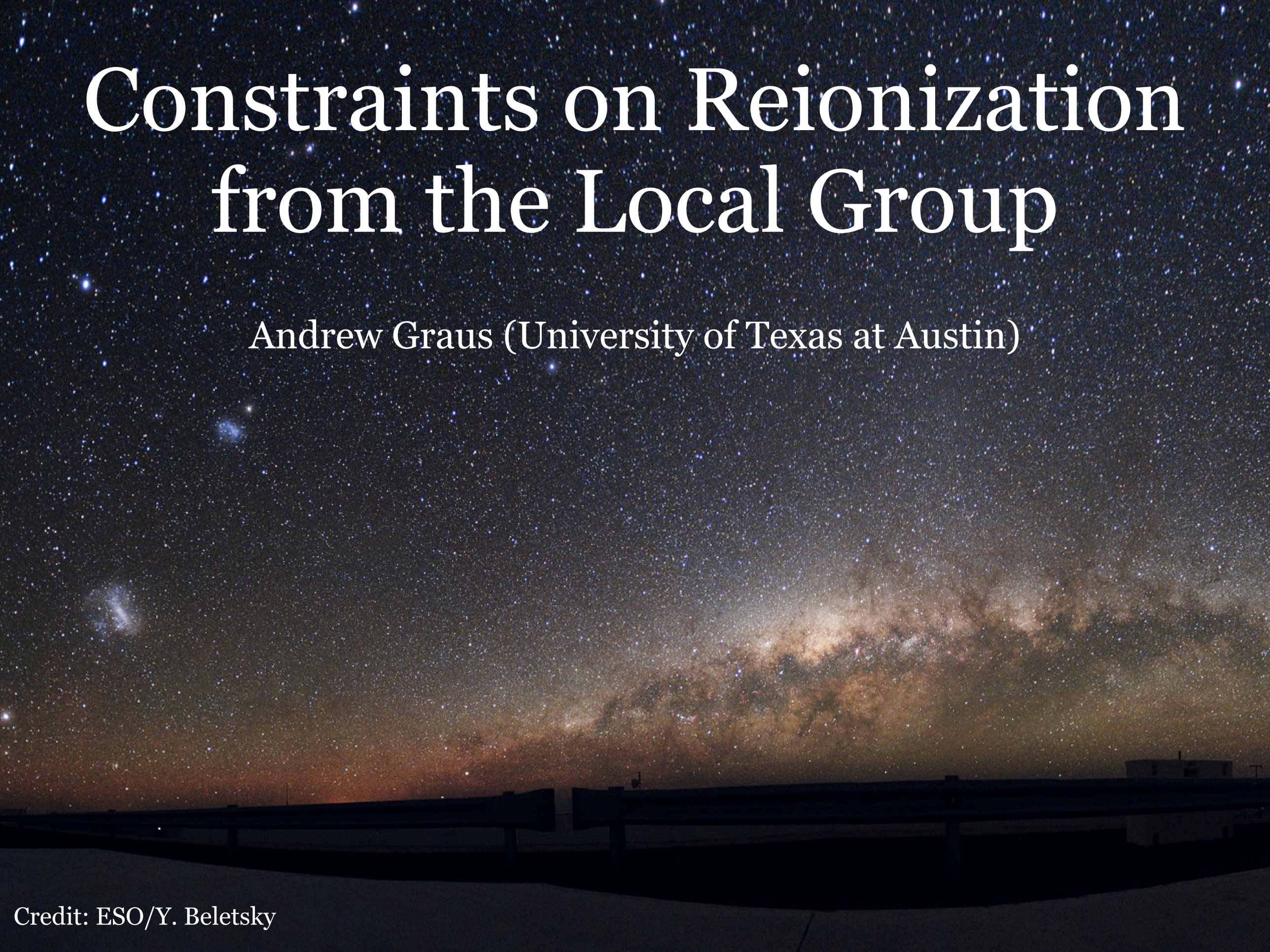
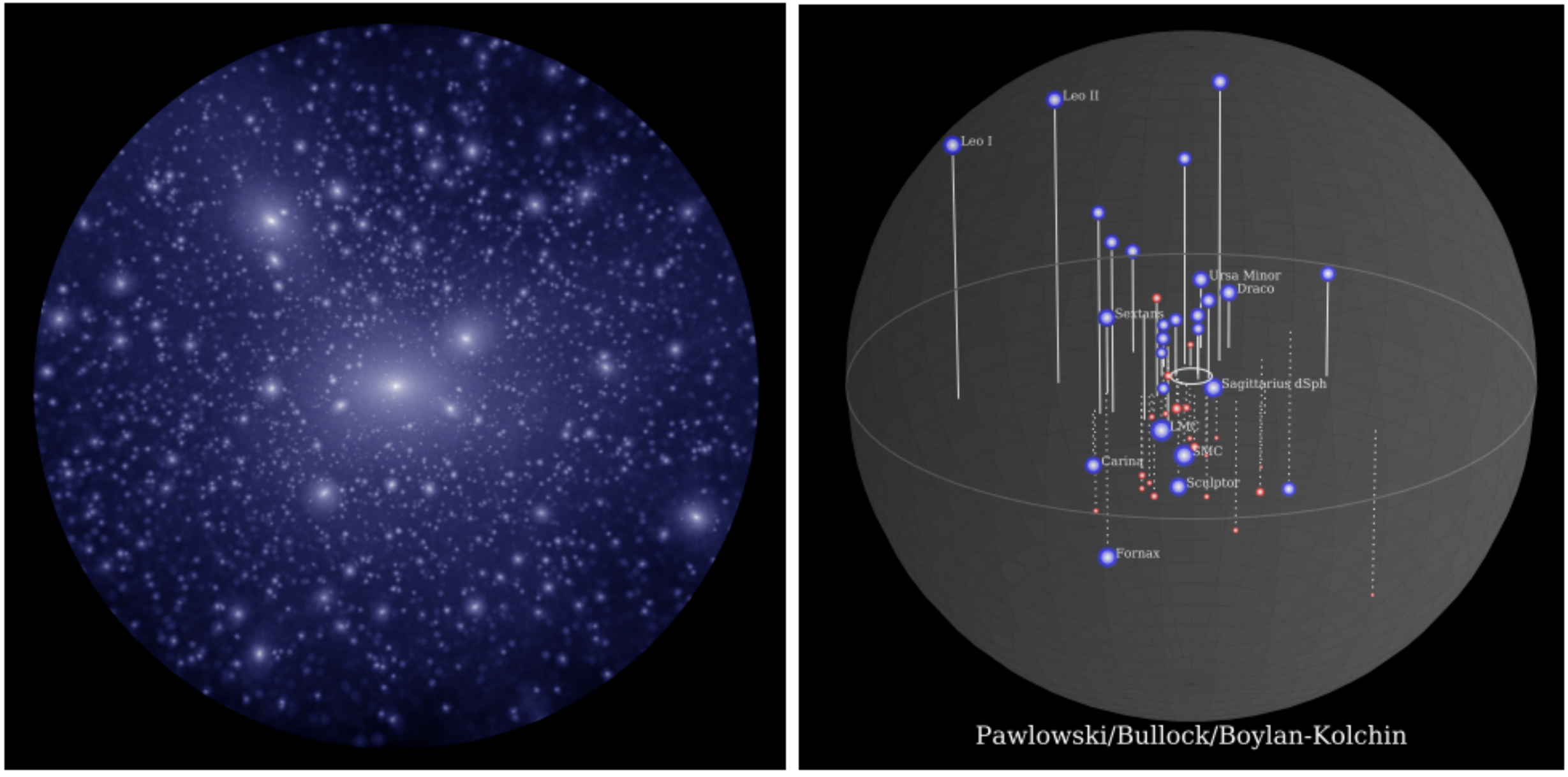
Constraints on Reionization from the Local Group

Andrew Graus (University of Texas at Austin)



Credit: ESO/Y. Beletsky

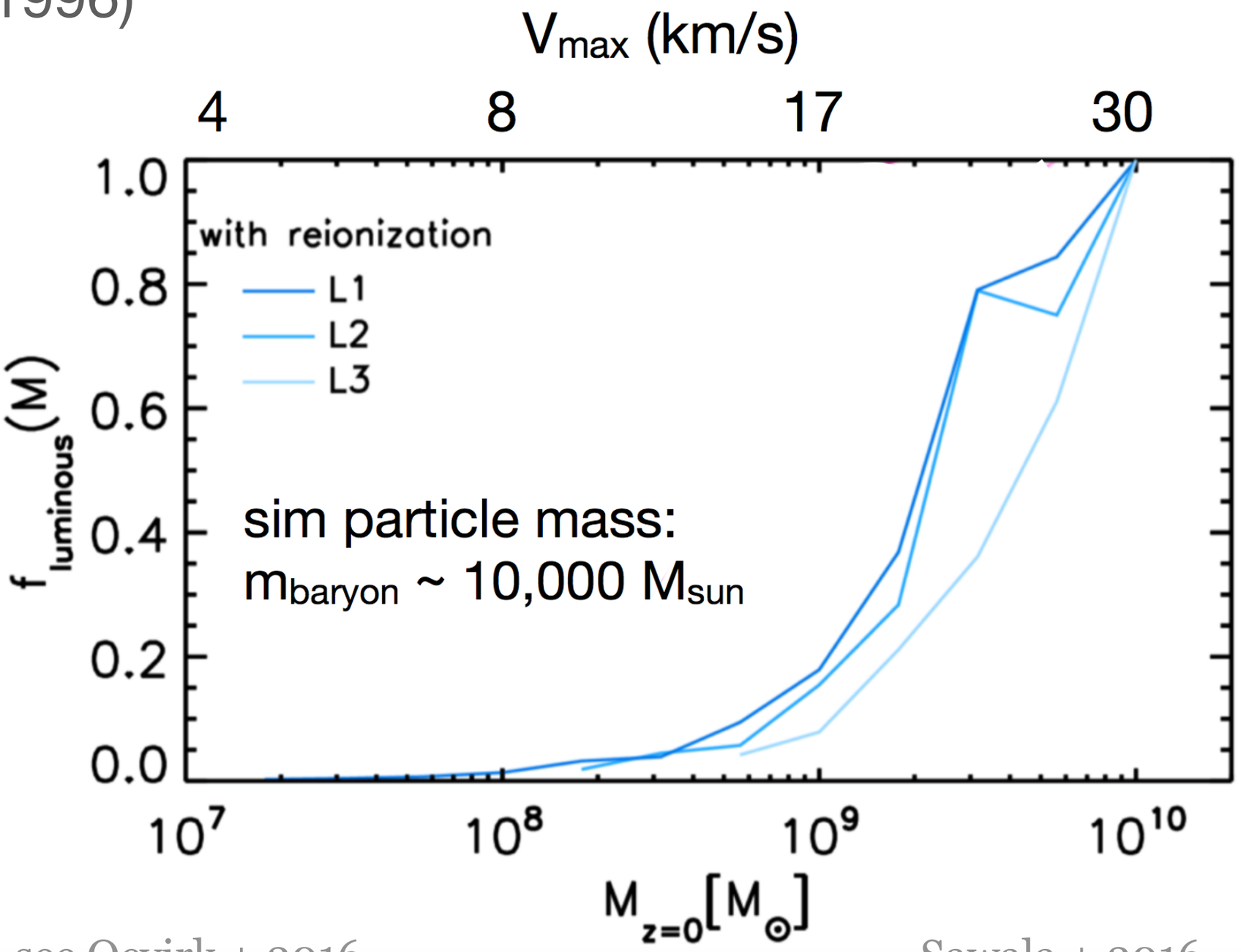
The missing satellites



Klypin + 1999

The missing satellites

- Theory suggests that reionization impacts galaxies that form in halos around Vmax ~ 30 km/s (Efstathiou 1992, Thoul & Weinberg 1996)



Also see Ocvirk + 2016 Sawala + 2016

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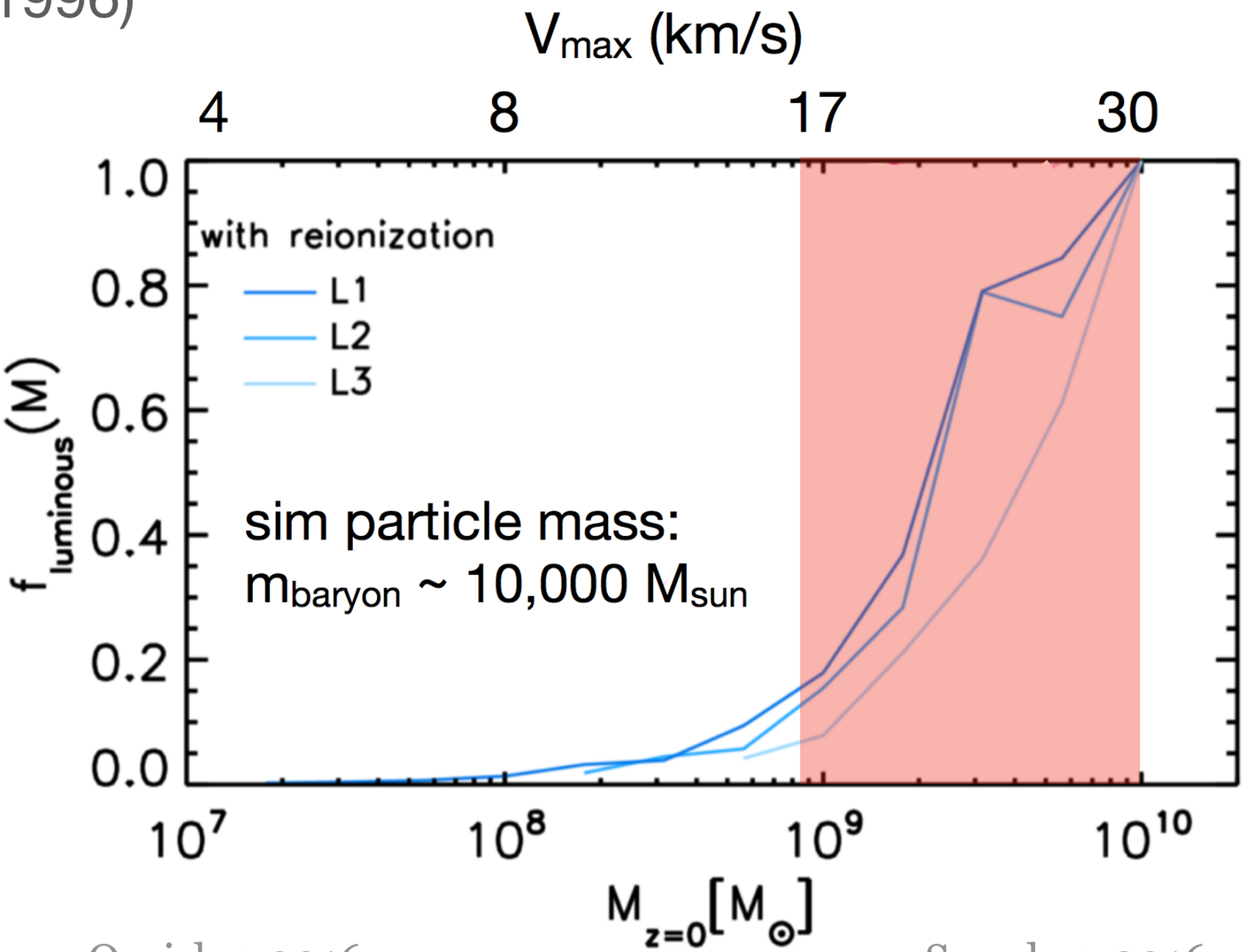

