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Science & Technology Facilities Council

Modelling groups and clusters of galaxies with the L-Galaxies SAM

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L-Galaxies SAM - Strengths and weaknesses

- Self-consistent galaxy formation model across cosmic time, built on merger trees (*Henriques 2015*)

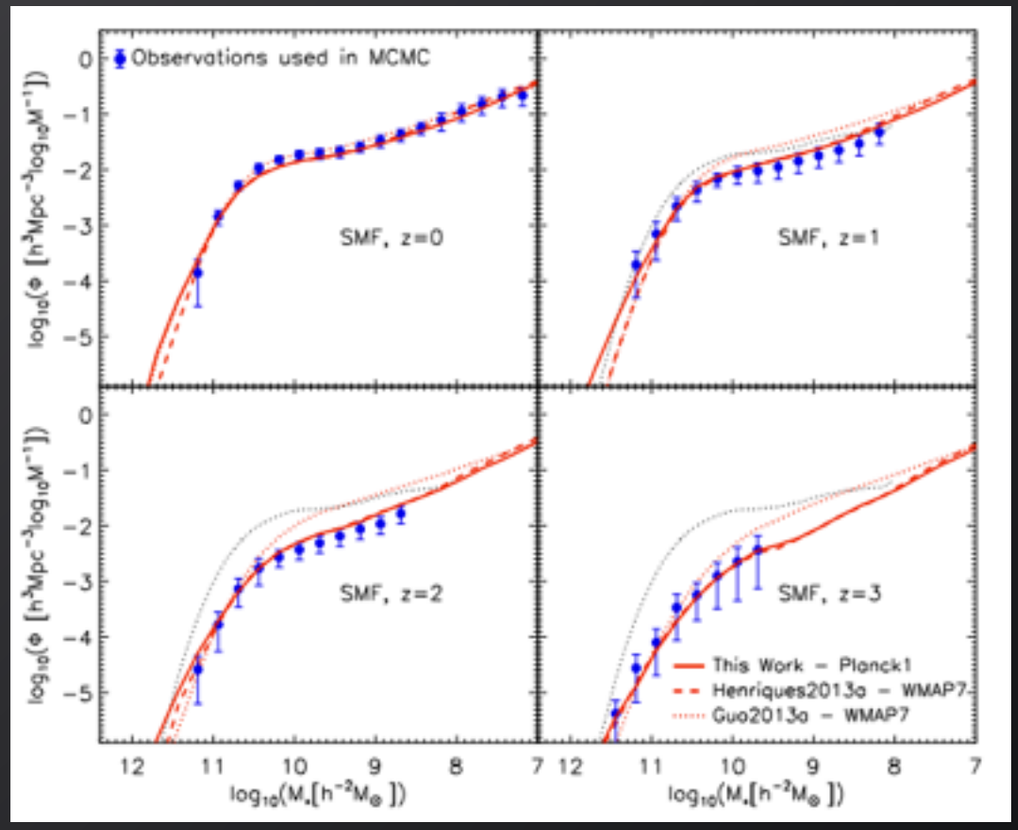
- Includes various physical phenomena. Parameters tuned with MCMC

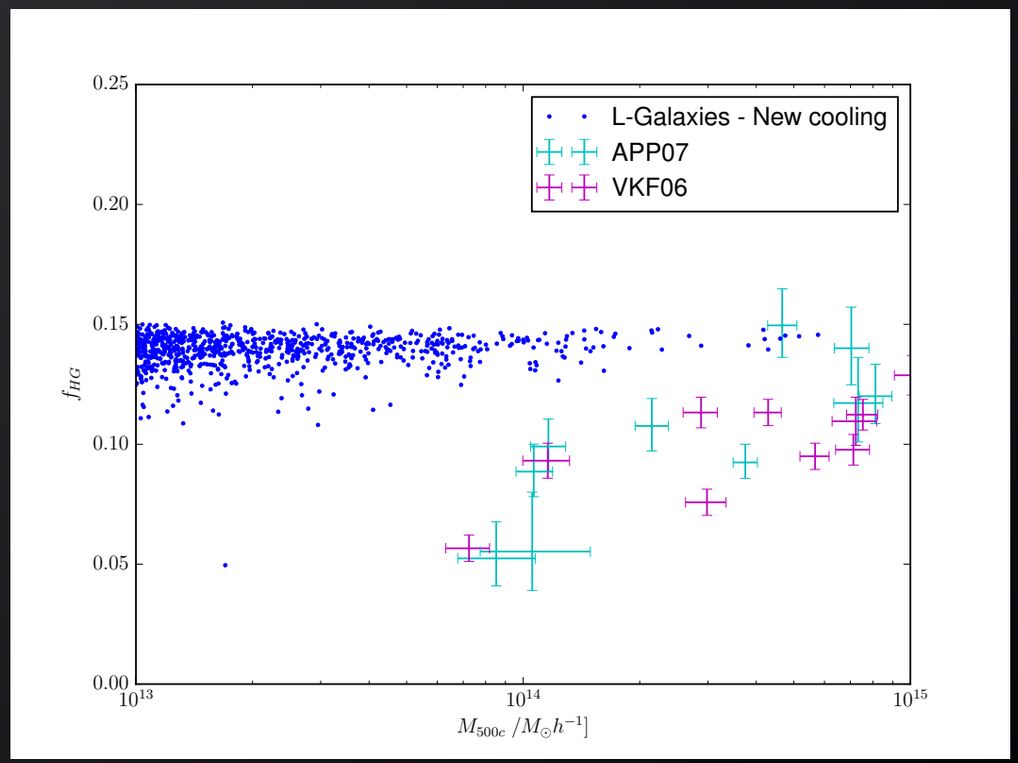
- Reproduces successfully key observables at $z \leq 3$

