Fluorescent Hα emission from dark haloes

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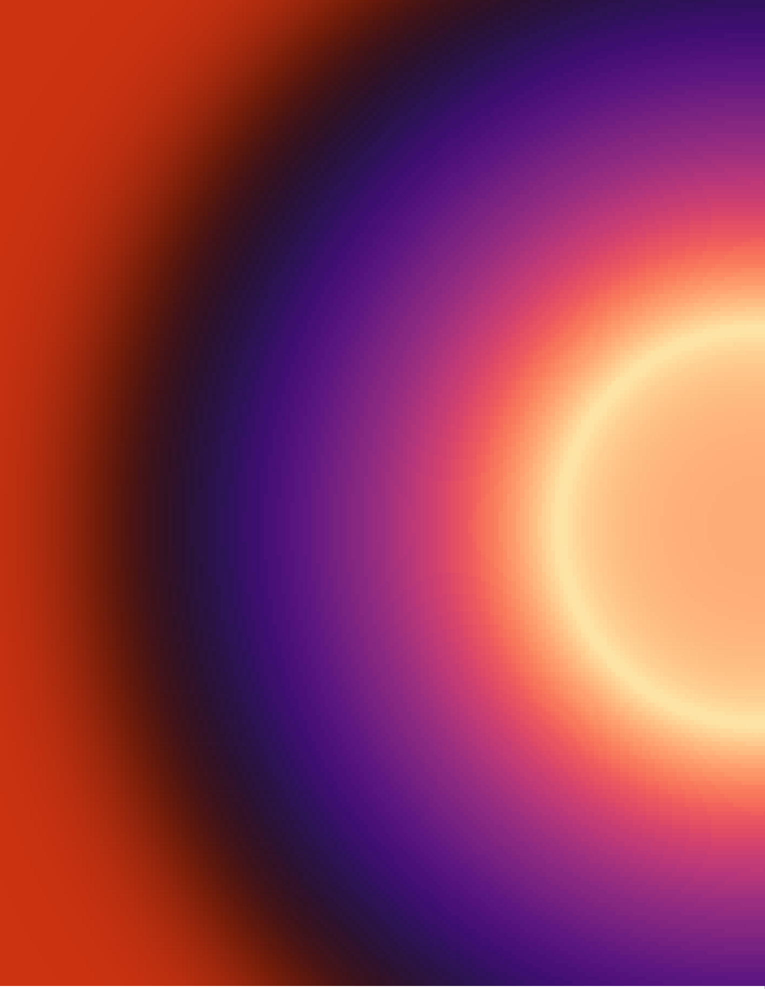
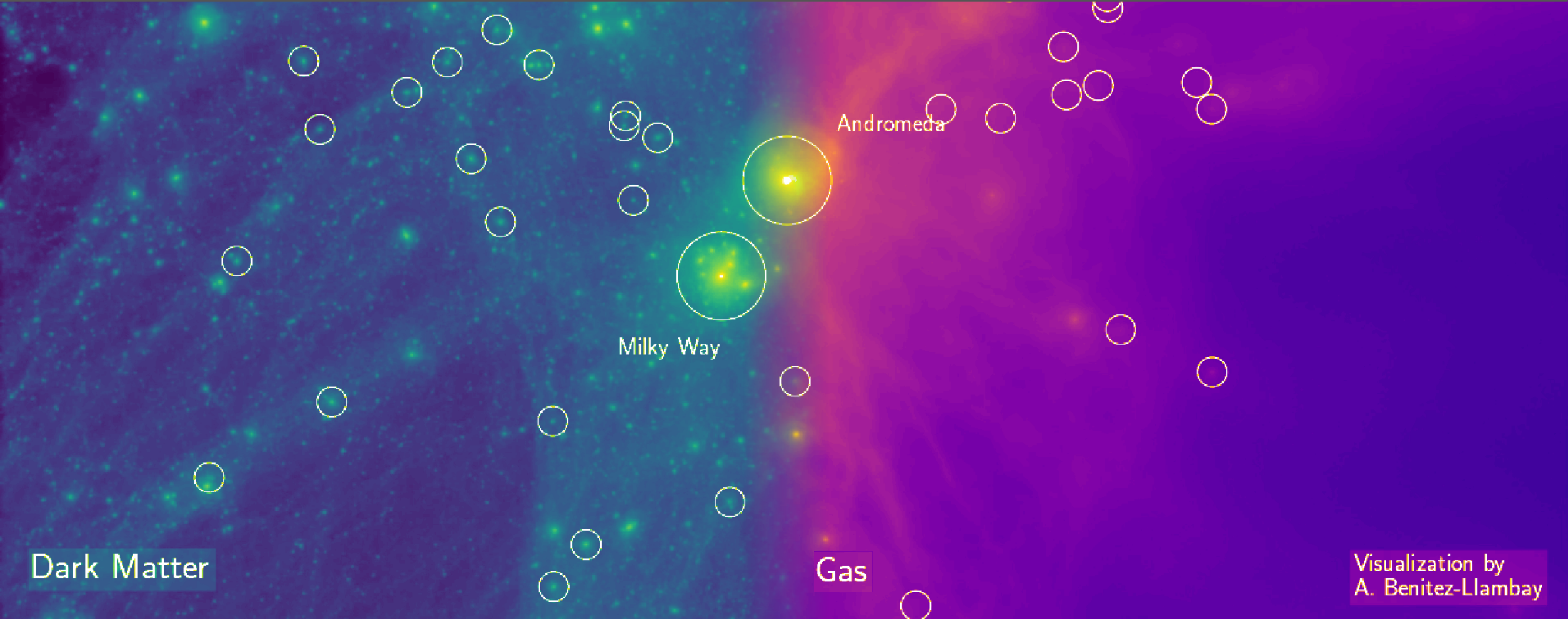
(with M. Fumagalli, R. Cooke, T. Theuns, A. Benítez-Llambay)



