Formation and Evolution of Galaxies - Paper Reading 2

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1 Star Formation Main Sequence

Read first **Noeske et al. (2007)**

1. Figure 1 shows the stellar mass $> 95\%$ completeness limit as a dotted vertical line. Does it change over the four redshift ranges? If so, why?
2. Noeske et al. (2007) derive the star formation rates as shown in Figure 1 using two methods, depending on whether there is a detection at 24 micron. Describe the two methods. Why do they make this distinction?
3. What is the star formation main sequence? Does it evolve with redshift? If so, how?
4. Describe the three distinct galaxy populations as found on the SFR-M_* plane.
5. What physical explanation do they provide for the evolution of the normalization?

2 Galaxy properties

Read first **Kauffmann et al. (2003)**

6. Kauffmann et al. (2003) introduce a new method to determine the stellar mass based on two spectral features. Describe the techniques from other works to determine the galaxy-halo relation mentioned in the paper and explain their shortcomings.
7. Describe the two spectral features on which they base the stellar mass measurement.
8. Do the D(4000) and $H\delta_a$ indices depend on the metallicity of the stellar population? If so, how?
9. How do Kauffmann et al. (2003) model the star formation history?
10. How does the probability of a recent burst of star formation relate to the two spectral indices?
11. Figure 10 in Kauffmann et al. (2003) shows colour diagrams for the SDSS galaxies and Bruzual&Charlot modelled sources, in which a clear offset between the data and models is visible. Describe the origin of this offset.
12. The stellar mass is derived from the mass-to-light ratio and the SDSS observed luminosities. How does the mass-to-light ratio relate to luminosity?
13. How does galaxy morphology affect the mass-to-light ratio measurement?
14. Describe the V_{max} correction method.
15. Why do we see a bimodality in the distribution of the 4000-Å break as presented in Figure 21?

3 Mass-metallicity relation

Read first **Tremonti et al. (2004)**

16. In this paper, they derive the metallicity from optical nebular emission lines. What physical processes determine the strength of those lines? What is an important limiting factor?
17. Give the formula for the R_{23} metallicity indicator.
18. How is the method to derive the metallicity presented in Tremonti et al. (2004) different from the R_{23} indicator?
19. What is the trend that they find between galaxy luminosity and metallicity?
20. What is the trend that they find between stellar mass and metallicity? How does it compare to the luminosity-metallicity trend?
21. What is the trend that they find between effective yield and baryonic mass? What does this imply?

References

Kauffmann, G., Heckman, T. M., White, S. D. M., et al. 2003, MNRAS, 341, 33, doi: 10.1046/j.1365-8711.2003.06291.x

Noeske, K. G., Weiner, B. J., Faber, S. M., et al. 2007, ApJL, 660, L43, doi: 10.1086/517926

Tremonti, C. A., Heckman, T. M., Kauffmann, G., et al. 2004, ApJ, 613, 898, doi: 10.1086/423264