BUT

- Fails at reproducing main properties of the ICM :

  —> Metallicities (*Yates 2016*)
  —> Baryon and hot gas content
  —> No X-ray properties



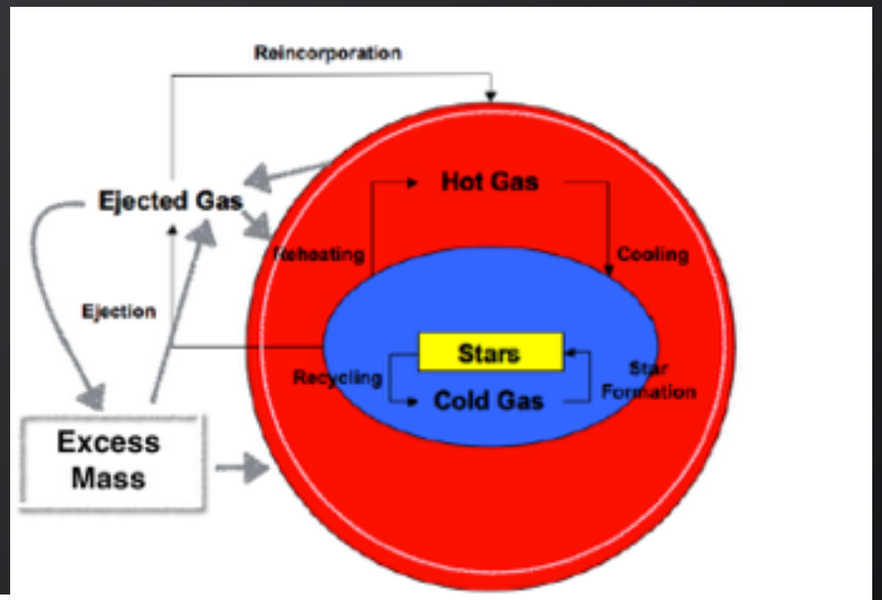


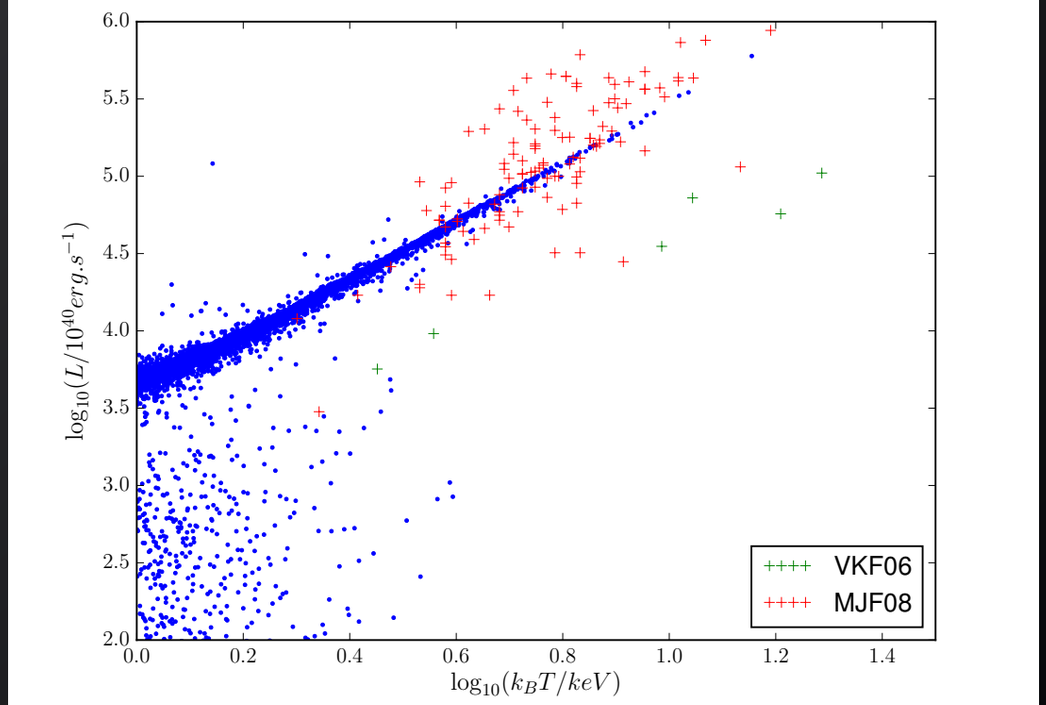
How to overcome the ICM problem ?

