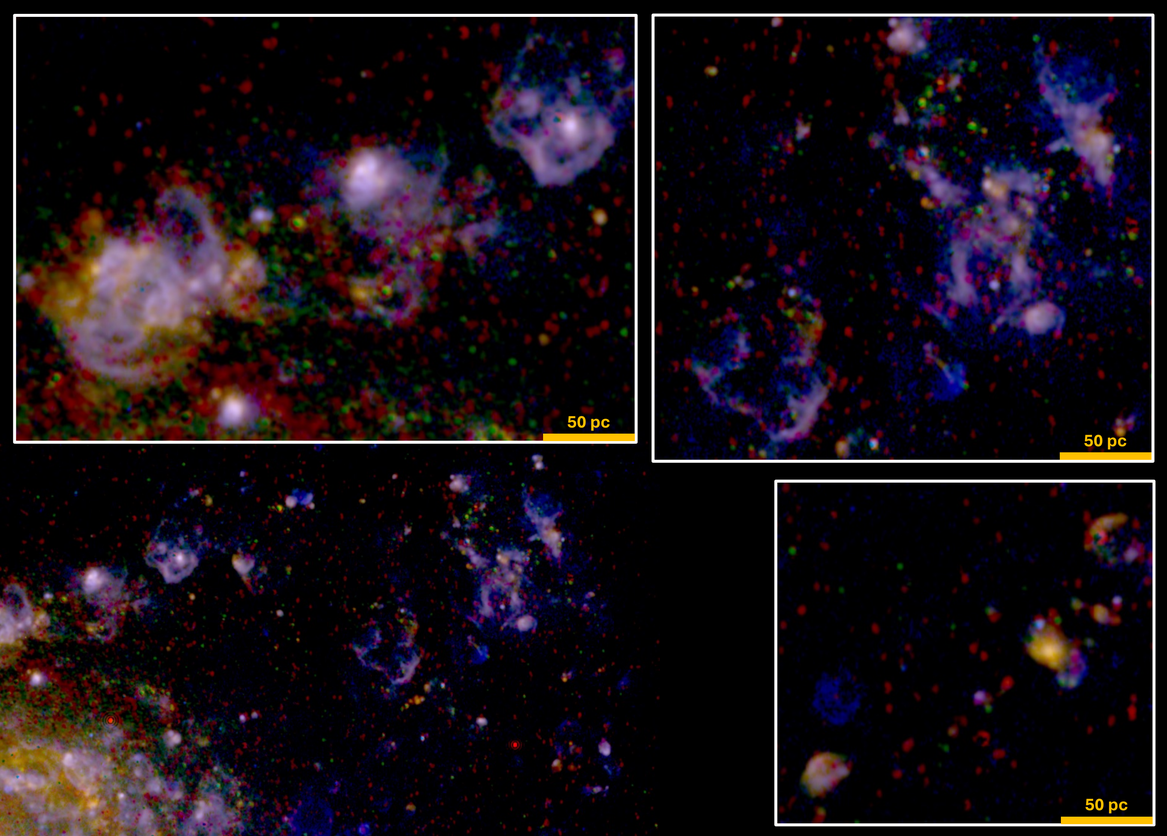
M 64 (a.k.a Evil Eye galaxy) – Distance at 4.4 Mpc, Recent minor merger with dusty inner disk and counter-rotating outer HI disk
JWST Observations - F150W F187N F200W F300M F335M F405N F430M of NIRCam; F770W F1000W F1130W F2100W of MIRI

What we want to know & What we are doing

- ✓ Parsec-scale star formation and dust, and their correlation in merger induced starburst system, M 64
- ✓ Match images to a common scale (2 to 7 pc)
- ✓ Produce continuum-subtracted Pa α, Br α, and PAHs maps

RGB of M 64 using Br α (Red), Pa α (Green), Hα (Blue, HST)