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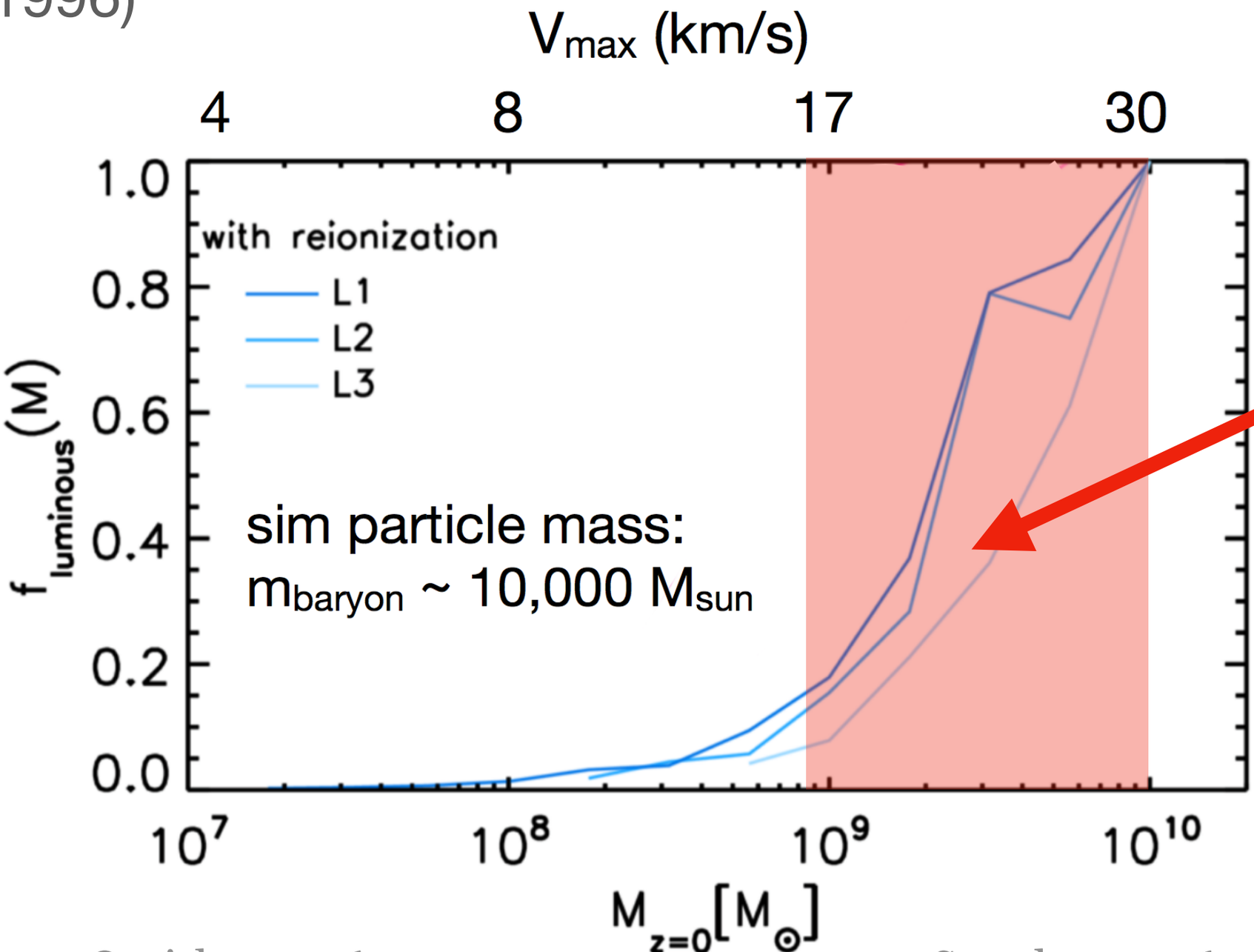

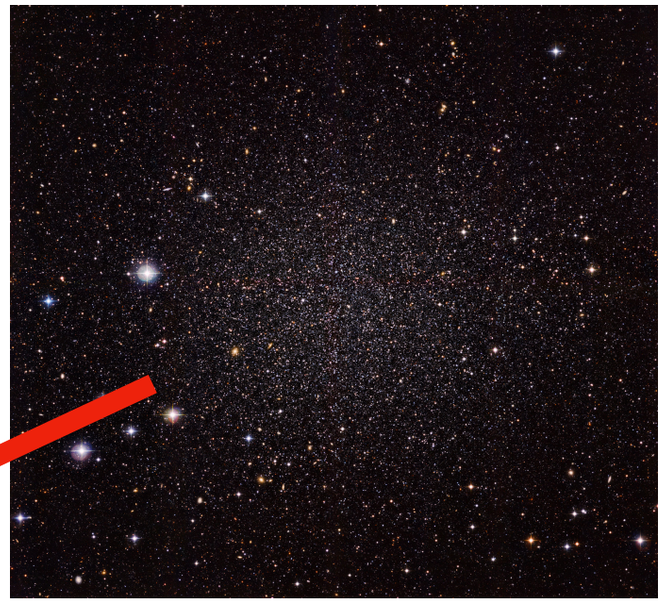

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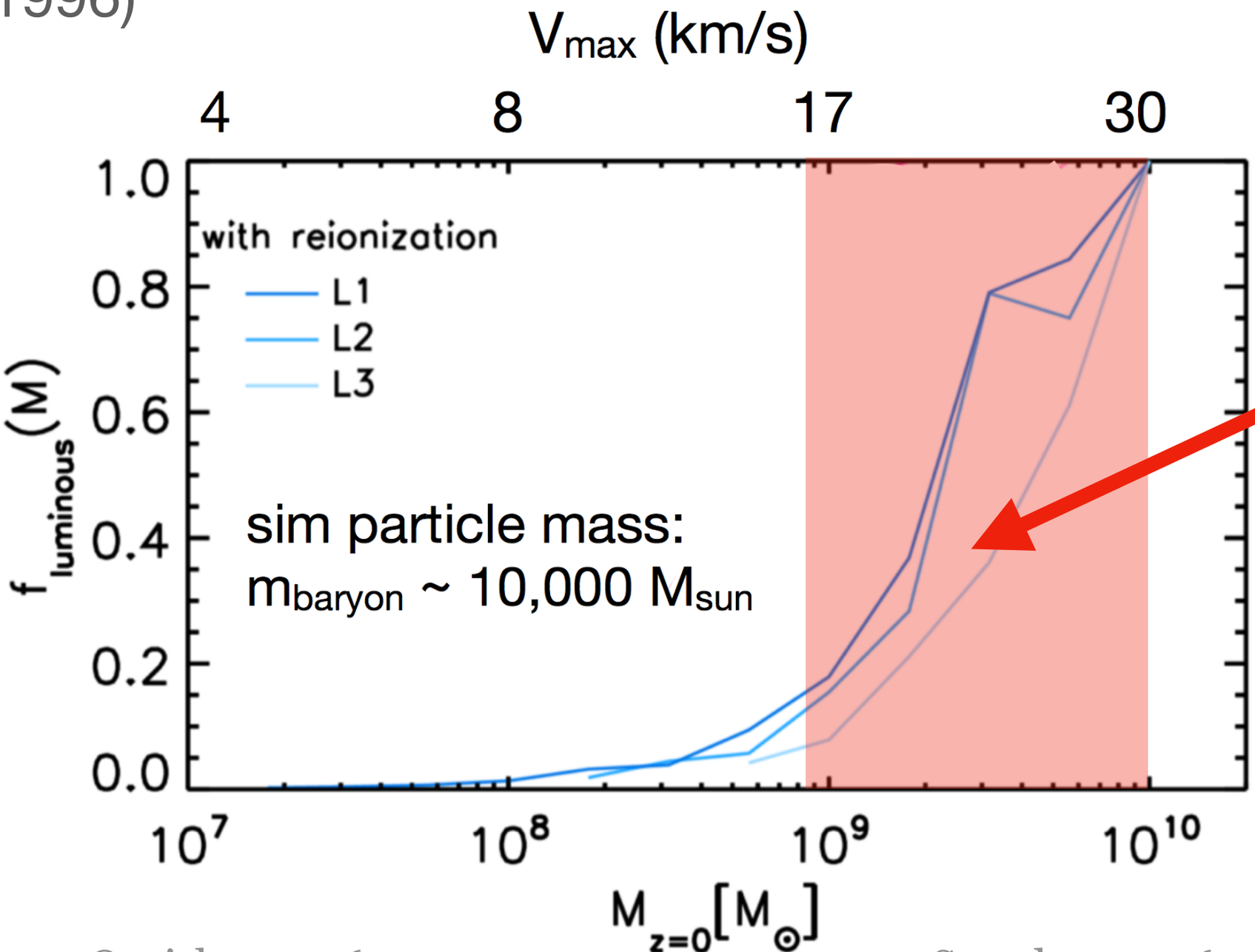
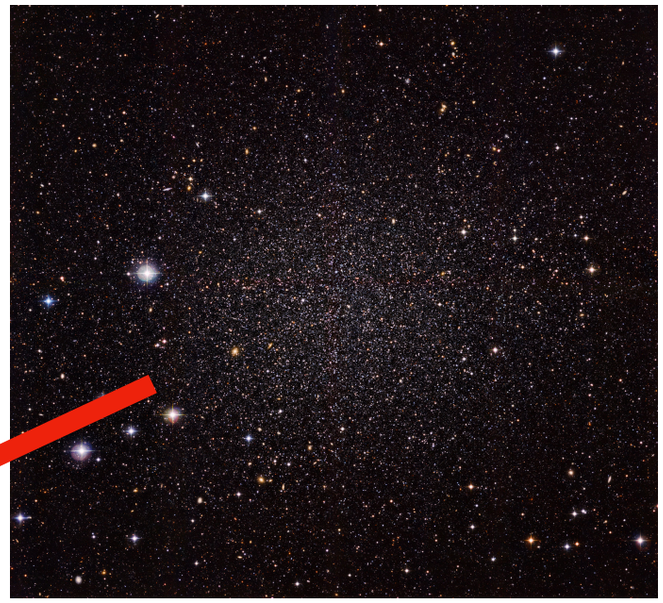
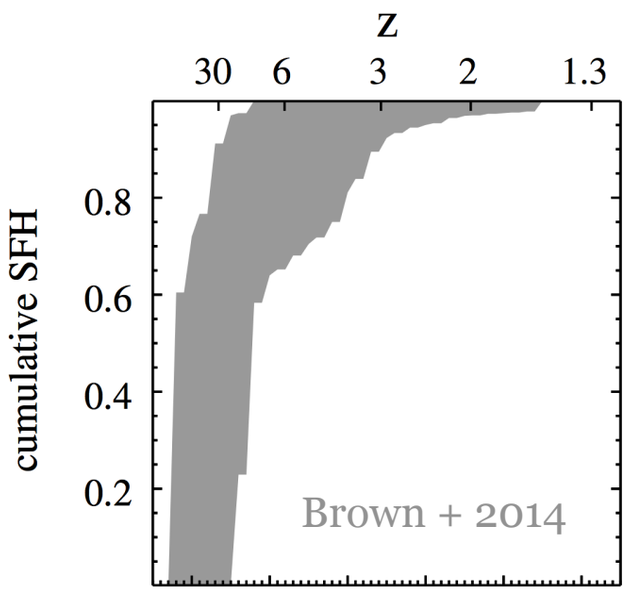
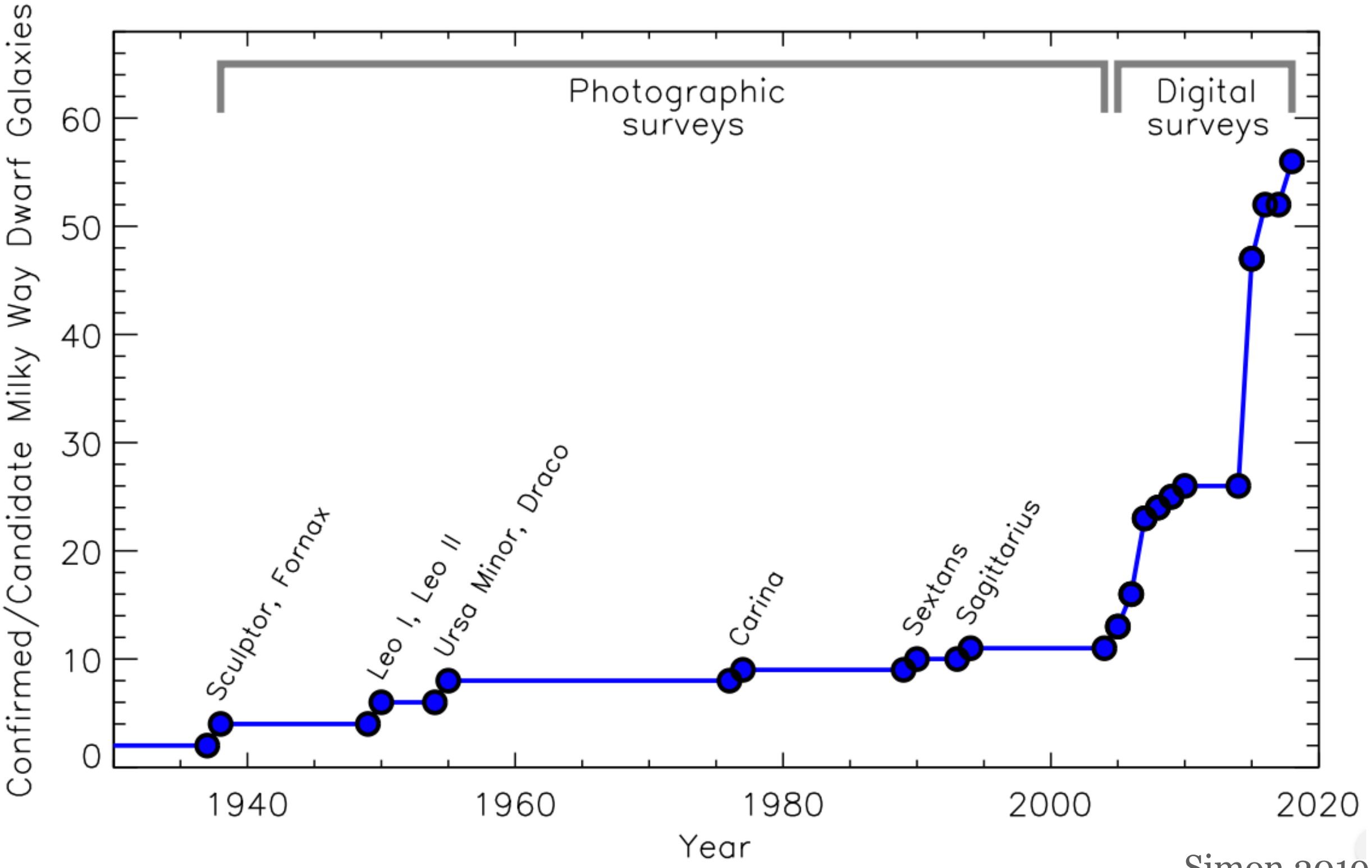