DEX XV, Edinburgh, January 2019

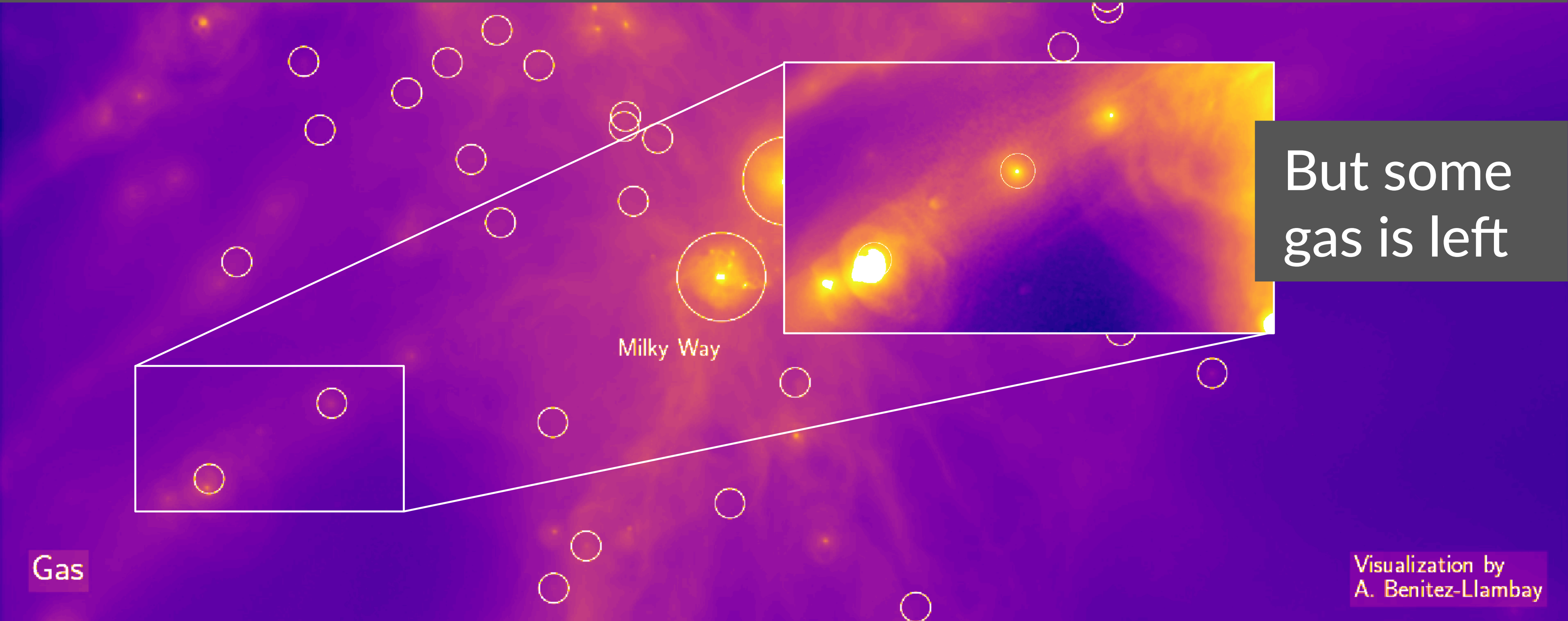
A central prediction of CDM

Many small DM haloes, in which SF is inhibited

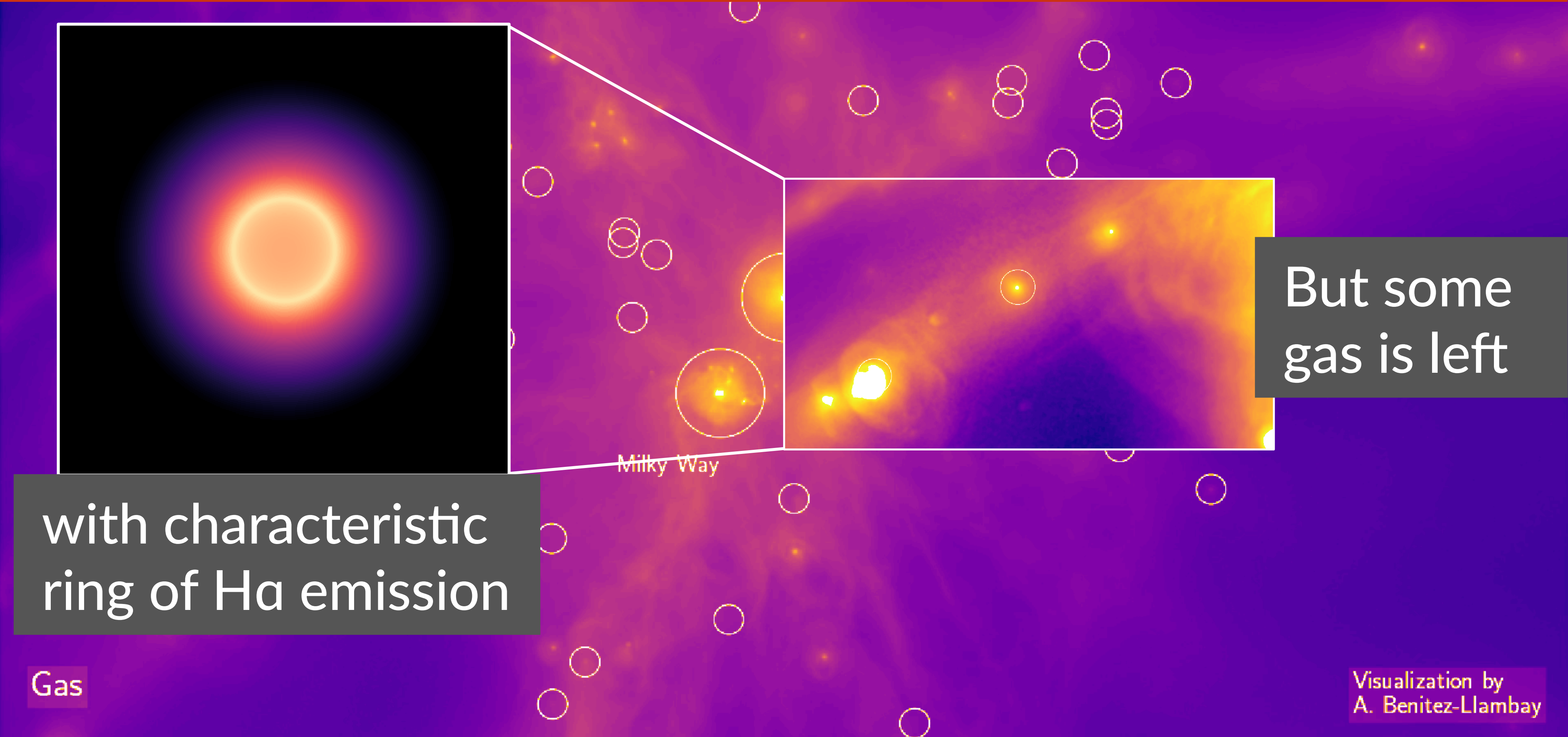


A way to verify the prediction?

Many small DM haloes, in which SF is inhibited



A way to verify the prediction?



