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Probing cosmic monsters: confronting hydrodynamic simulations with new observations of high-density environments

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Propositions accompanying the thesis

Probing Cosmic Monsters

Confronting Hydrodynamic Simulations with New Observations of High-density
Environments

1. The opposite evolution of the concentration of the distribution of dark matter and stellar mass in clusters over cosmic time is not in tension with the Λ CDM cosmology. (Chapter 2)
2. Rather than the brightest galaxy, the galaxy with the highest associated halo mass is more likely to be the central one in a galaxy group. (Chapter 3)
3. Binning groups in narrow halo mass ranges provides a better understanding of the growth of the diffuse light in a stacking analysis. (Chapter 3 & 4)
4. When systematics in the imaging data are the limiting factor, improvements in the data processing pipeline can only go so far. However, combining a large sample and an optimised analysis, it is still possible to obtain useful constraints. (Chapter 4)
5. Galaxy quenching models at high redshifts ($z > 1.5$) need an upgrade to explain recent observations. Considering an environment-dependent halo mass function is a good starting point. (Chapter 5)
6. To fully characterise any type of object, detailed studies of a small sample of individual objects and statistical analysis of a large sample are complementary, and both are necessary. (Chapter 3 & 4)
7. Given the multifaceted way modern astronomy research is conducted, simply dividing astronomers into discrete groups like theorists and observers is obsolete.
8. The quality and quantity of scientific research output is anti-correlated over a fixed time period, especially for early-career researchers.
9. Having time to explore different ideas should be prioritized over fast research outputs when the goal is anything more than building a database/catalogue.
10. The first step to solving a problem is to acknowledge it; the next is to take small, incremental, and intentional steps to resolve it. This is also applicable when we talk about equity, inclusion, and sustainability in academia.
11. A creative hobby can be an excellent way to de-stress, zoom out of research problems to promote new insights, and practice being okay with making mistakes while trying something new.
12. Scientific thinking and emotional intelligence are crucial life skills in a globalized world with information overload, and should be part of the mandatory education curriculum worldwide.

Syeda Lammim Ahad
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