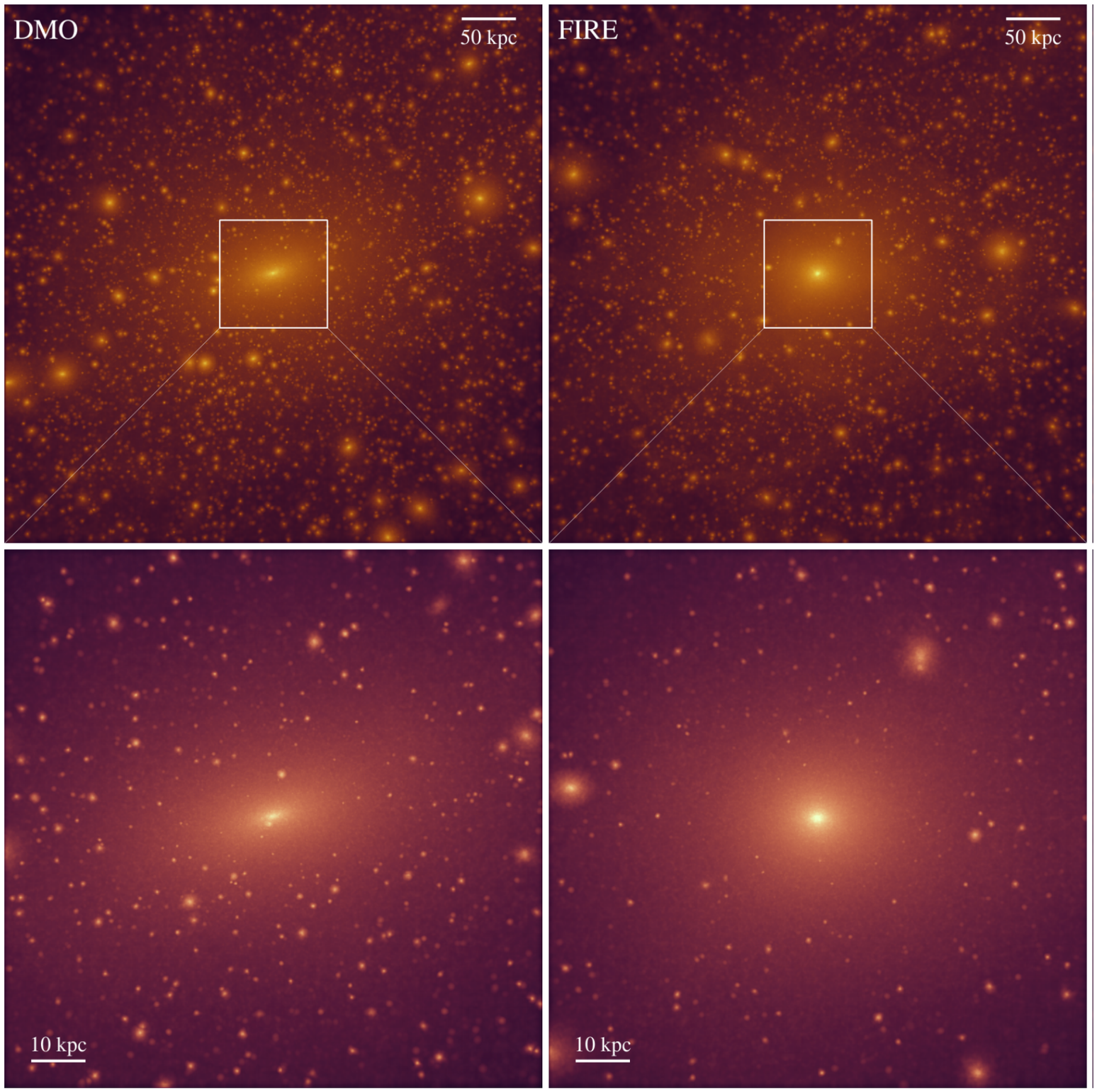
Also see Ocvirk + 2016 Sawala + 2016

The found satellites



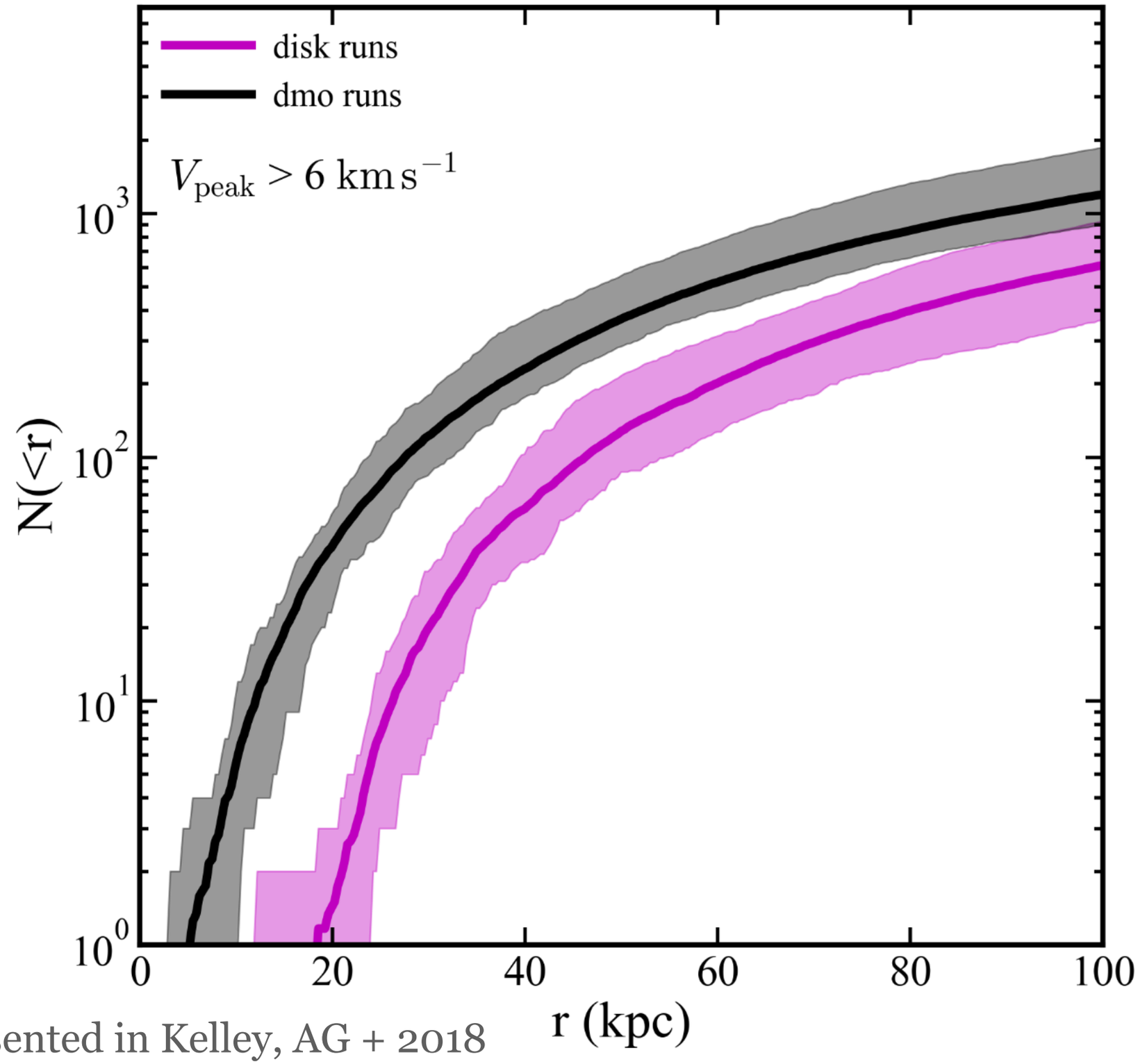
Simon 2019

Subhalo disruption



Garrison-Kimmel, AG + 2018

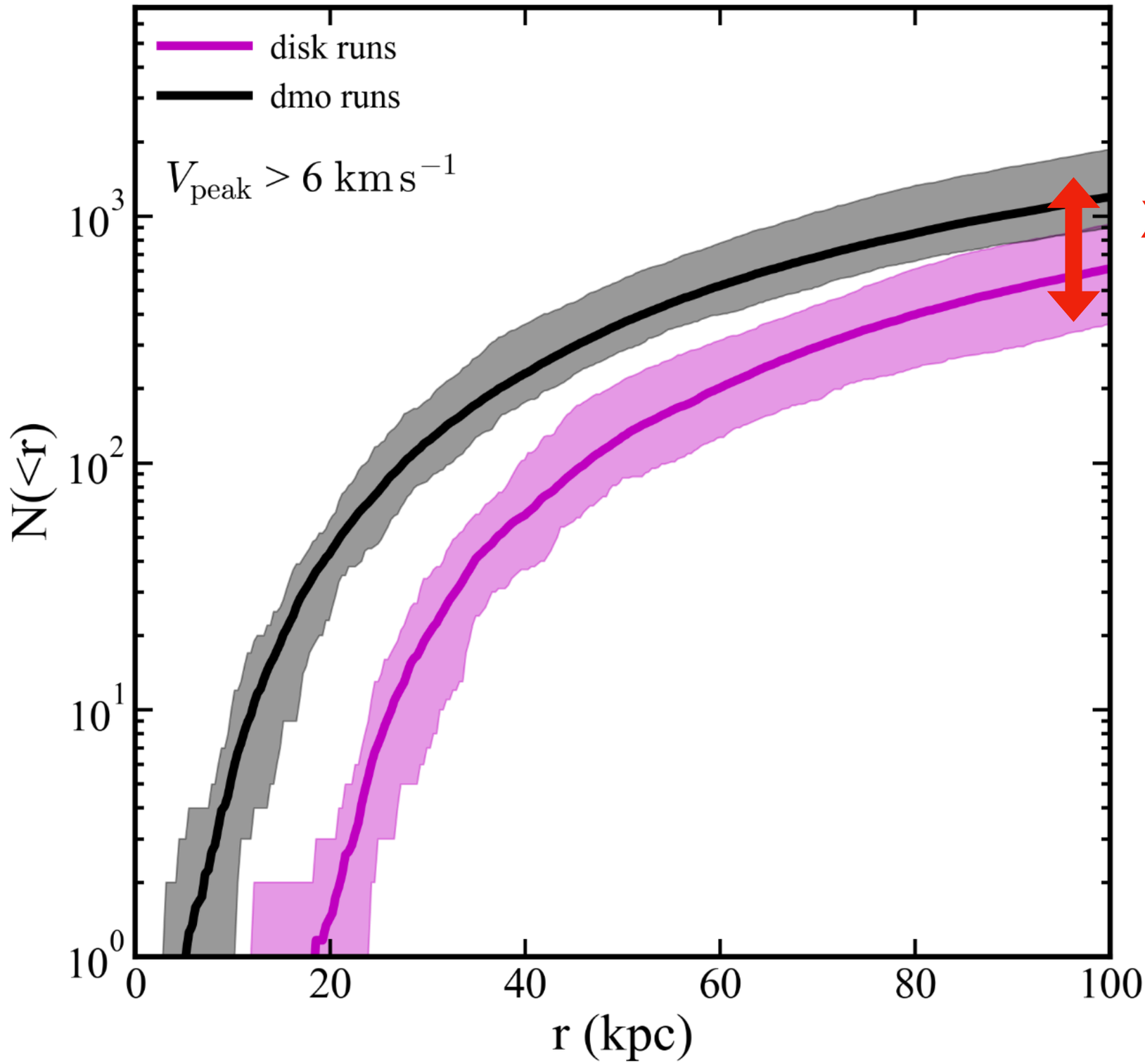
Subhalo disruption



Graus+ 2018

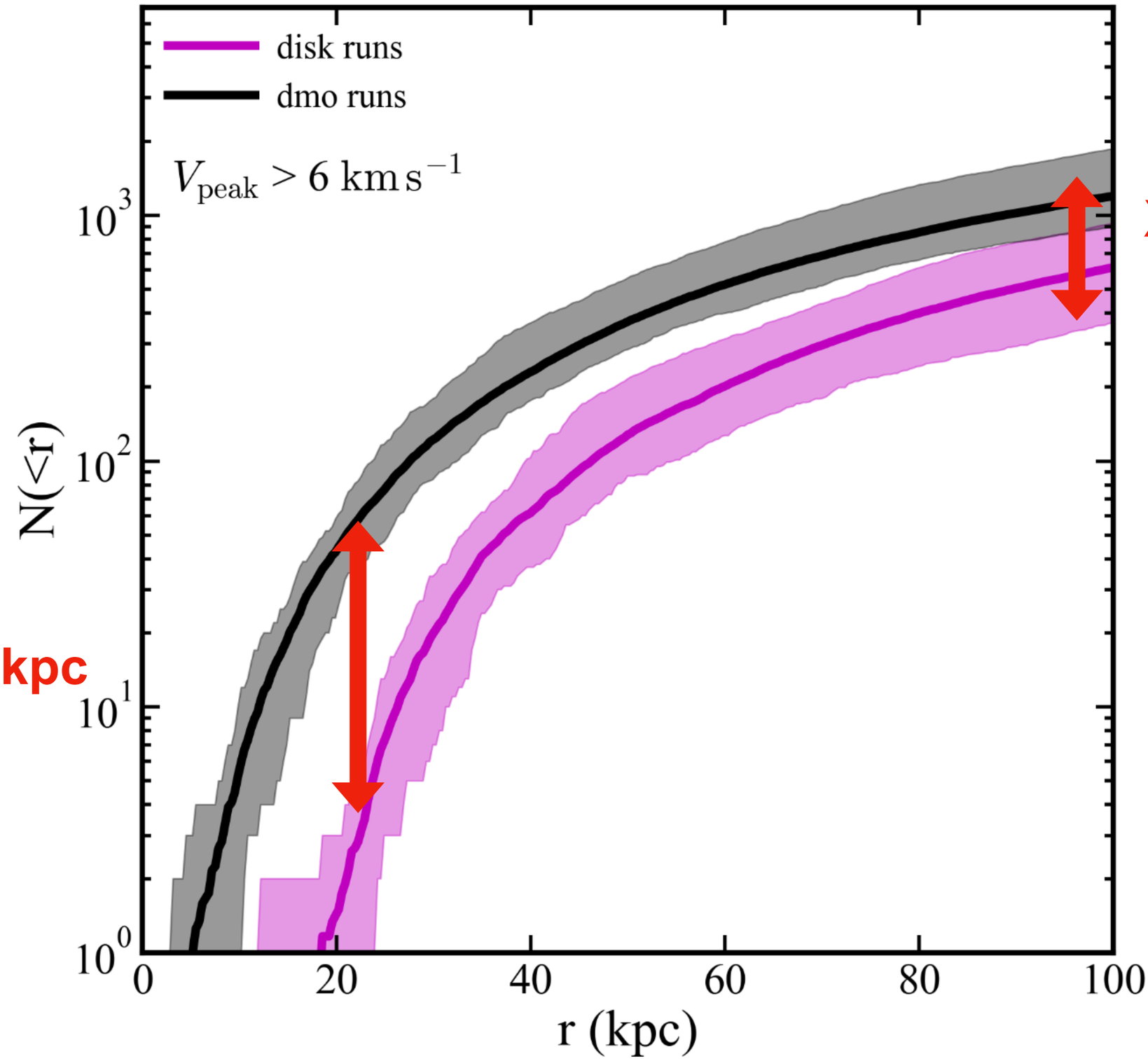
Simulations presented in Kelley, AG + 2018