But some gas is left

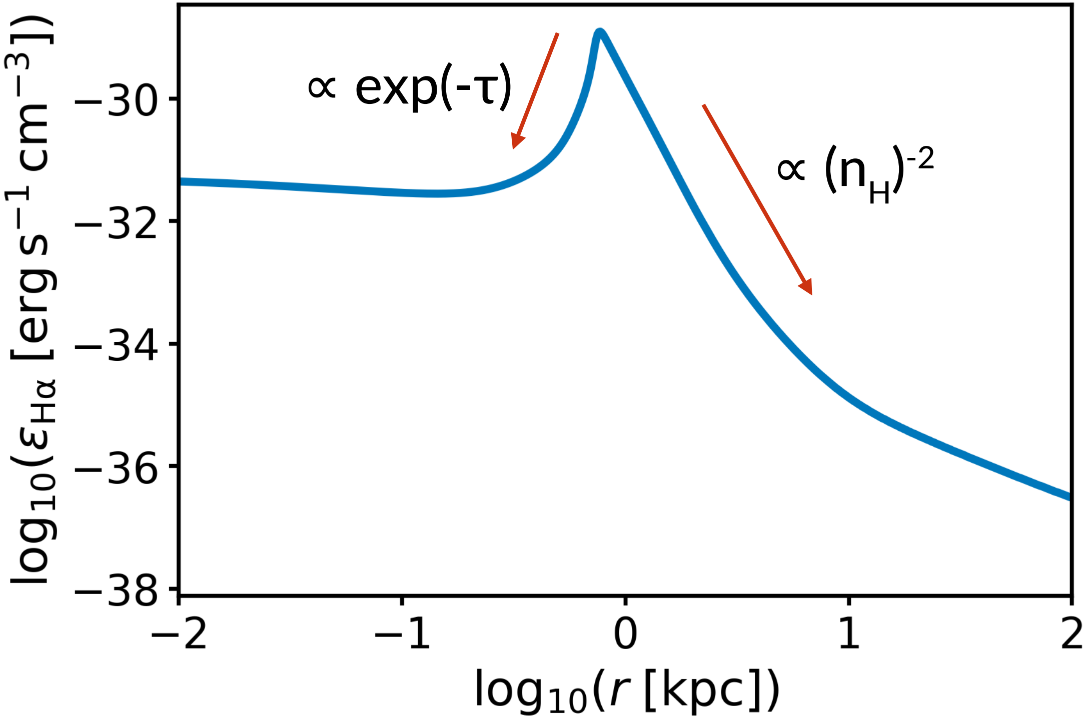
with characteristic ring of Hα emission

Predicting Hα emission

Used our own radiative transfer code, assuming:

- Hydrostatic equilibrium between gas and DM potential