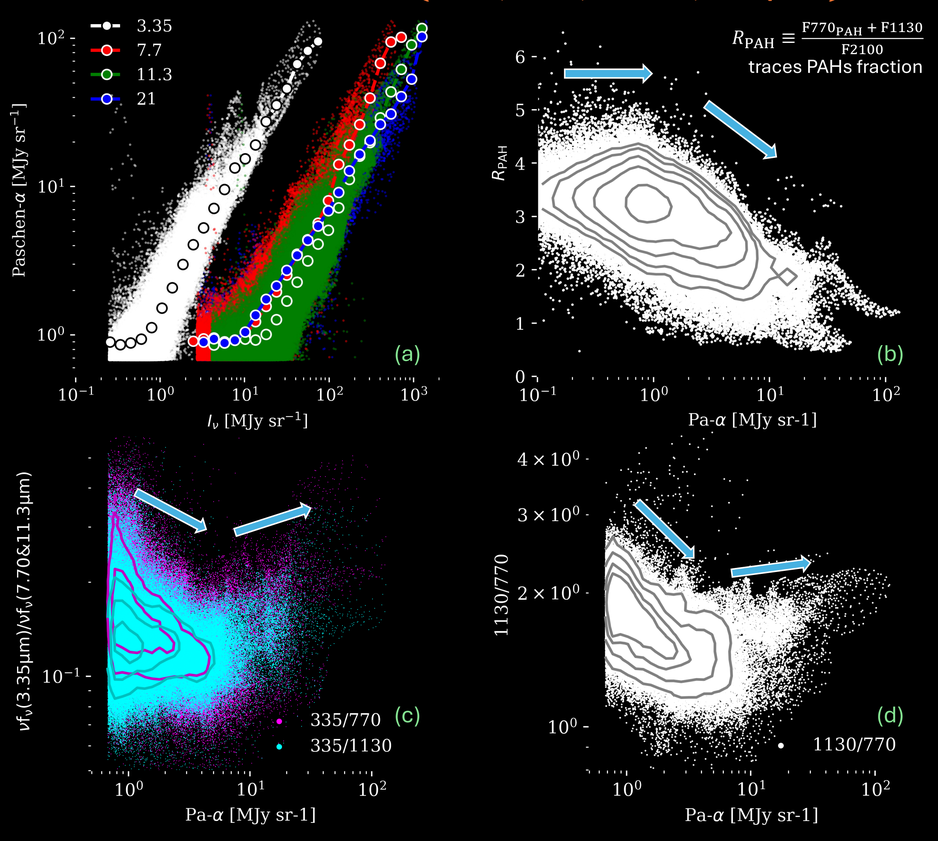


Resolution: 0.14 arcsec (≈ 2.8 pc; PSF of F430M)