Subhalo disruption



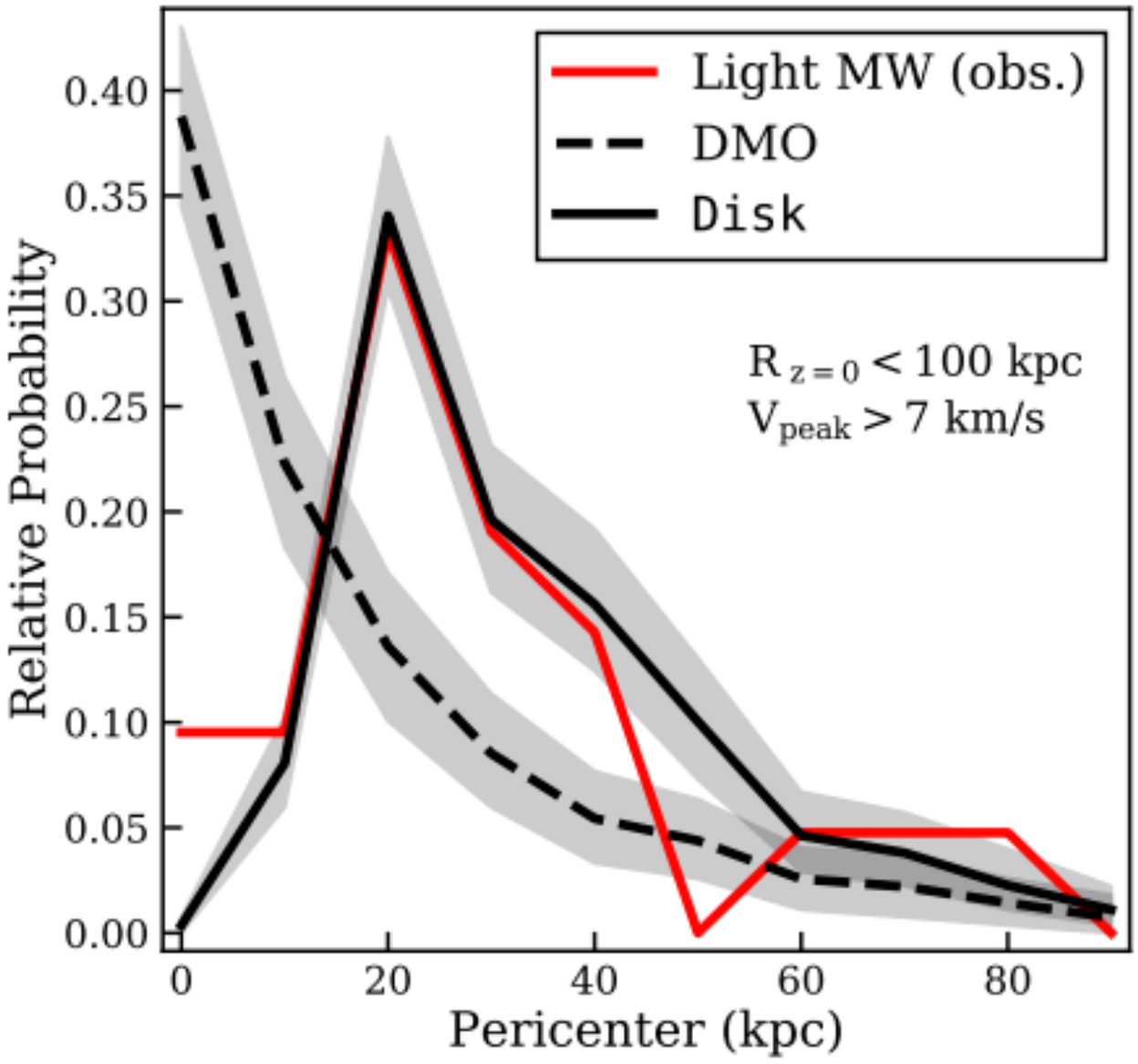
Graus+ 2018

Subhalo disruption



Graus+ 2018

Subhalo destruction

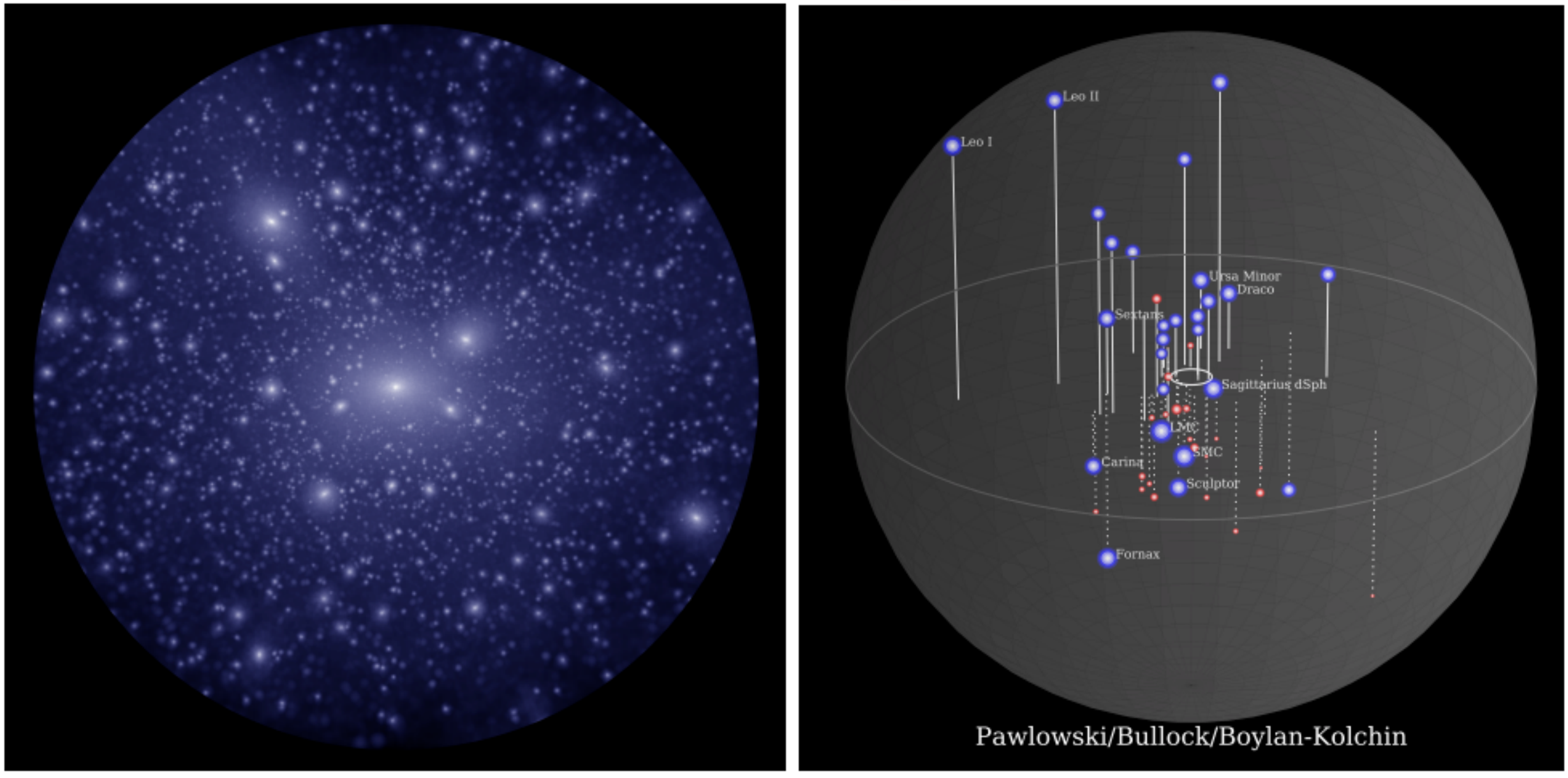


Disk disruption is necessary to explain the pericenter distribution of dwarfs seen in Gaia