- Thermal and ionisation equilibrium with the UVB

Emissivity peaks at ionisation front; project this to get surface brightness...



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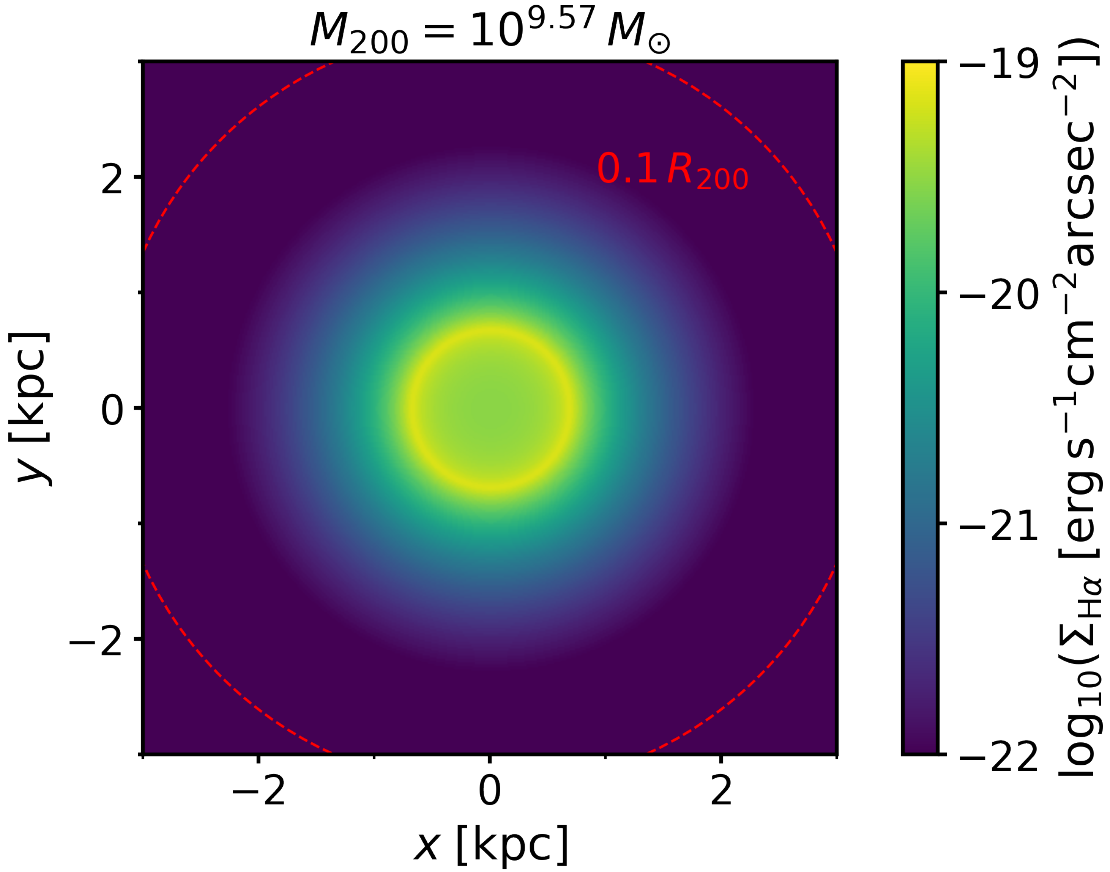
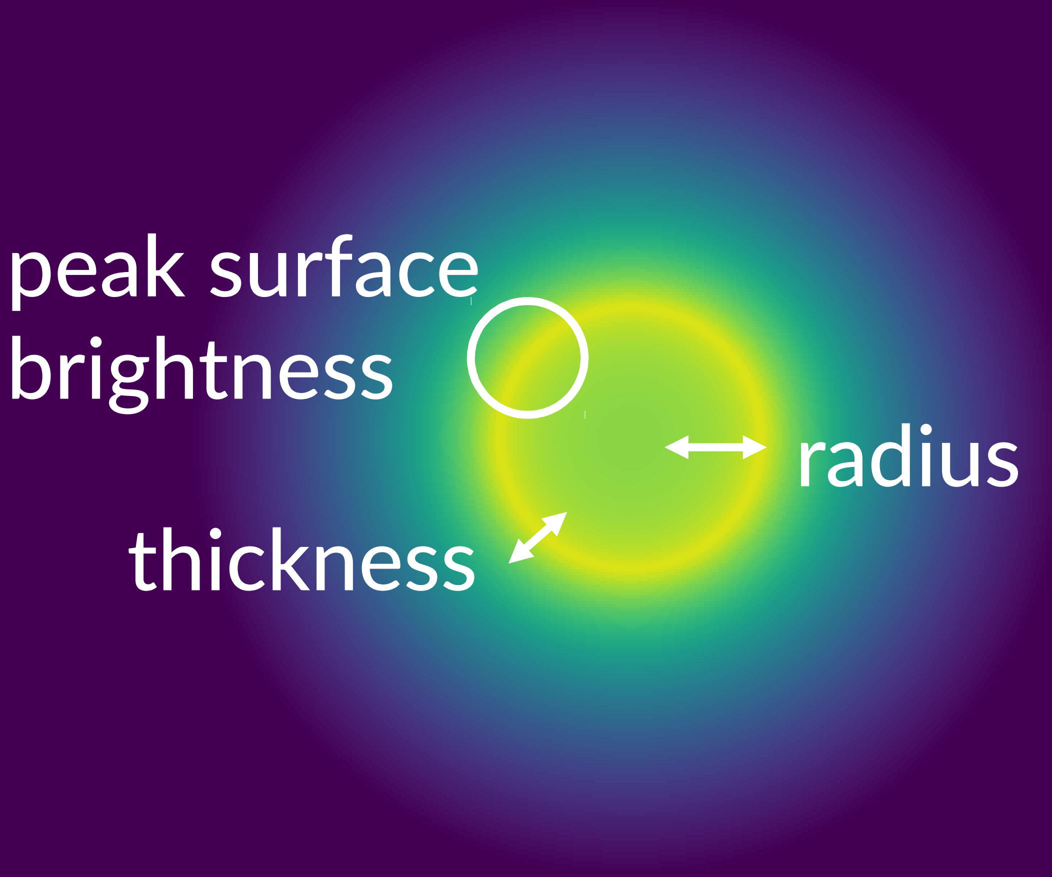
Rings

