PAH EMISSION AND AGE PROPERTIES IN z~0.3 RAM PRESSURE STRIPPED GALAXIES

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ABSTRACT

We present a study on RAM pressure stripped galaxies in the Abell 2744 cluster. Using JWST and HST observation we characterize the properties — including the 3.3μm Polyclic Aromatic Hydrocarbons (PAH) luminosity — of both the disks and the stripped tails of these galaxies, in a spatially-resolved way.

We find strong PAH emission in the star forming stripped clumps of the galaxies that can be explained only with a fast (<10 Myr) PAH formation mechanism or with PAH being strongly affected by RAM pressure. Both possibilities tell us something previously unexplored about these dust grains.

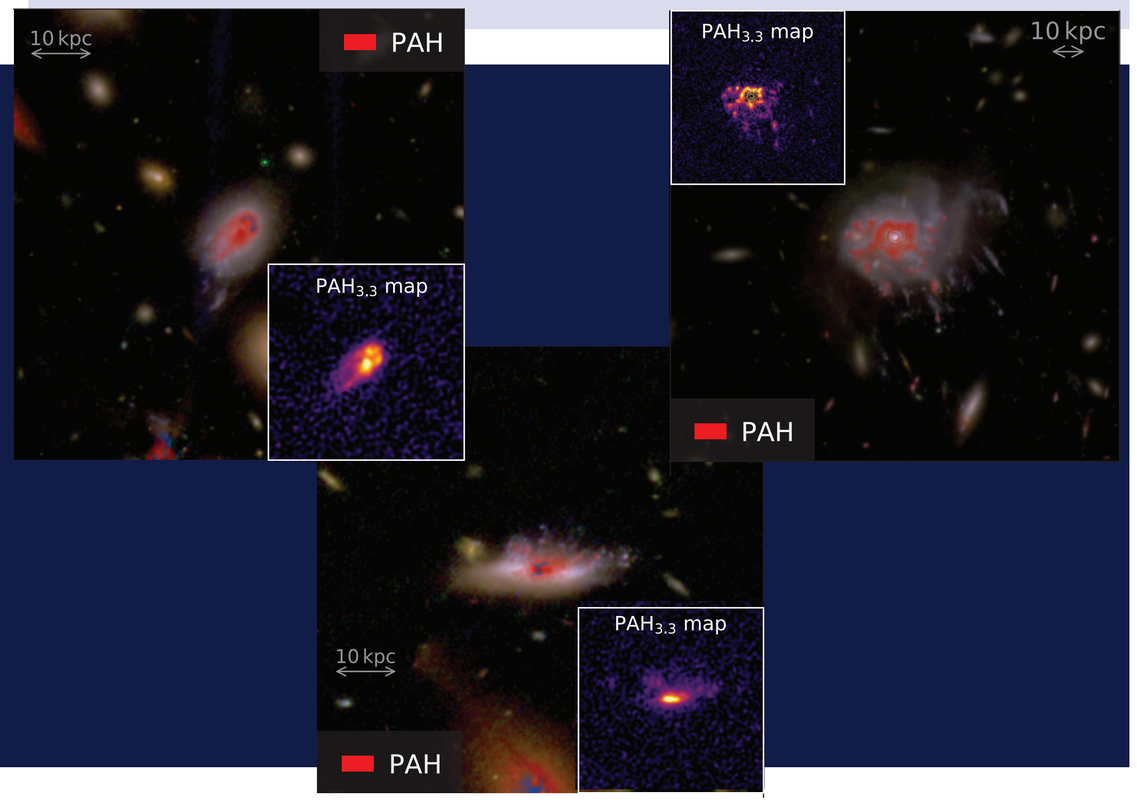
For the first time at such high redshift we find evidences of the fireball model in the tails of the RAM pressure stripped galaxies.

DATA AND ANALYSIS

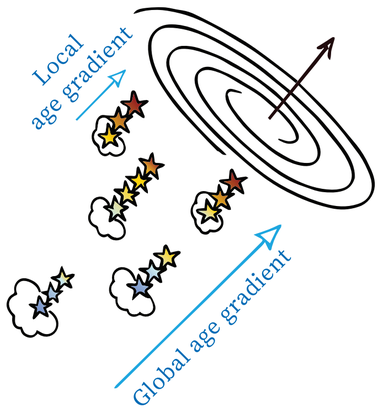
We investigated the cluster Abell 2744 using NIRCam photometry from the UNCOVER and Megascience surveys, together with ancillary HST data, resulting in ~30 filters covering from UV to IR wavelenghts.

We selected RAM Pressure stripped galaxies from both visual inspection, MUSE data and other preovius works.

We used the F430M filter to trace the 3.3μm PAH band, estimating the continuum contribution to the filter flux from interpolating nearby filters. We computed spatially resolved SED fititng of the galaxies and of the stripped clumps to infer their physical properties.