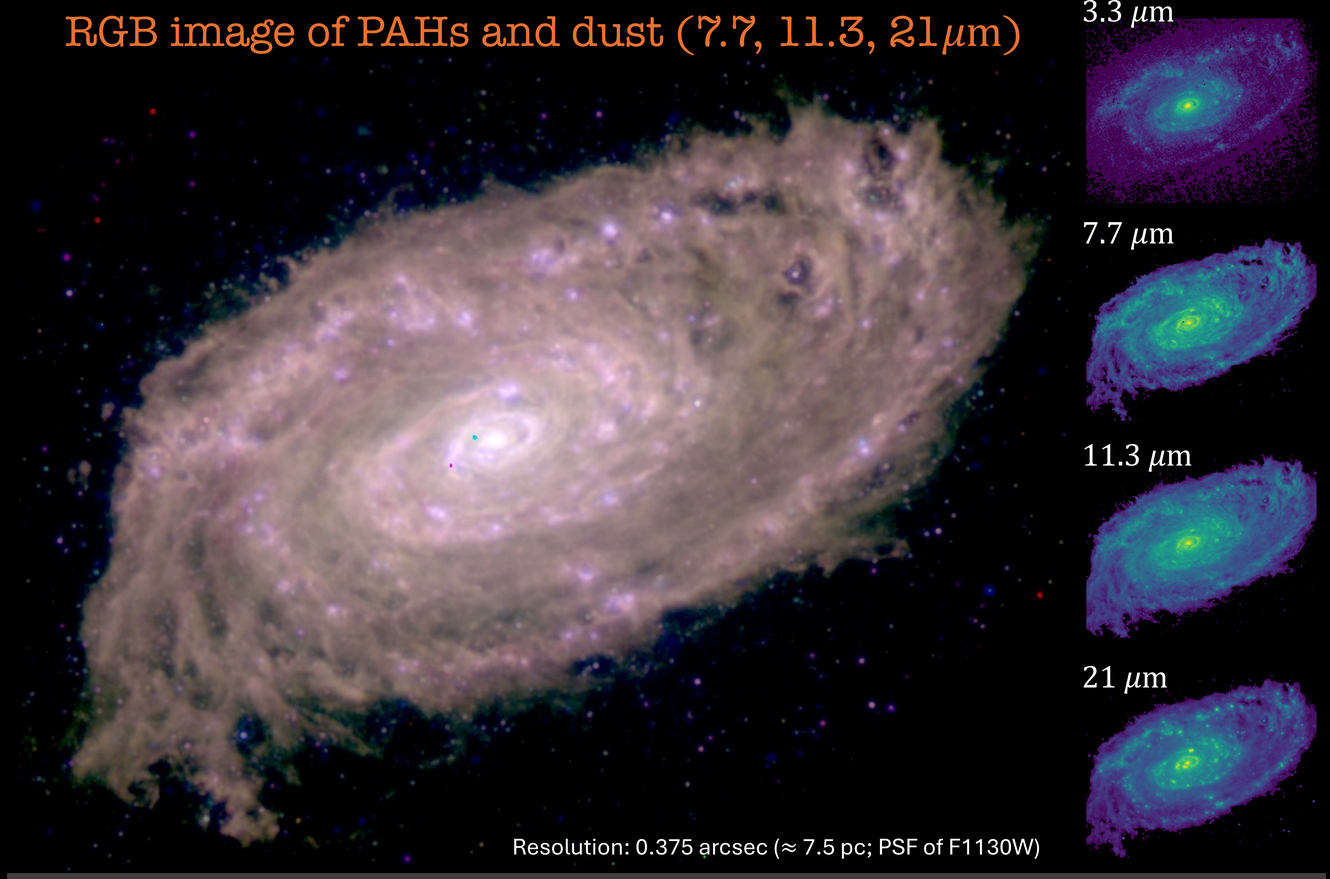
Star forming regions

- Top left region, where strong dust lane exists, shows relatively weak Hα than other regions in the galaxy
- Both closed and open shell structures are observed; some host bright cores, while others do not
- Multiple shells are identified in some regions, appearing either side-by-side or intertwined
- Different morphologies between Pa α (Br α) and Hα are found

Pa α vs PAHs (3.3, 7.7, 11.3, 21μm)



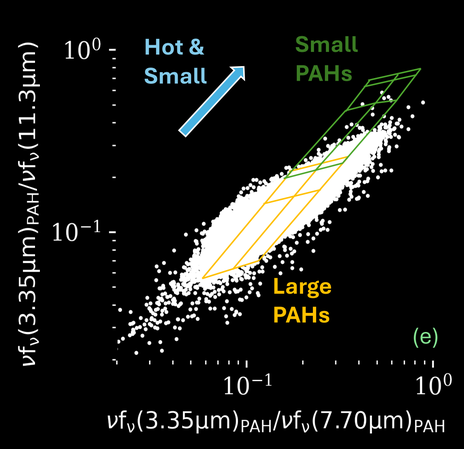
RGB image of PAHs and dust (7.7, 11.3, 21μm)



Resolution: 0.375 arcsec (≈ 7.5 pc; PSF of F1130W)

- Mixed population of small and large PAHs (e)
- PAH emission correlates well with Pa α (a)
- Above a certain Pa α level, the PAH fraction declines as Pa α increases (b)
- Under weak Pa α (< 3 MJy/sr), all PAH sizes are present; under mild Pa α (3 - 10 MJy/sr), only large (or cool) PAHs persist; and under strong Pa α (> 10 MJy/sr), only small (or hot) PAHs survive (c)
- Similar behavior is seen in the F1130/F770 ratio, with a clear correlation at low Pa α but a weaker trend at high Pa α (d)

Relations between PAHs



What will we do?

- Create a high-resolution, high-accuracy dust extinction map using Pa α, Br α, and Hα
- High resolution ALMA CO data will be coming (PI: J. Sun) and compared with PAHs and star formation rate
- Classify PAHs into subgroups (e.g., open vs extended; nebula vs diffuse) and assess their relation to with star formation
- Identify young star clusters and examine their correlation with PAHs
- Estimate the sizes of individual HII regions and quantify the strength of stellar feedback processes