HI core surrounded by ionised gas

Limb brightening gives distinctive ring shape



What can we measure?



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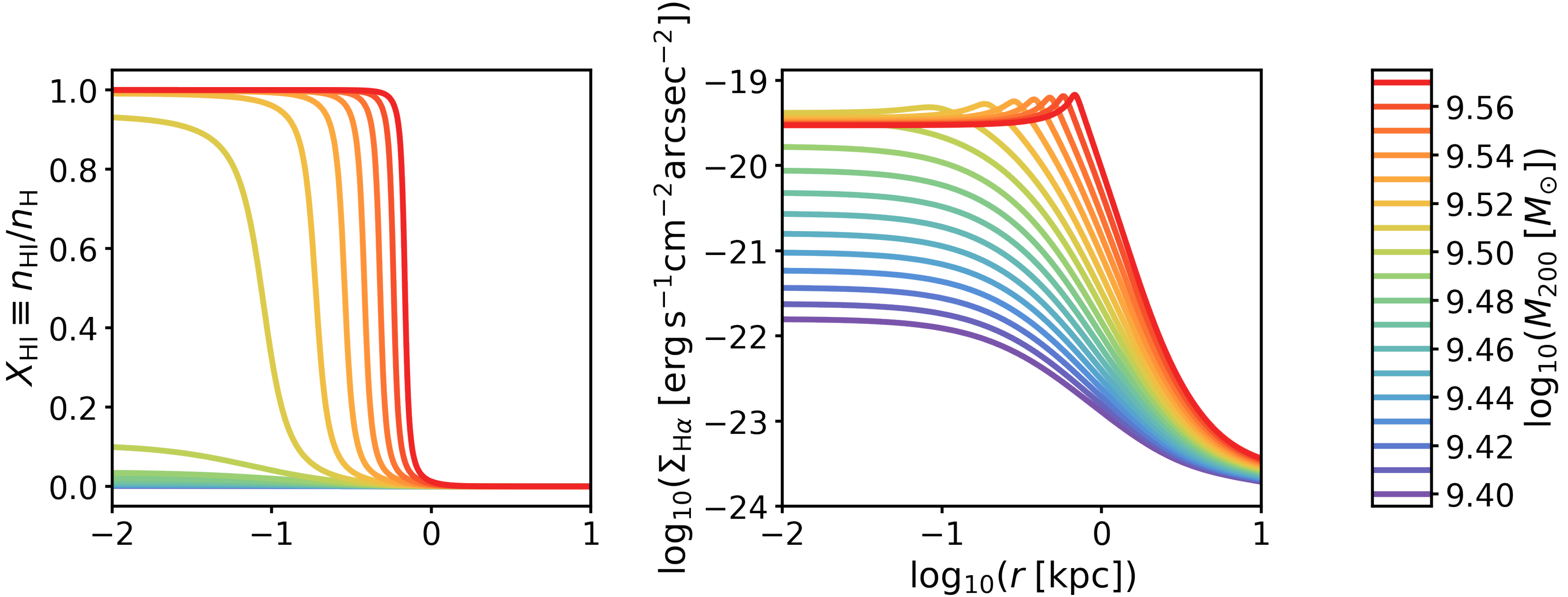
What can we learn from rings?