Kelley, AG + 2018

Missing satellites revisited

More Galaxies



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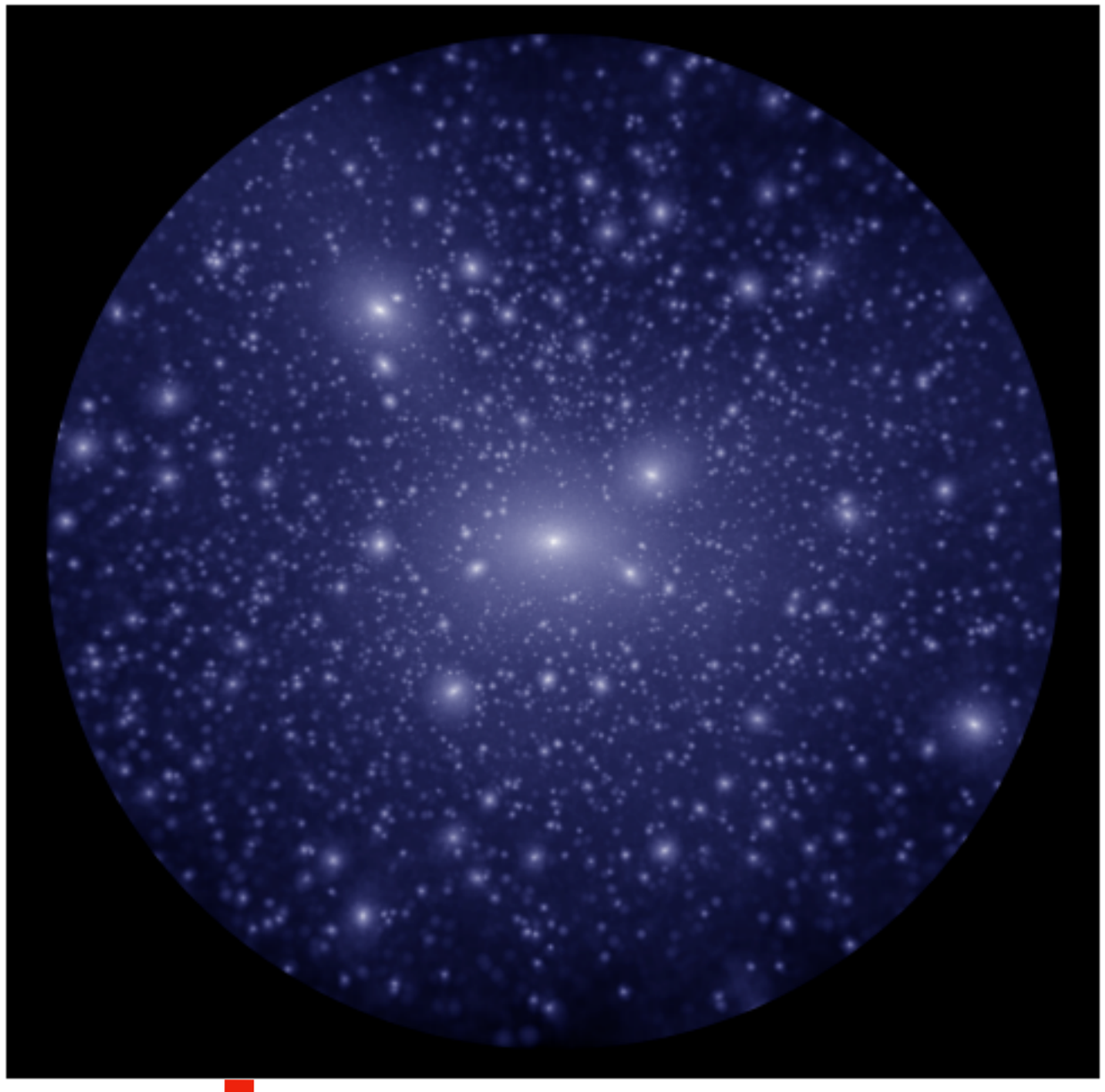
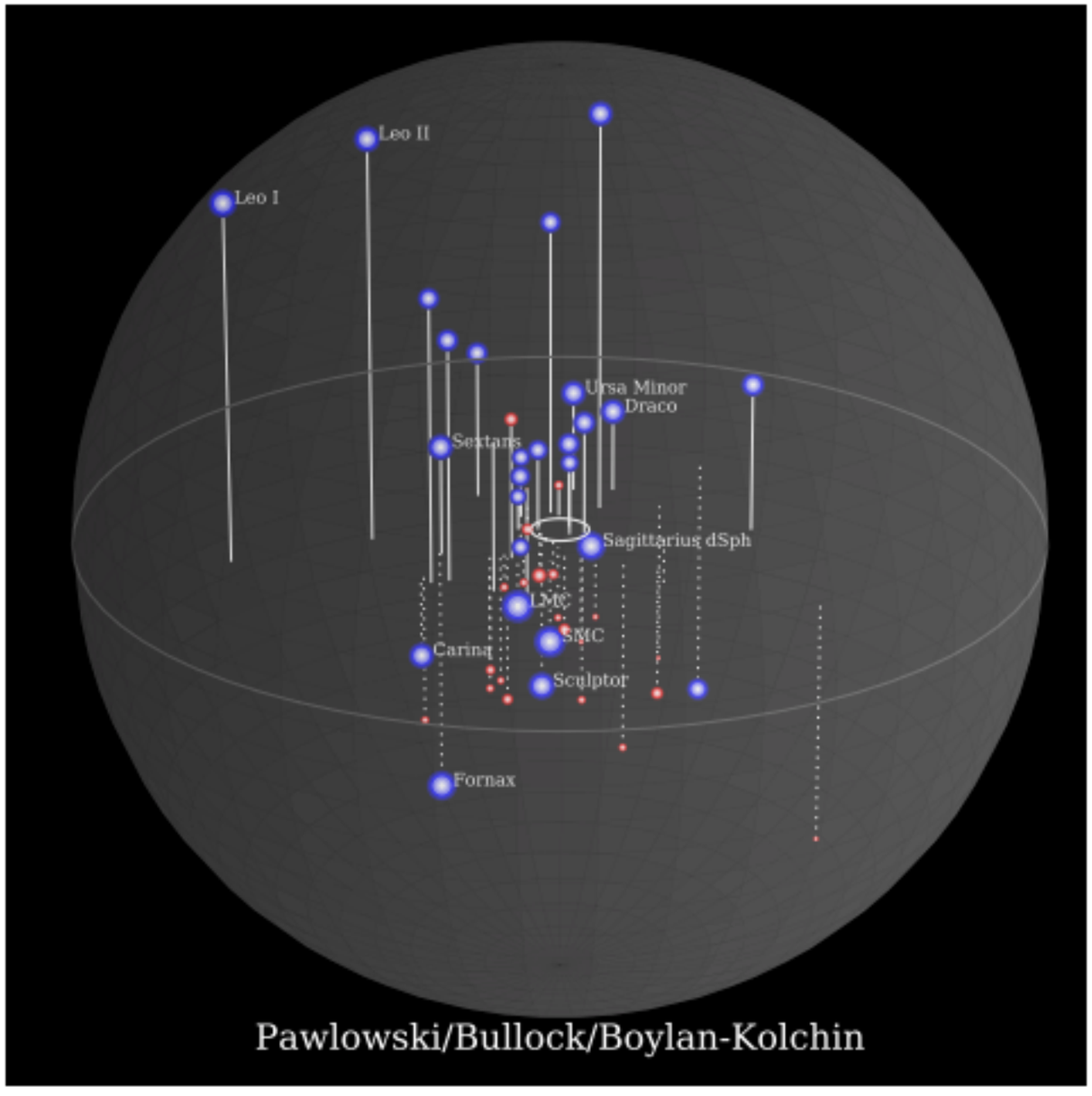
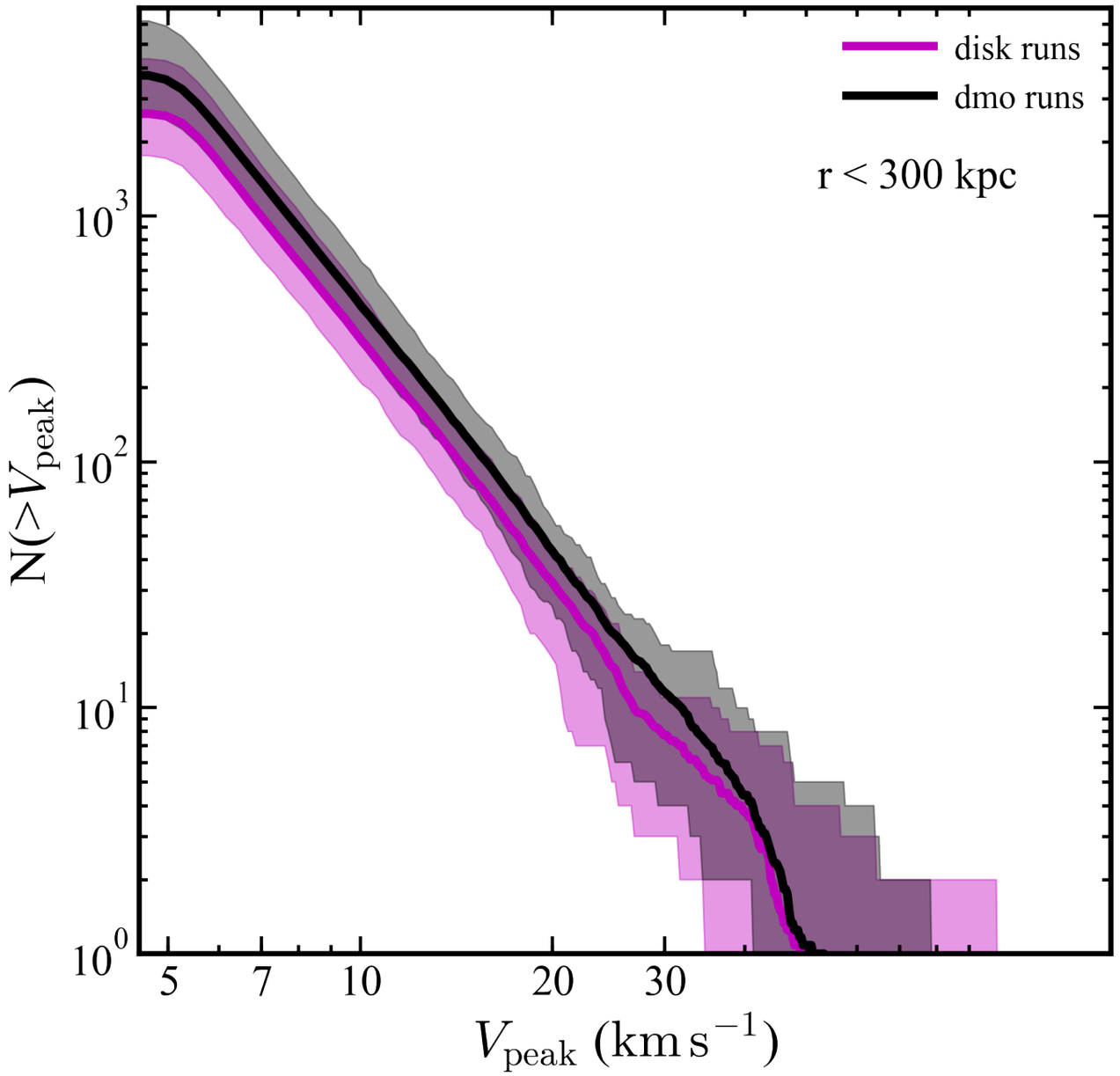
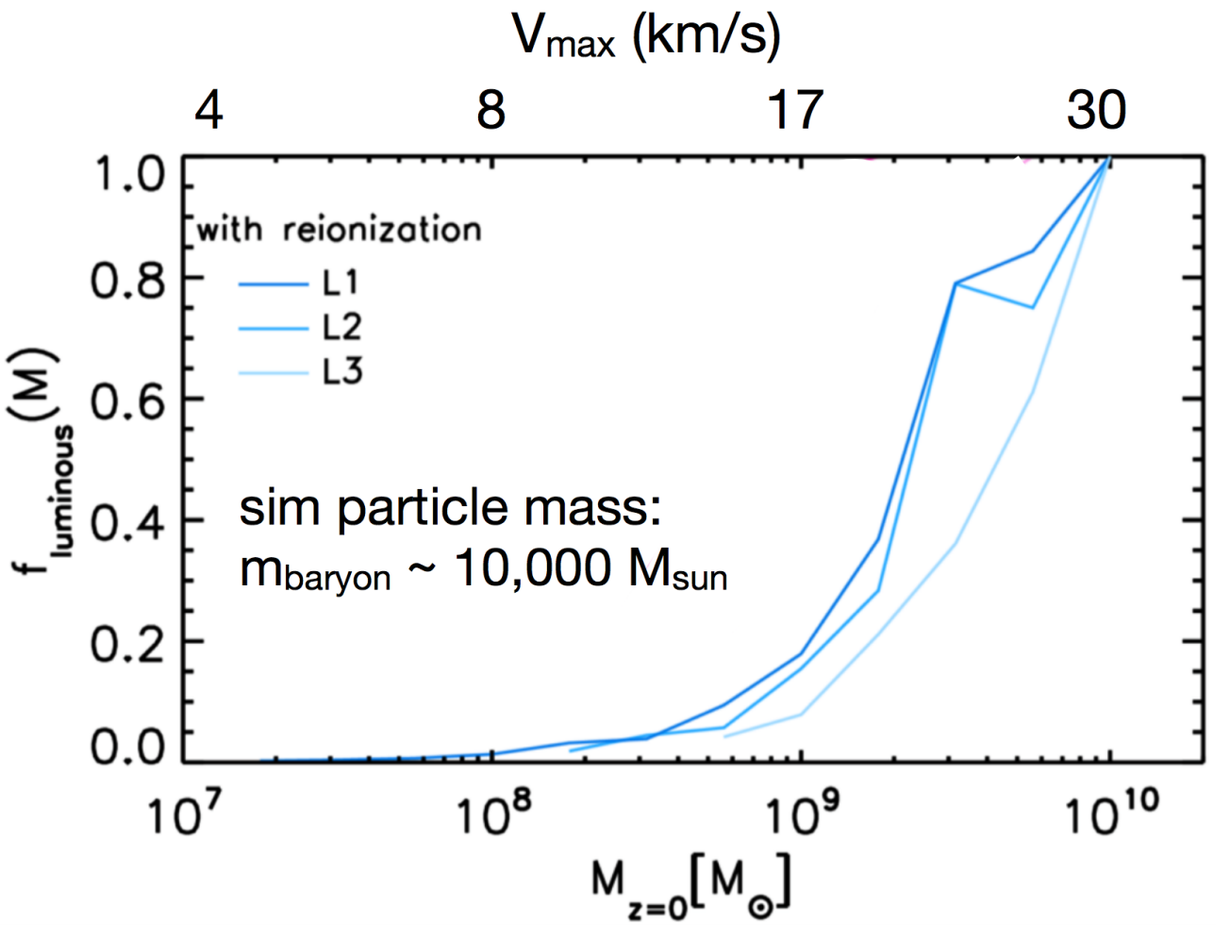


Less Halos



Missing satellites revisited





Graus+ 2018

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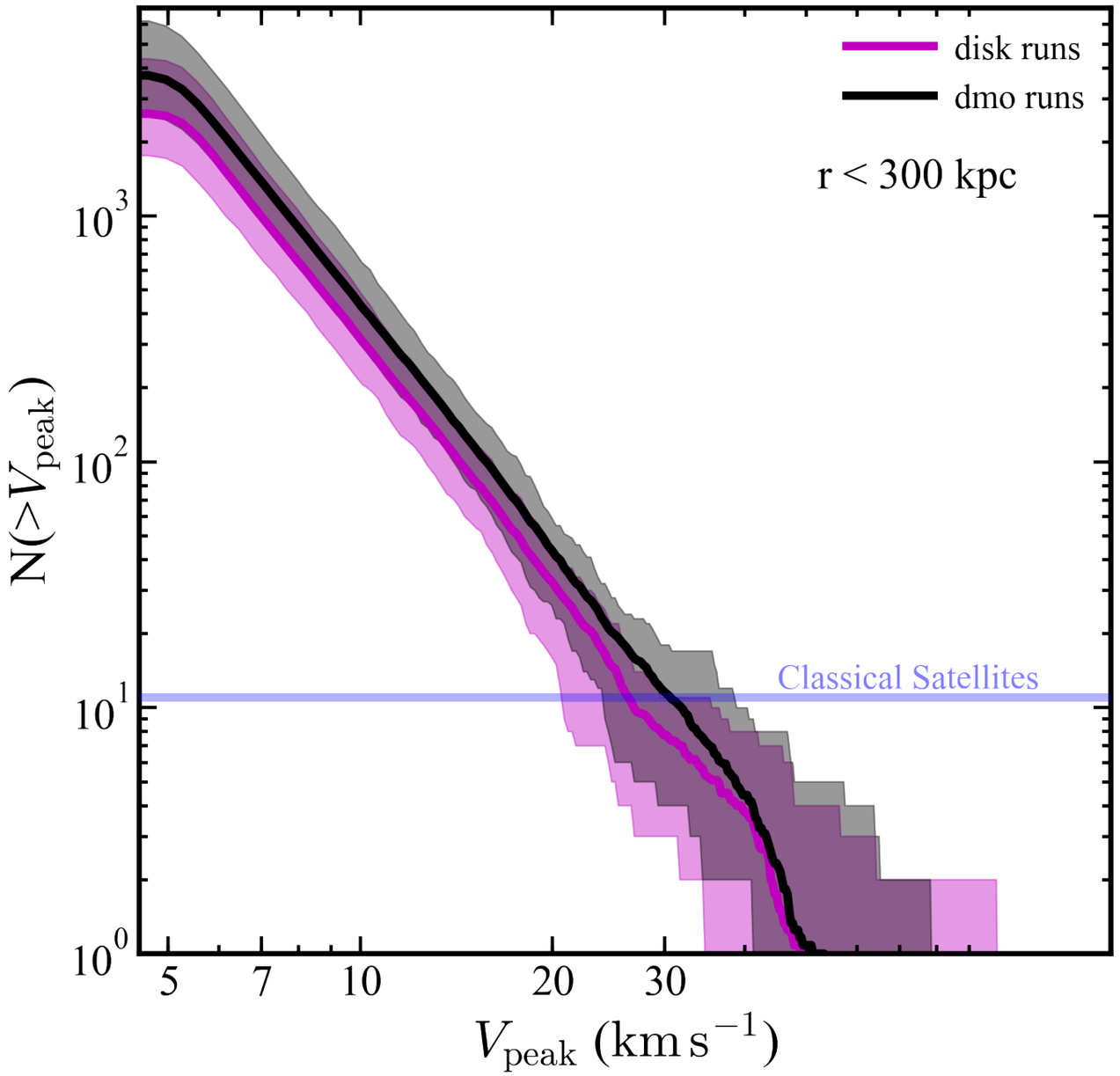

