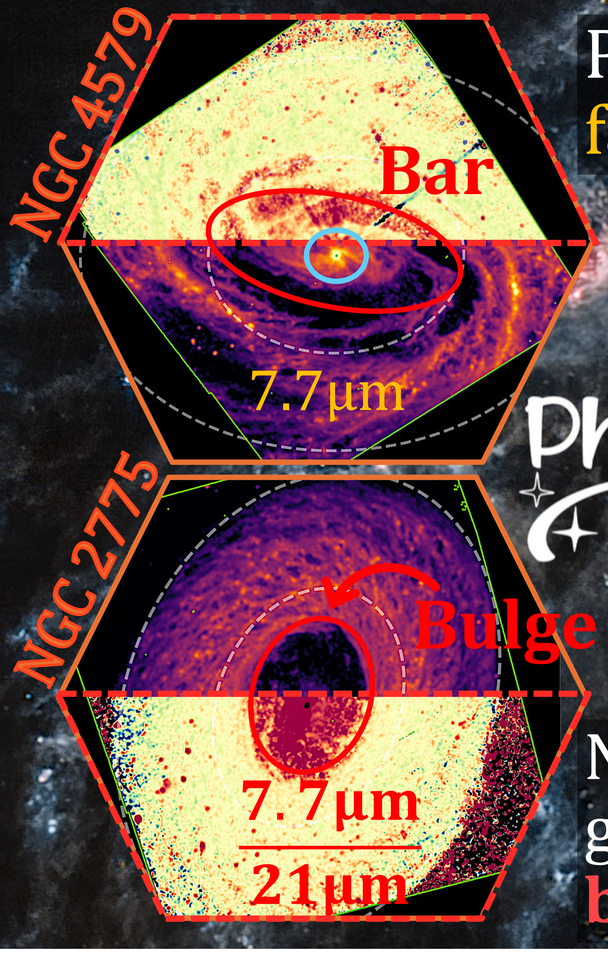
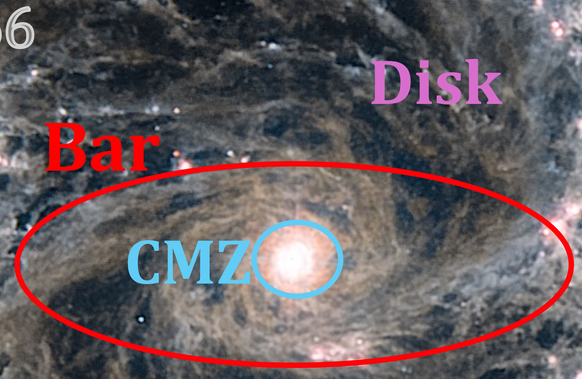
PAH Band Ratios Vary with Environment and sSFR across 74 Nearby Galaxies

Deb/Debosmita Pathak, Karin Sandstrom, Adam Leroy, Todd Thompson, Laura Lopez, The PHANGS Team



PAH band ratios are sensitive to the availability of energetic far-UV (FUV) photons and the overall radiation field intensity.



Mid-IR Dust & Gas Probability Distribution Functions Pathak+ 2024

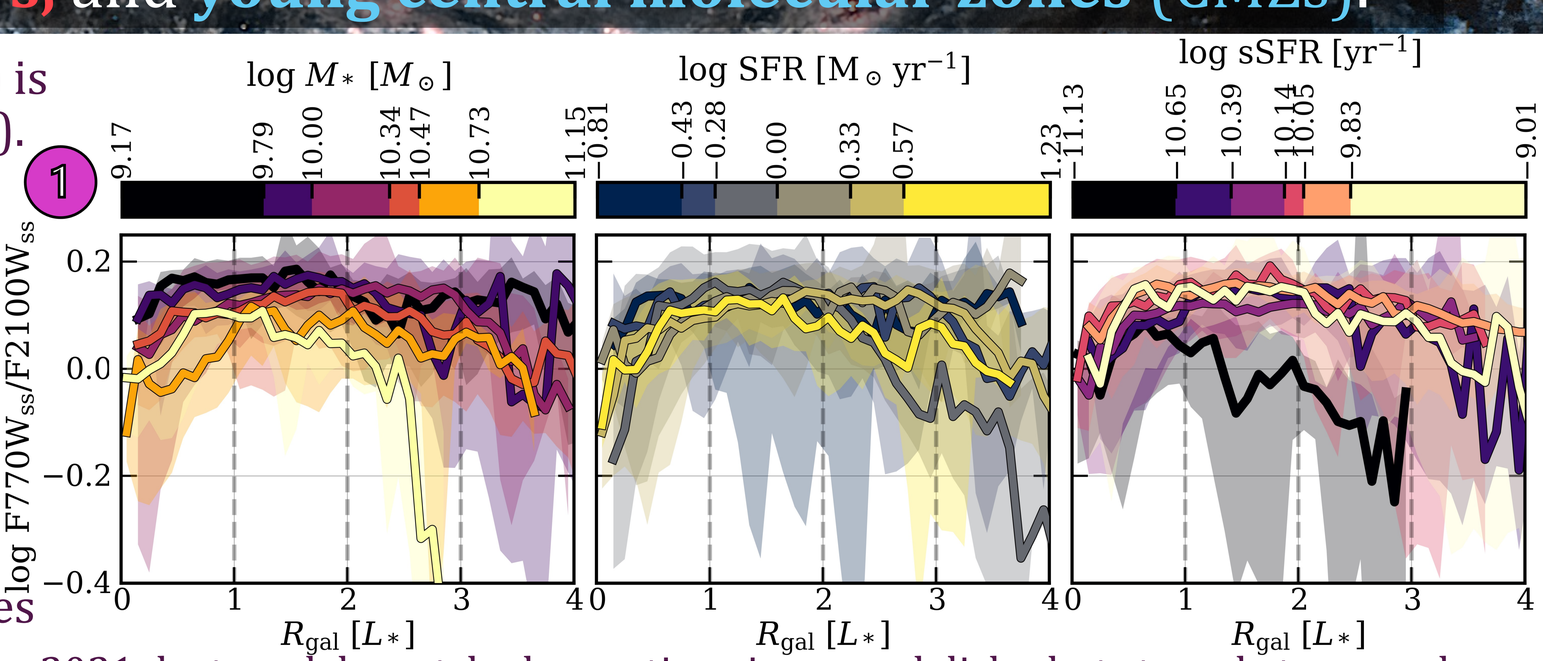
HII Region IR & UV Radiation Pressures, Stellar Feedback Pathak+ 2025a