1 - Fixing the baryon content and gas cooling mechanism

- Baryon problem fixed by introducing an extra phase
  The excess gas created by halo mass fluctuations is stored and re-accreted

- Gas density changed to an isothermal β profile
  X-ray luminosities and cooling mass can be calculated directly (no cooling radius involved)





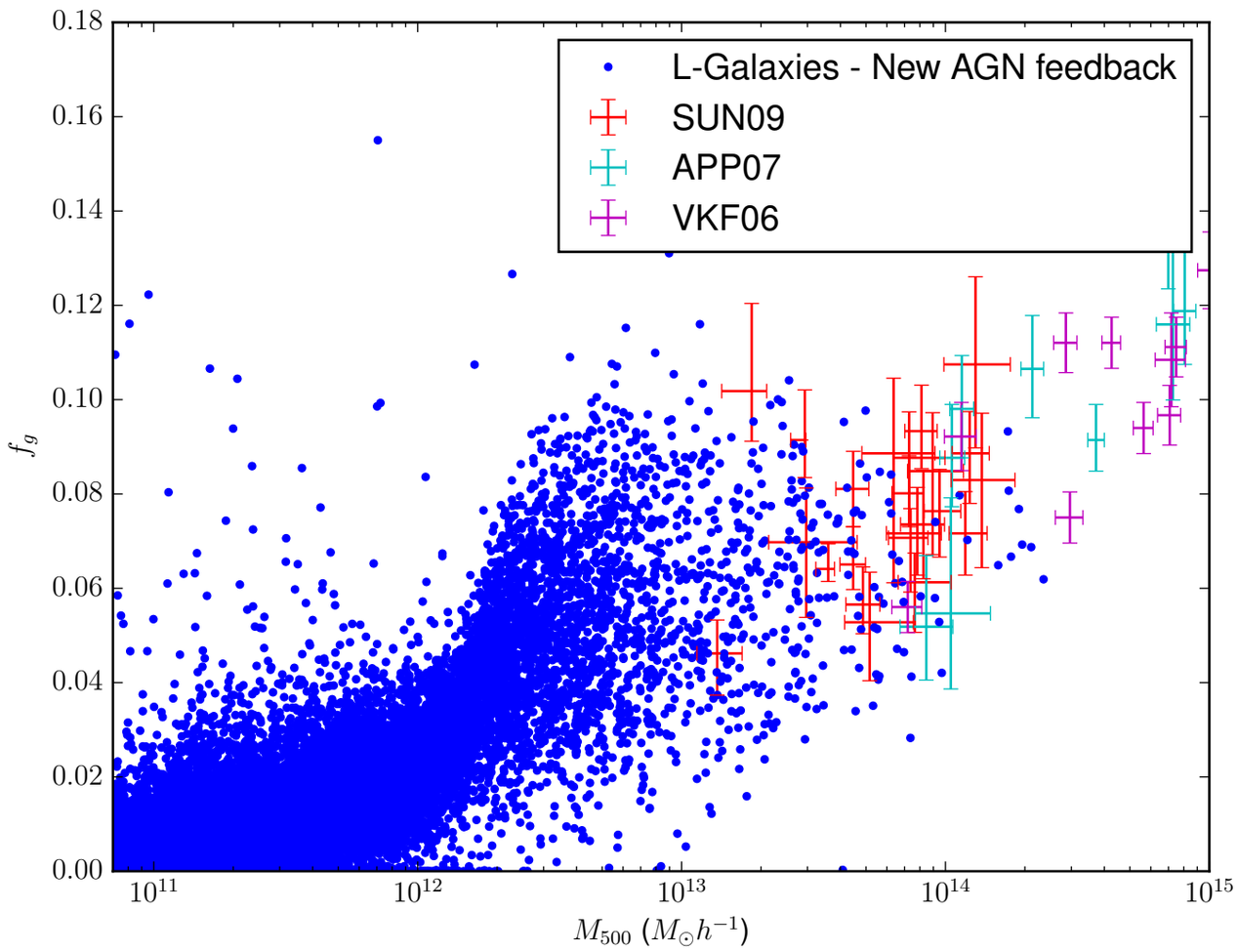
BUT

- If these solutions help getting X-ray luminosities and lower baryon fractions, the ICM content is still too high

How to overcome the ICM problem ?

2 - AGN feedback (work in progress)

- AGN feedback necessary to lower the gas content
- New black hole growth model :
  —> during mergers
  —> fraction of the cooling gas
- Mechanical feedback limited to 0.02 L_{EDD}
- Feedback used to reheat cooling gas and eject gas (hot and cold)



Conclusion

- L-Galaxies reproduced most of the galactic properties, but failed at describing the ICM properties

- Implementation of 3 new features :

—> Baryon fraction fix with an excess reservoir : correct amount of baryons for any merger trees

—> X-ray predictions available : self-consistently calculated luminosities with new cooling model. But ICM fraction still too high

—> New AGN feedback mechanism to lower the ICM content : Good improvements on the gas removal, need more investigations

Thank you for your attention.

Don’t hesitate to come and see my poster (two floors downstairs).