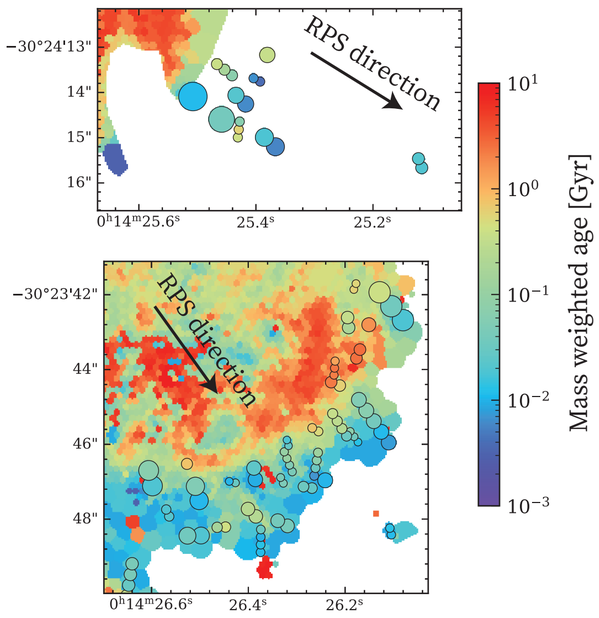


THE FIREBALL MODEL



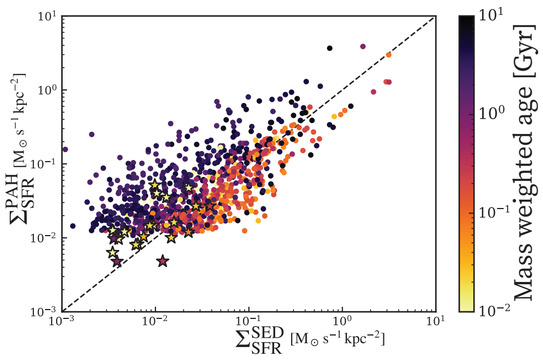
In RPS galaxies, the stripped gas eventually collapses to form stars, leading to a global age gradient in the tail, as further away gas takes more time to arrive there. Additionally, gas in star-forming clumps experiences stripping drag, resulting in an age gradient within each clump.

For the first time in such a distant cluster, we observed both global and local age gradients in the clumps of the selected galaxies.



PAH EMISSION

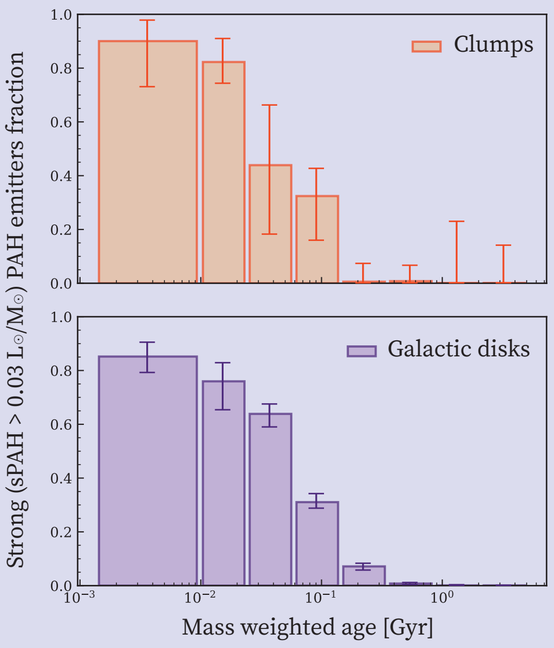
We find all the selected galaxies to be PAH emitters apart from one which is a known post-starburst galaxy from MUSE data.



The star formation rate measured from the PAH well correlates with the one inferred from the SED fitting for regions younger than 1 Gyr.

We found the PAH emission maps of the galaxies to be elongated in the stripping direction. Moreover, some galaxy shows PAH emission in the star forming clumps out of the disk.

DISCUSSION



The observation of PAH out of the galaxy disk can be explained by in-situ formation or by direct stripping of these molecules.

The measured distribution of PAH emitting regions is the same between the galaxtic disks and the clumps. For this reason, if the PAHs are formed in the clumps, they should be completely formed in <10 Myr, excluding an AGB origin. More simply, the PAH are small enough to be affected by RAM pressure stripping together with the atomic gas.

CONCLUSIONS

In the RAM pressure-stripped galaxies of Abell 2744, we analysed photometric data from JWST and HST and made the following findings:

- We observed age gradients in the RPS tails consistent with the fireball model;
- A mild correlation exists between the star formation rate measured from SED fitting and the one from PAH luminosity.
- We found asymmetric maps of PAH emissions and noted instances of PAH emissions in stripped gas clumps.
- PAHs in the clumps must either be formed in less than 10 million years or be stripped along with the atomic gas.

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