HII Region Masses, SFEs, Dynamical Equilibrium Pathak+ 2025c

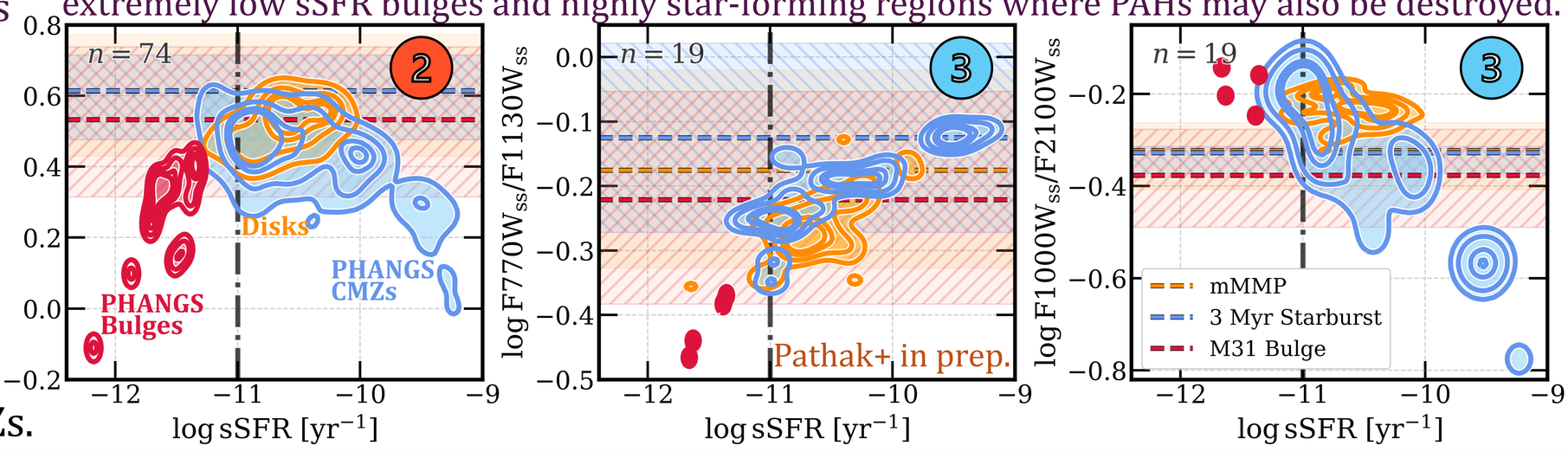
New JWST measurements of mid-IR PAH band ratios in nearby galaxies reveal low 7.7μm emission in both **FUV-poor old stellar bulges and bars,** and **young central molecular zones** (CMZs).

The PAH-to-continuum ratio (R^*_{PAH}, 7.7/21μm) is often used as a tracer of PAH abundance (q_{PAH}).

1. However, across 74 nearby galaxies, we find systematically **low** R^*_{PAH} in massive galaxy centers, and globally across low sSFR galaxies.
2. Both old stellar bulges (lower sSFR, softer radiation) and young CMZs (higher sSFR, high radiation field intensity) show **low** 7.7/21μm relative to normal star-forming disks.
3. Short-λ PAH emission is suppressed in bulges (low 7.7/11.3μm), while the hot dust continuum is steeper in CMZs (low 10/21μm).



The Draine+ 2021 dust models match observations in normal disks, but struggle to reproduce extremely low sSFR bulges and highly star-forming regions where PAHs may also be destroyed.



– Takeaways –

PAH emission changes strongly with local sSFR. Compared to normal disks, R^*_{PAH} changes significantly in centers–due to inefficient heating of PAHs from softer radiation in bulges, and a combination of PAH destruction and high dust continuum in CMZs.

pathak.89@osu.edu | Pan Dust Conference, Tucson, AZ | November 2025