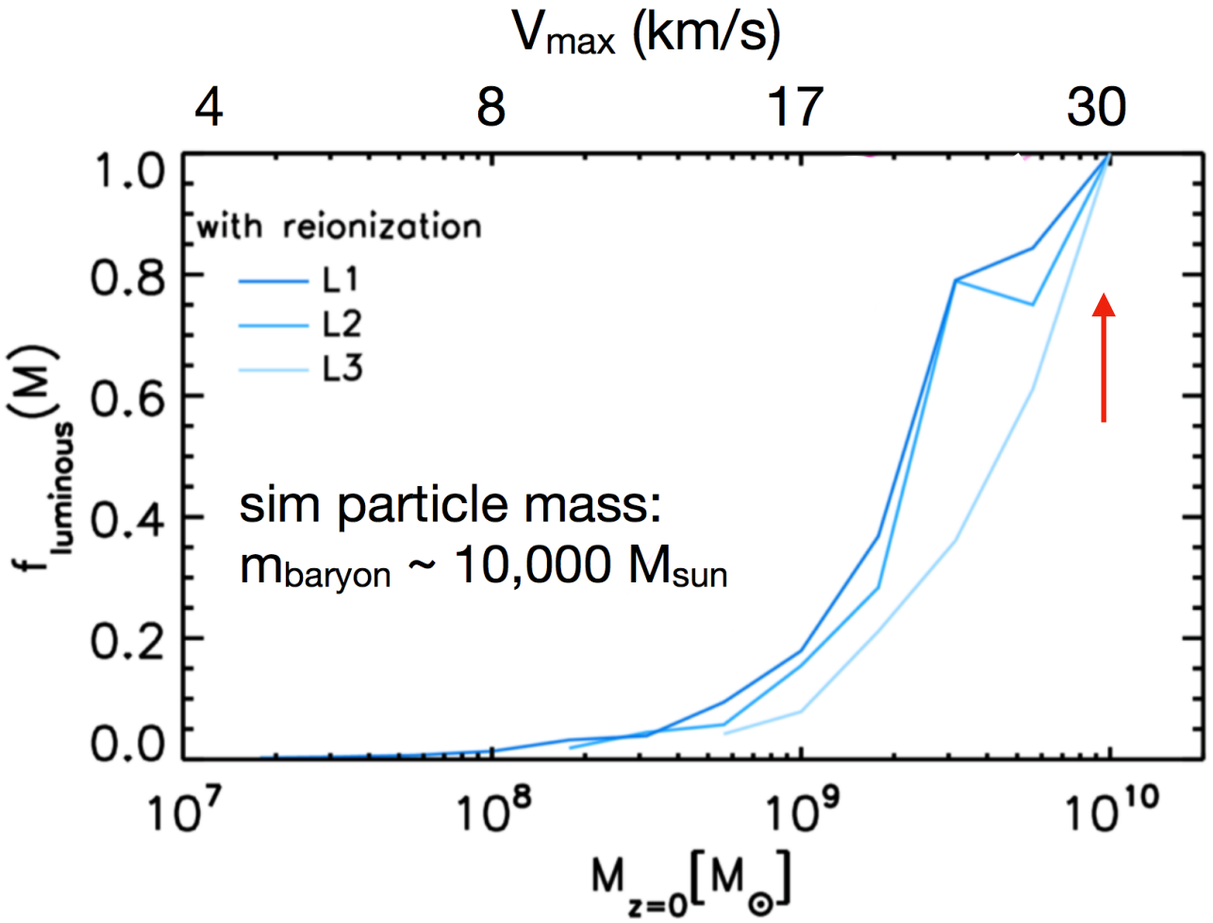

Graus+ 2018

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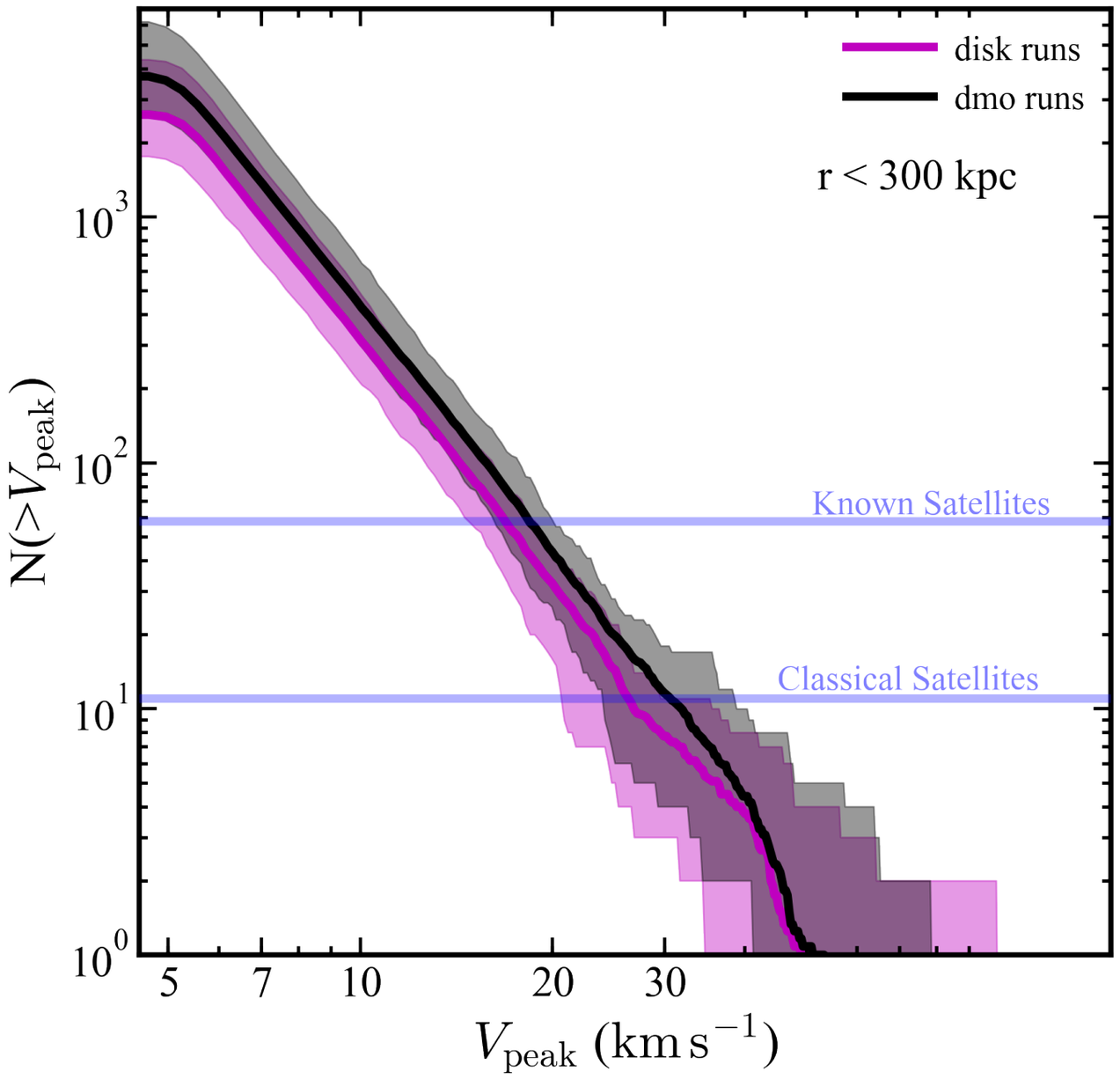