Existence of haloes in specific mass range



Rings only predicted for narrow halo mass range: need core of neutral but not star-forming gas

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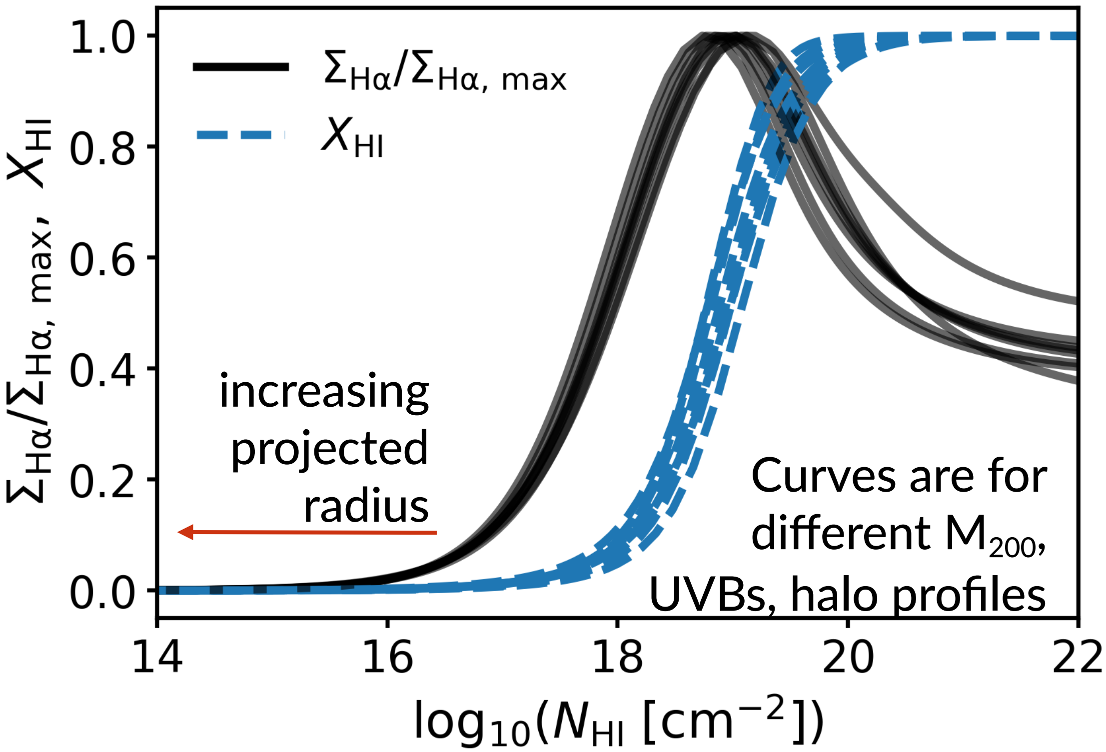
Density profile from size of ring

Surface brightness always maximal at $N_{HI} \sim 10^{18} cm^2$

Relation between N_{HI} and radius depends on ρ(r)