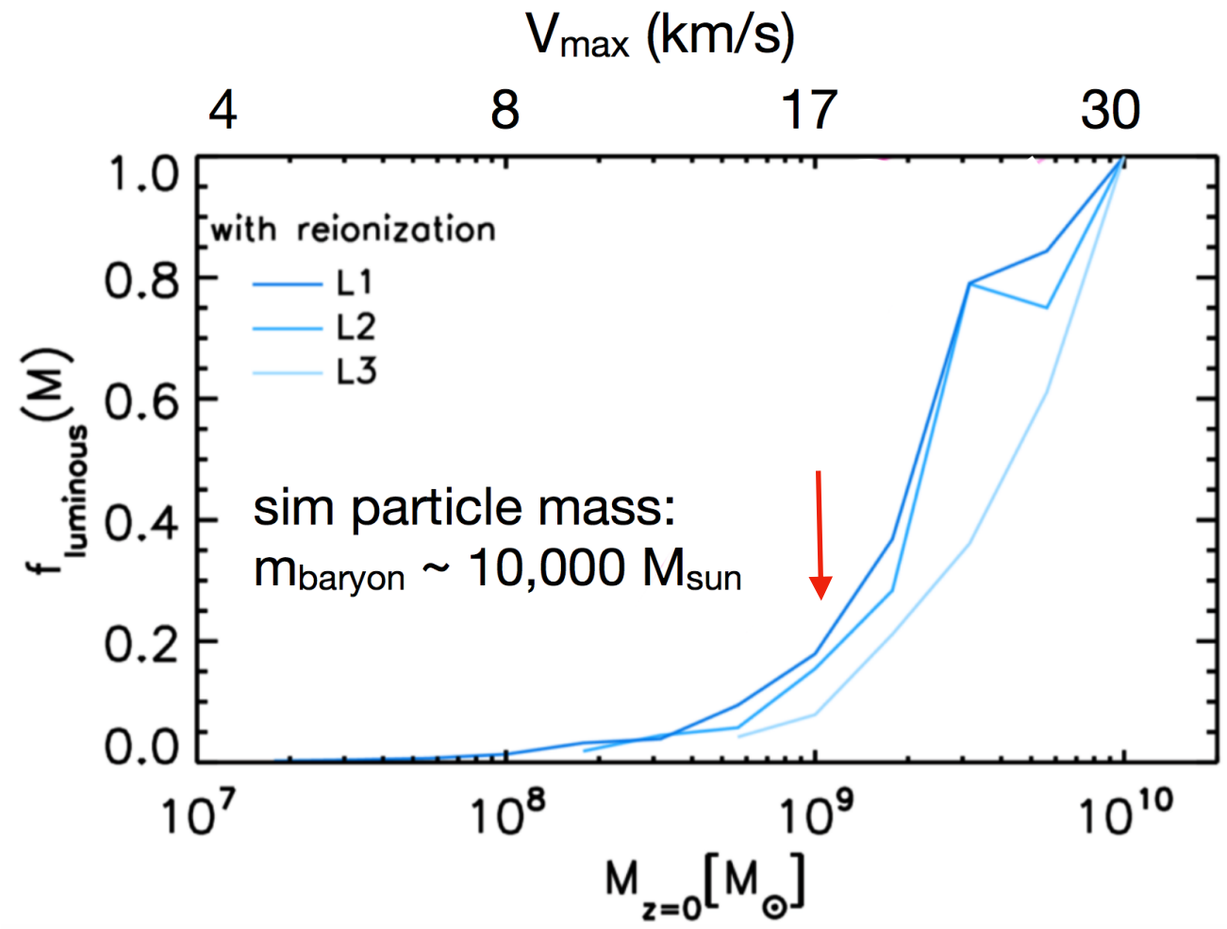

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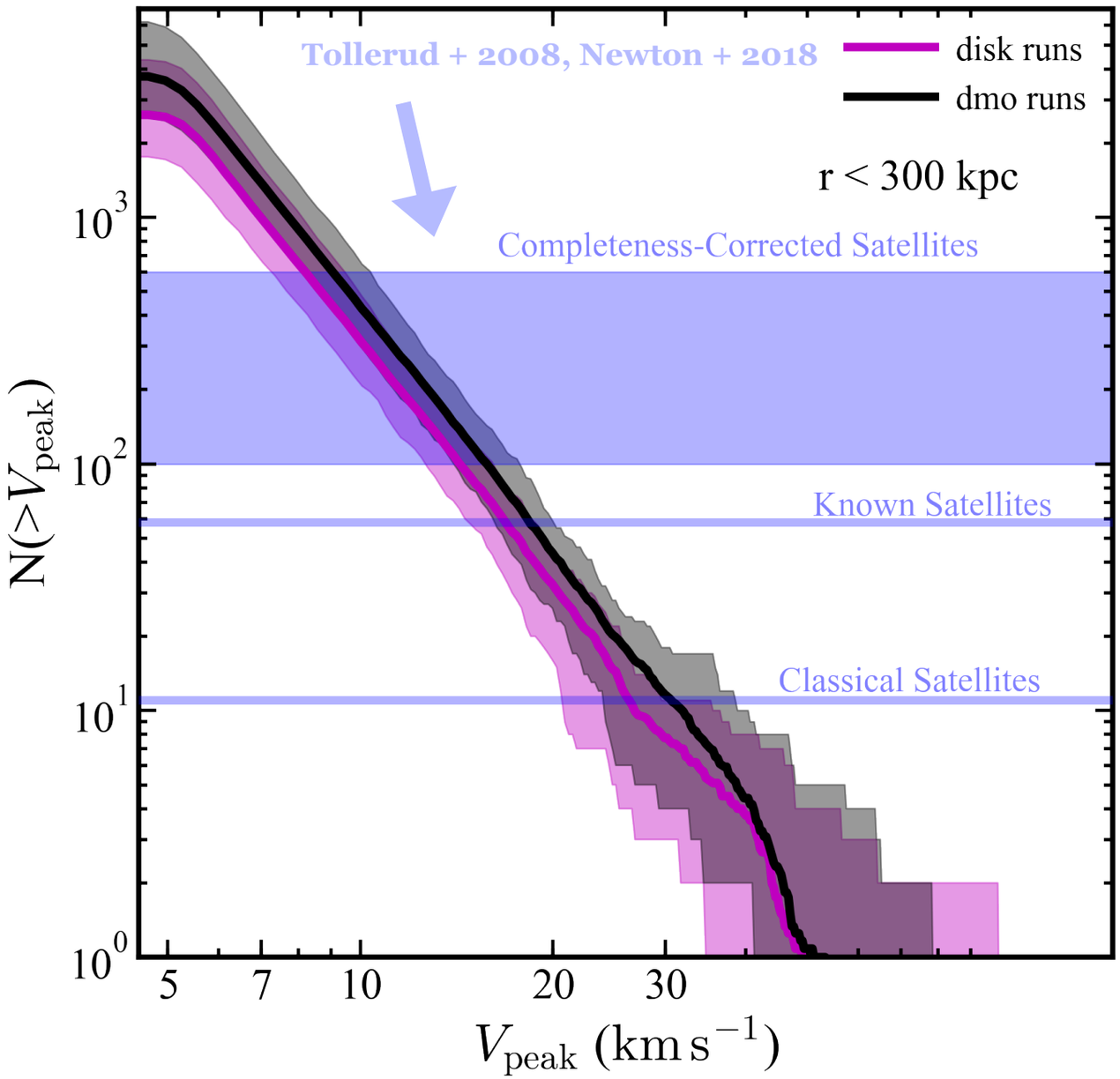
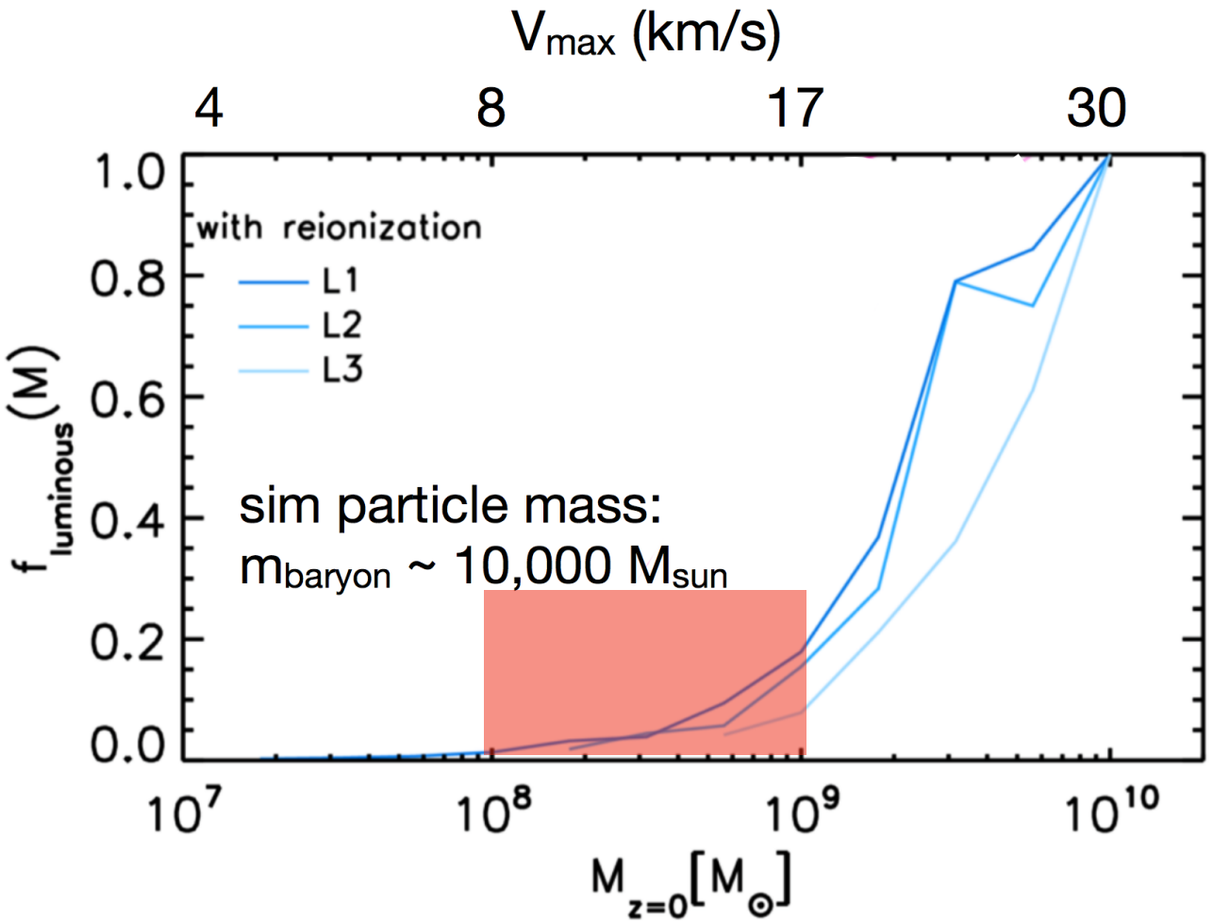
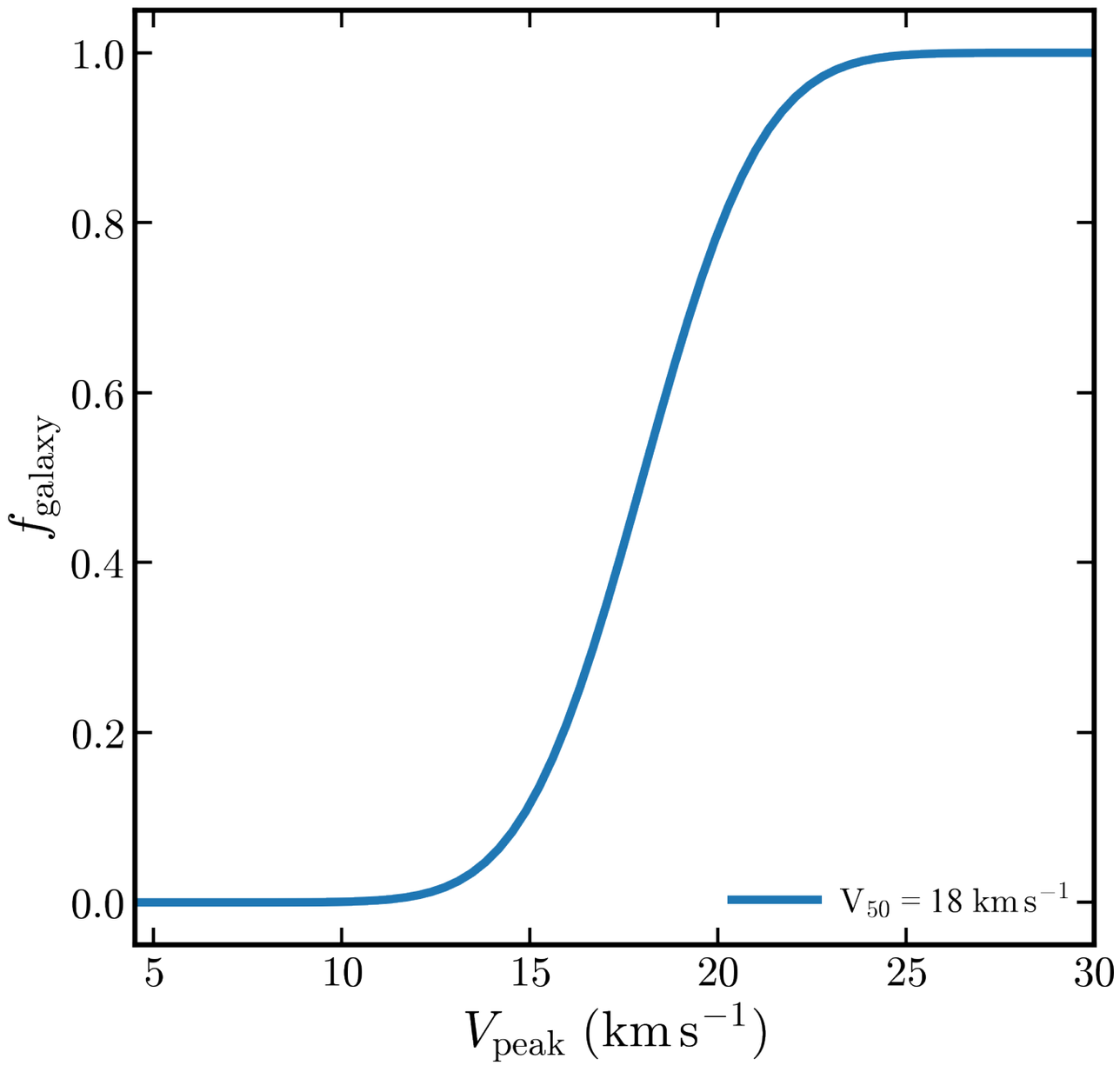
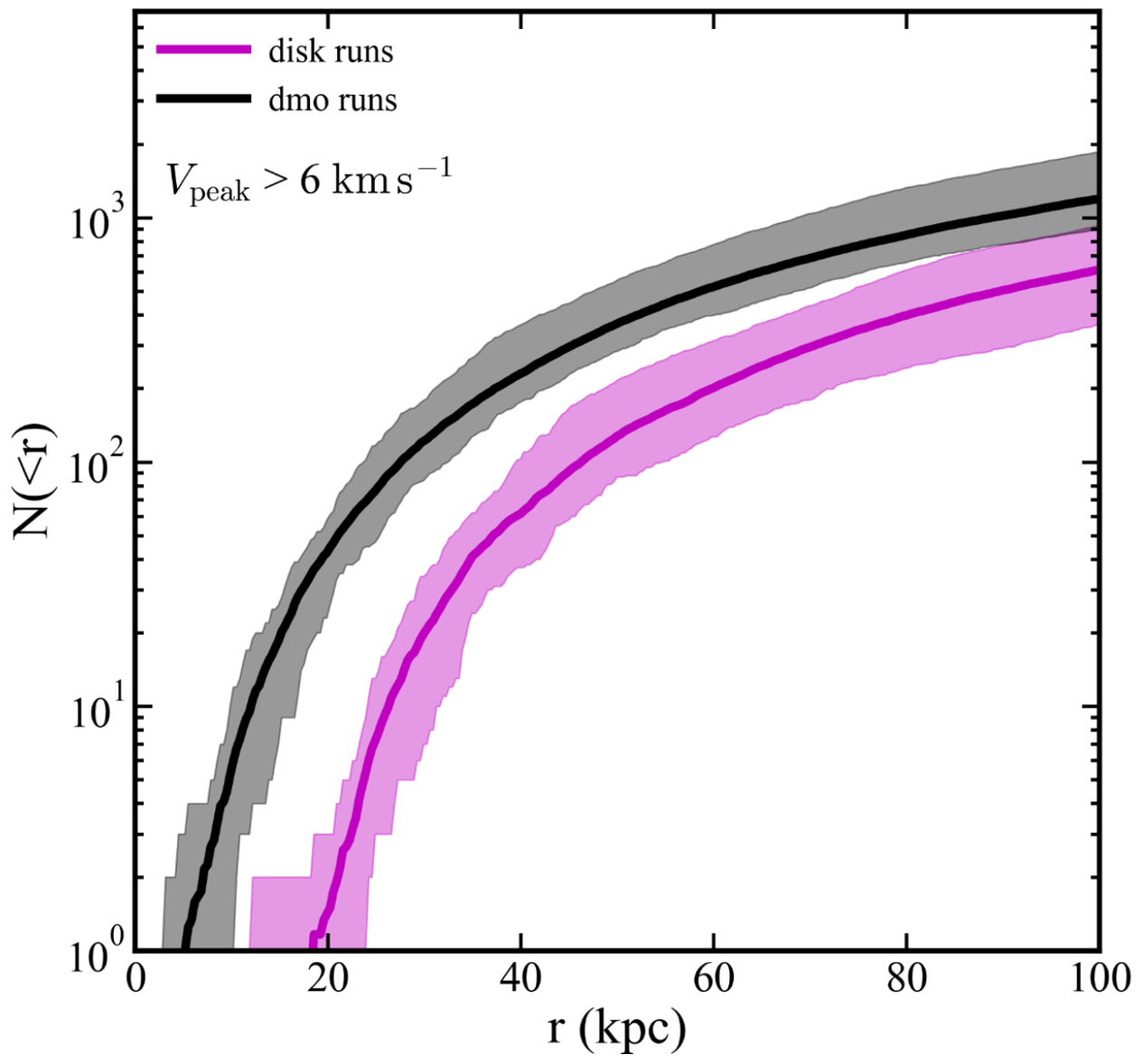




Graus+ 2018

Radial distribution of satellites





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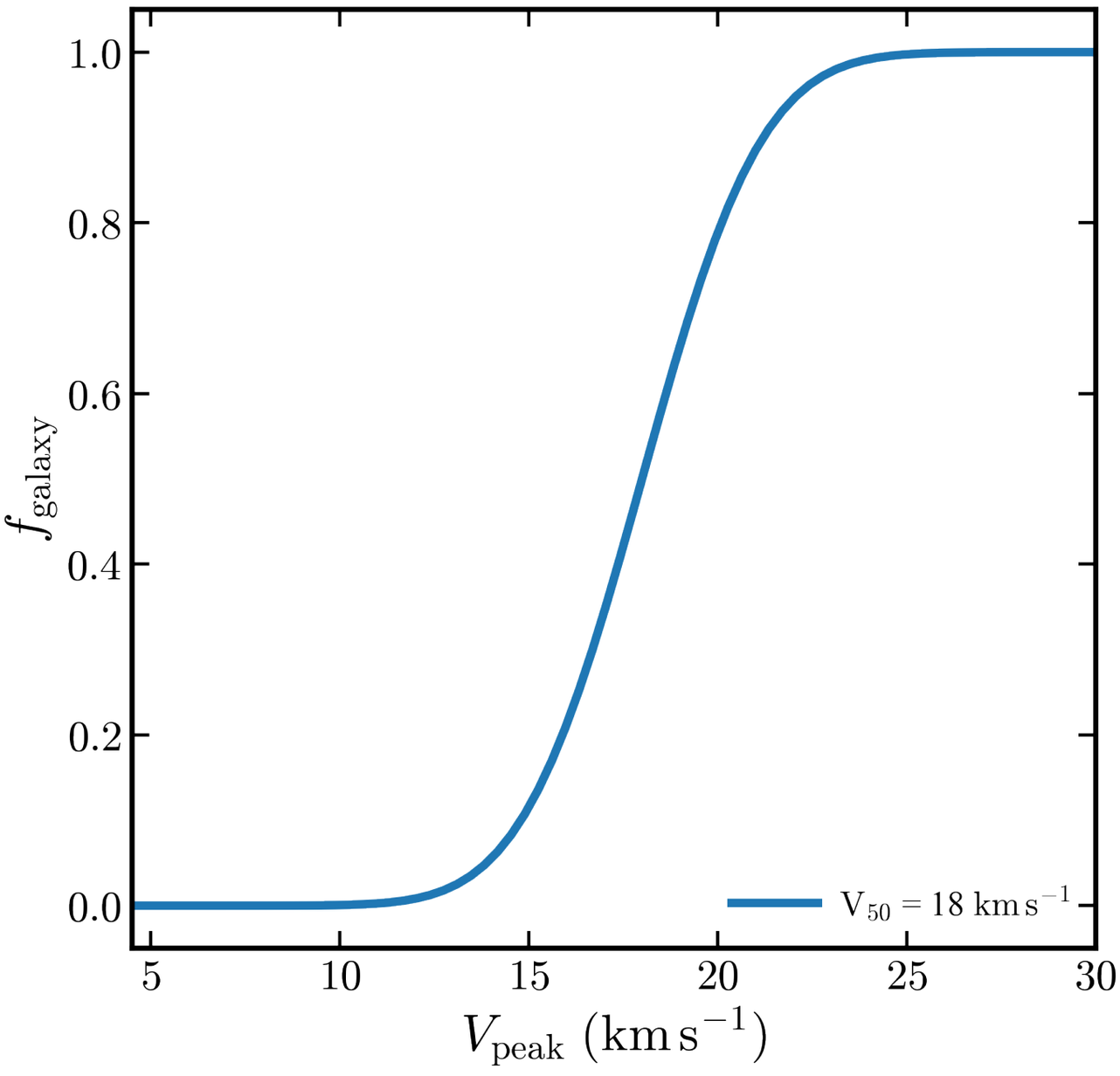