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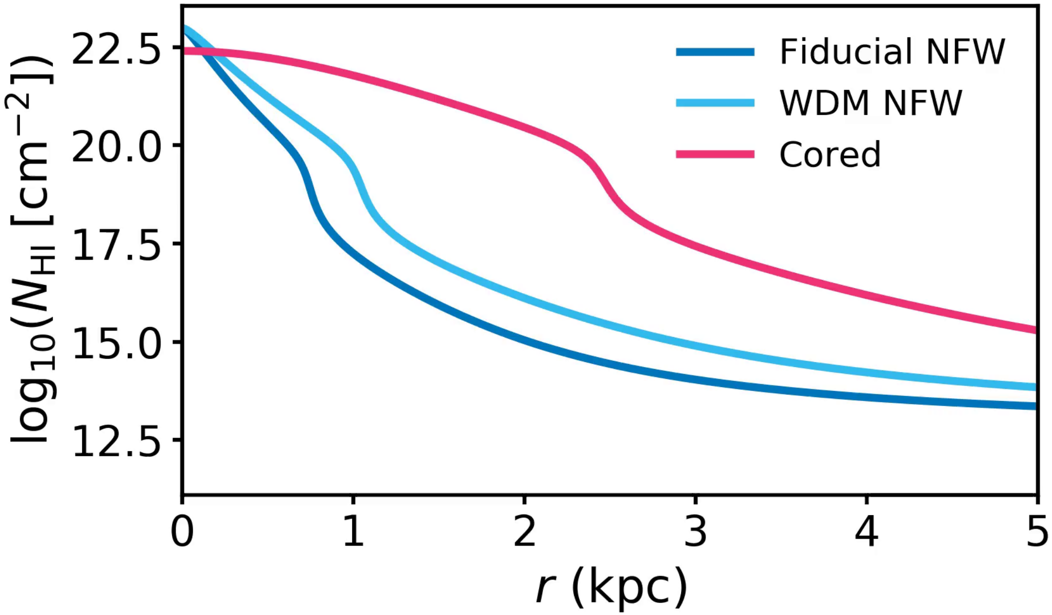
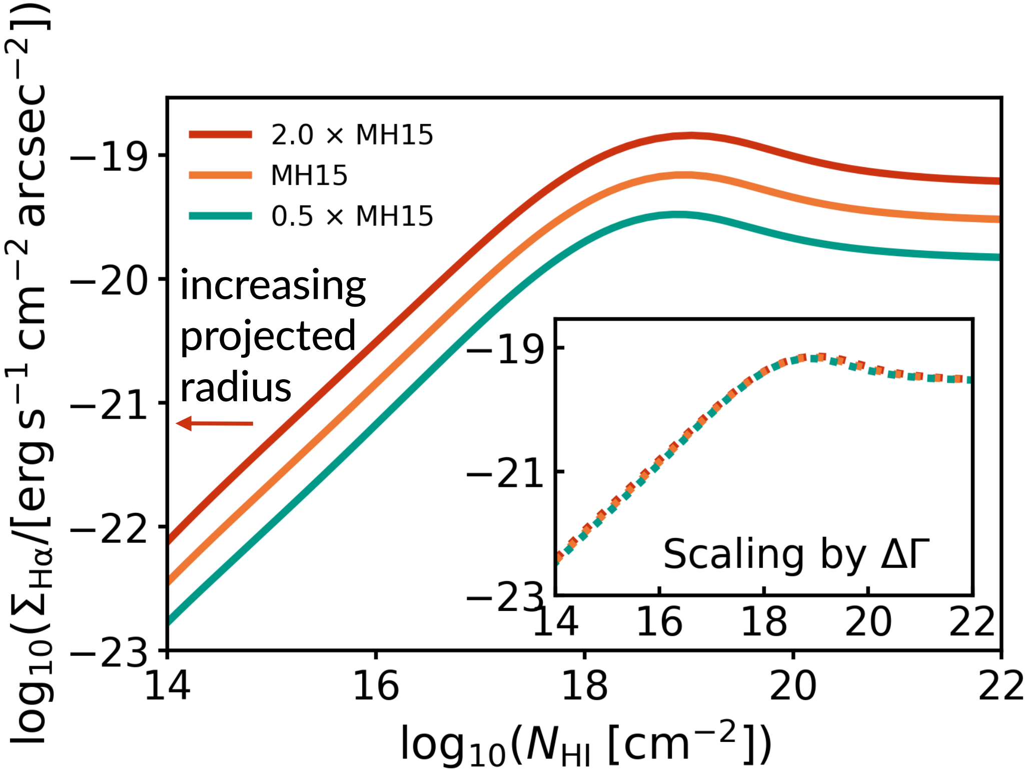
Density profile from size of ring

So ring radius is sensitive to c_{200}, cuspyness



UVB intensity from brightness of ring

Ring brightness is linear function of UVB photoionisation rate



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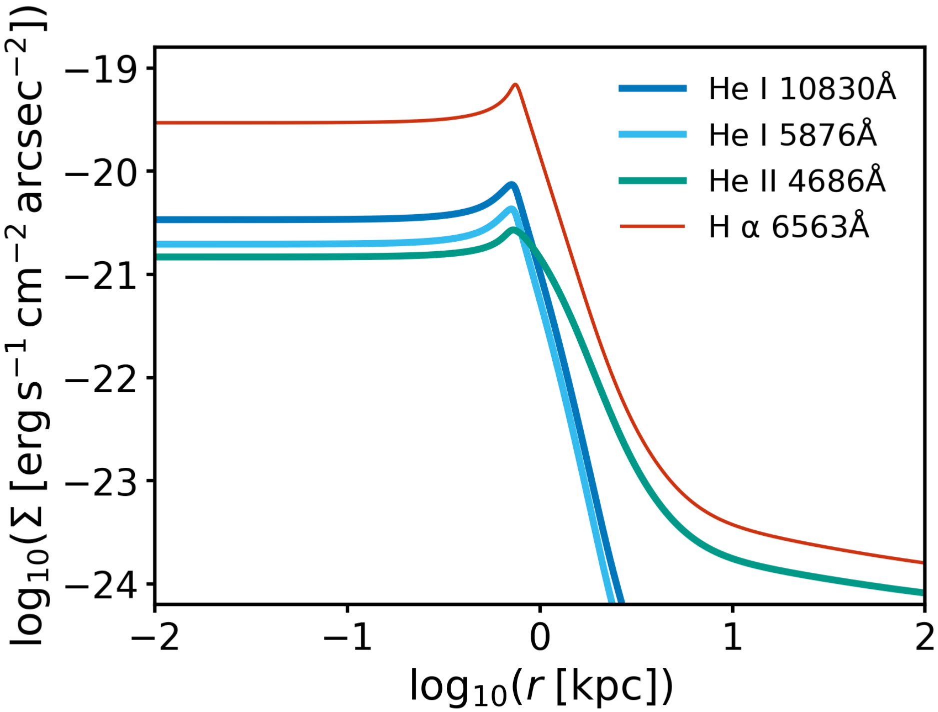
What else?

Get (faint) He rings for free

Surface brightness ratios depend on Y_p

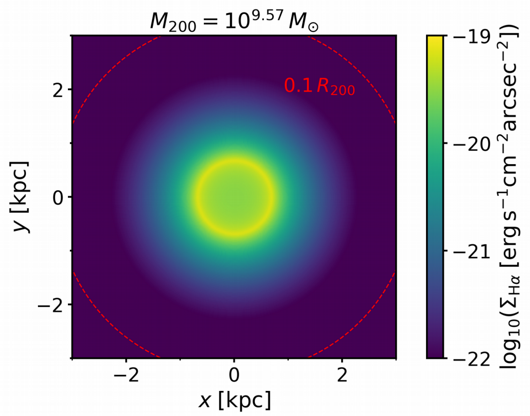


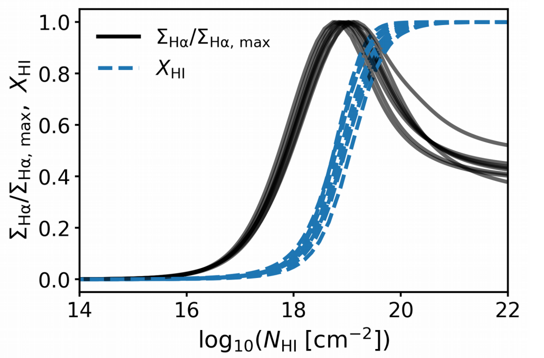
Summary

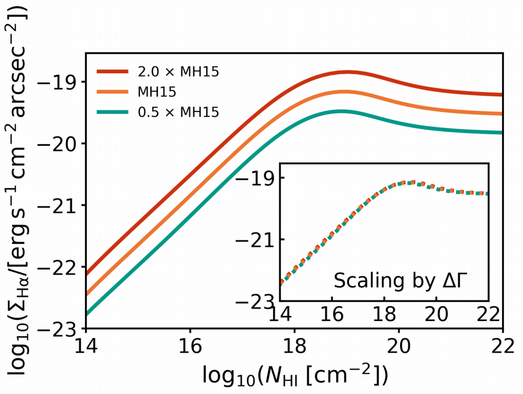
Hα emission from dark haloes looks like rings in projection

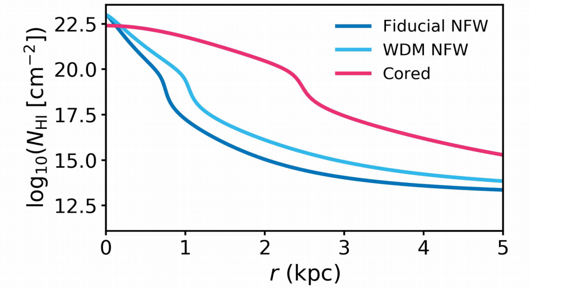
Properties of rings are sensitive to UVB, halo mass and density profile

Observing a ring would allow these to be constrained









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