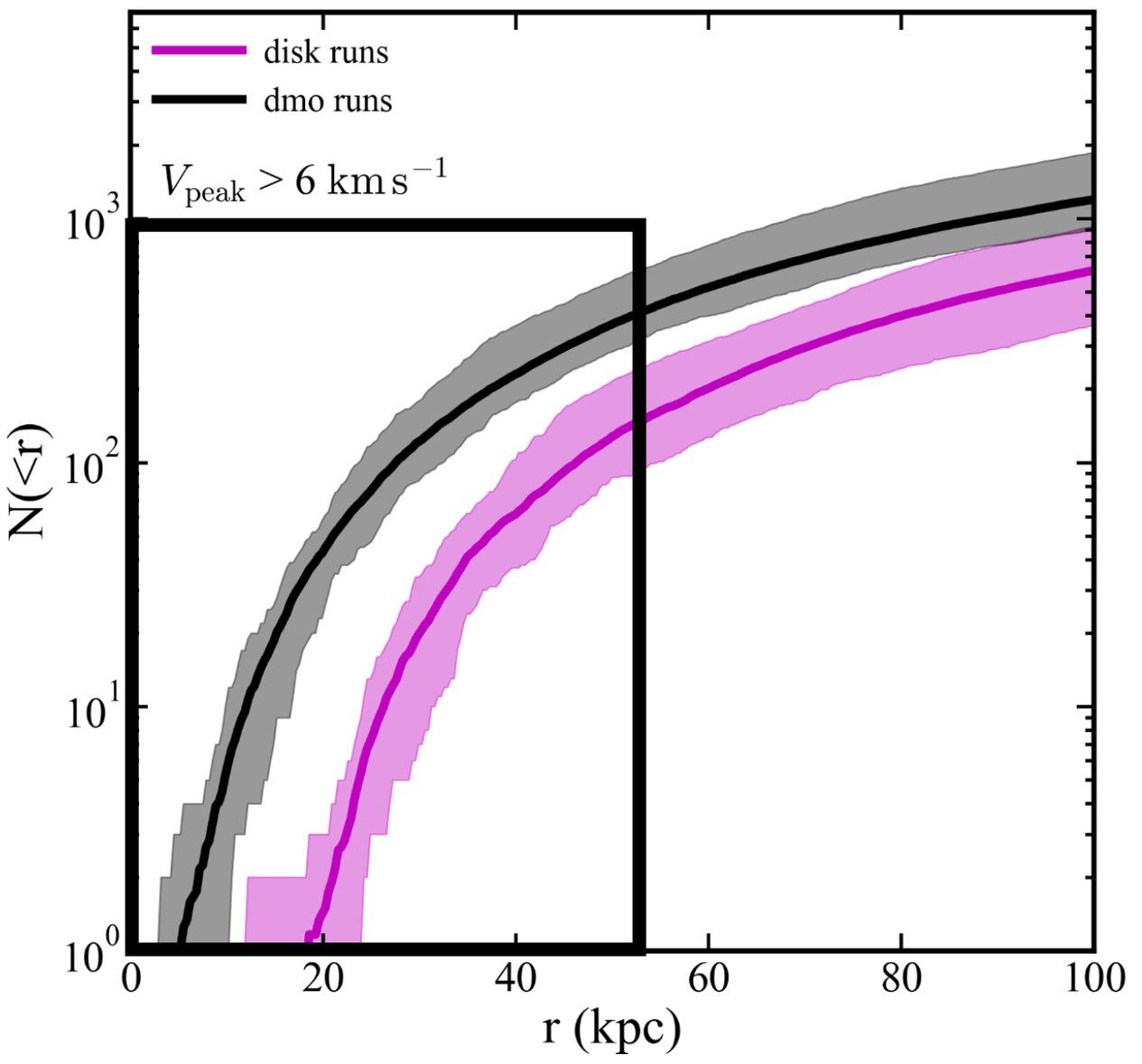

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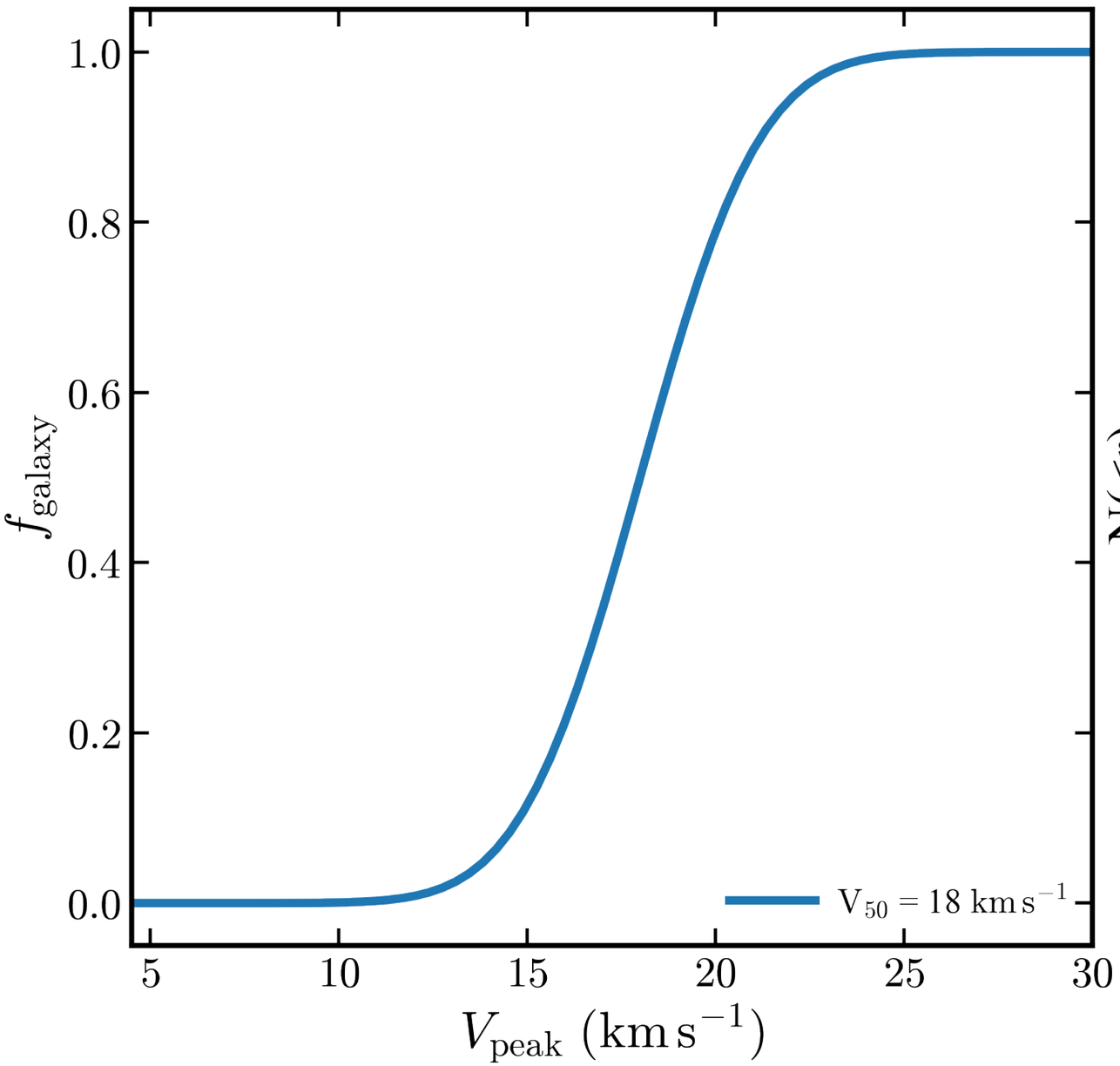

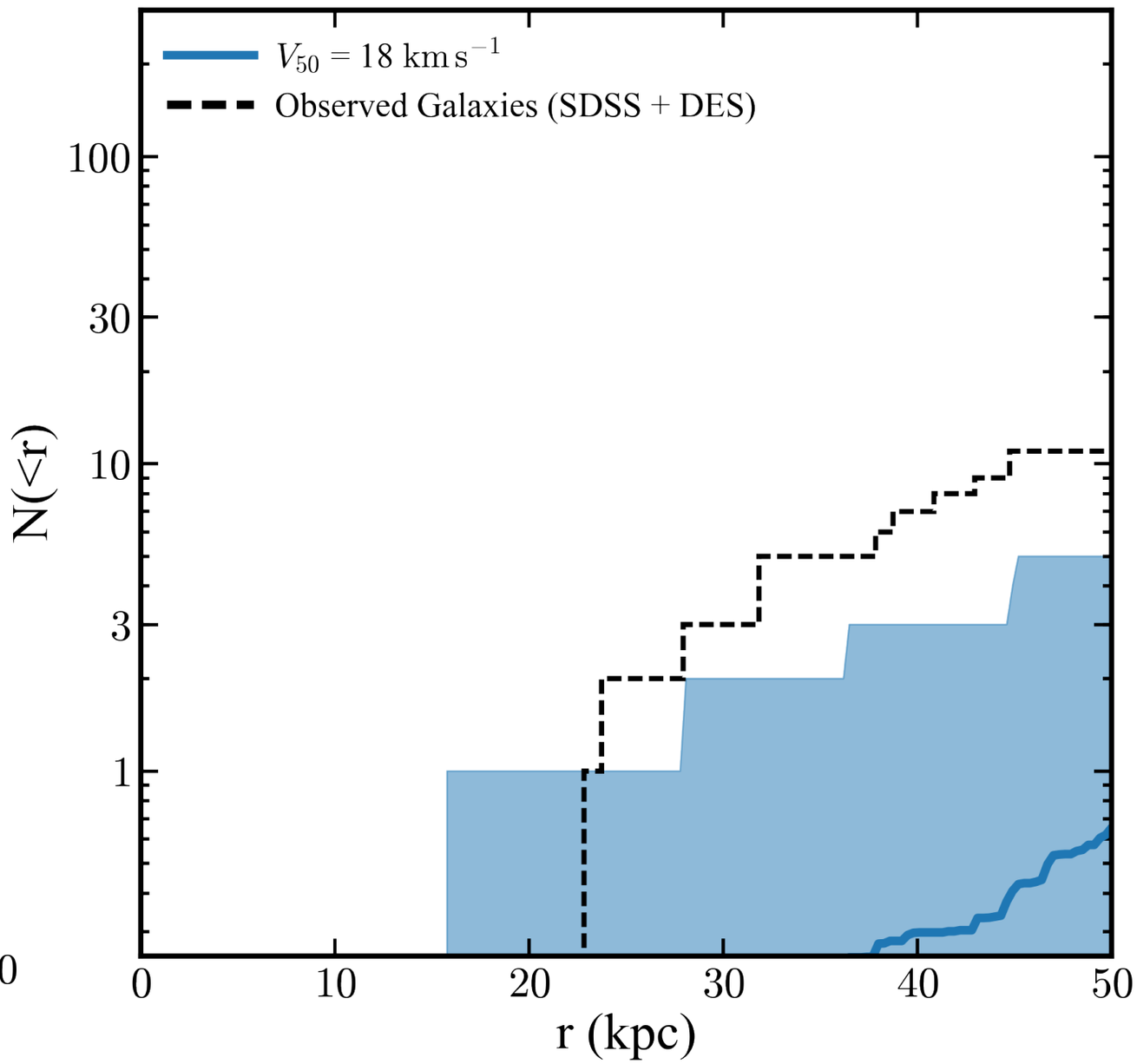

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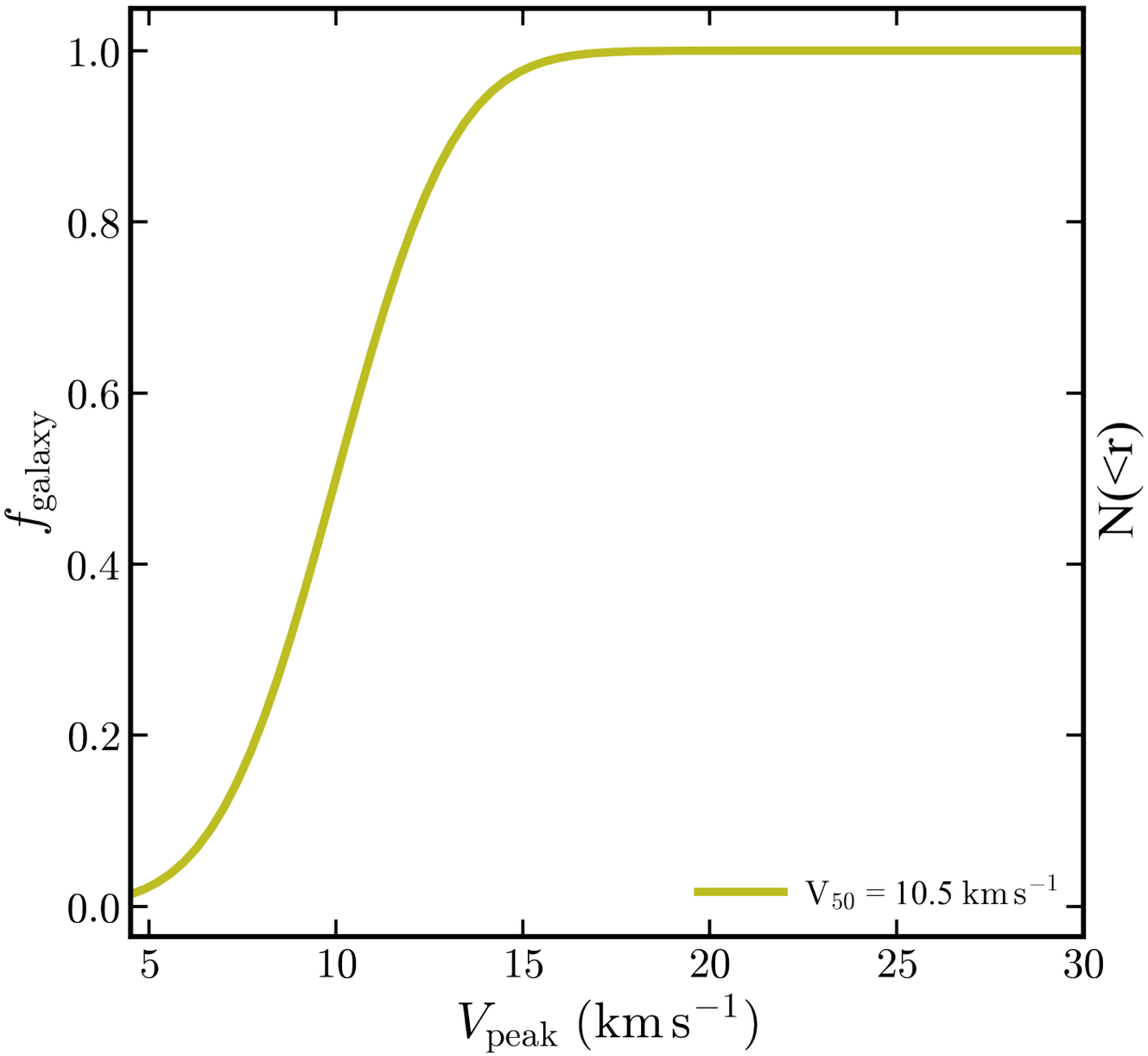

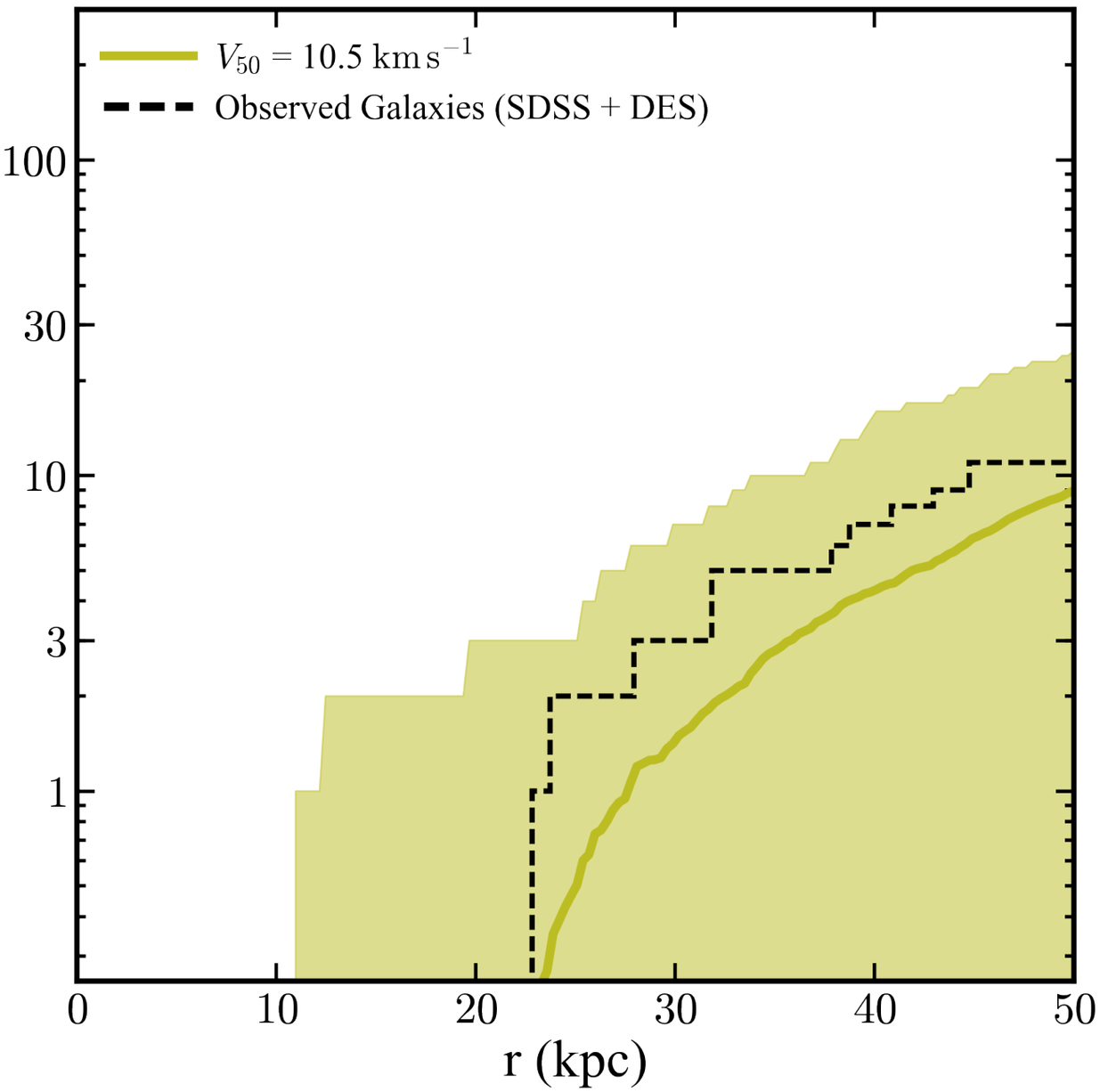

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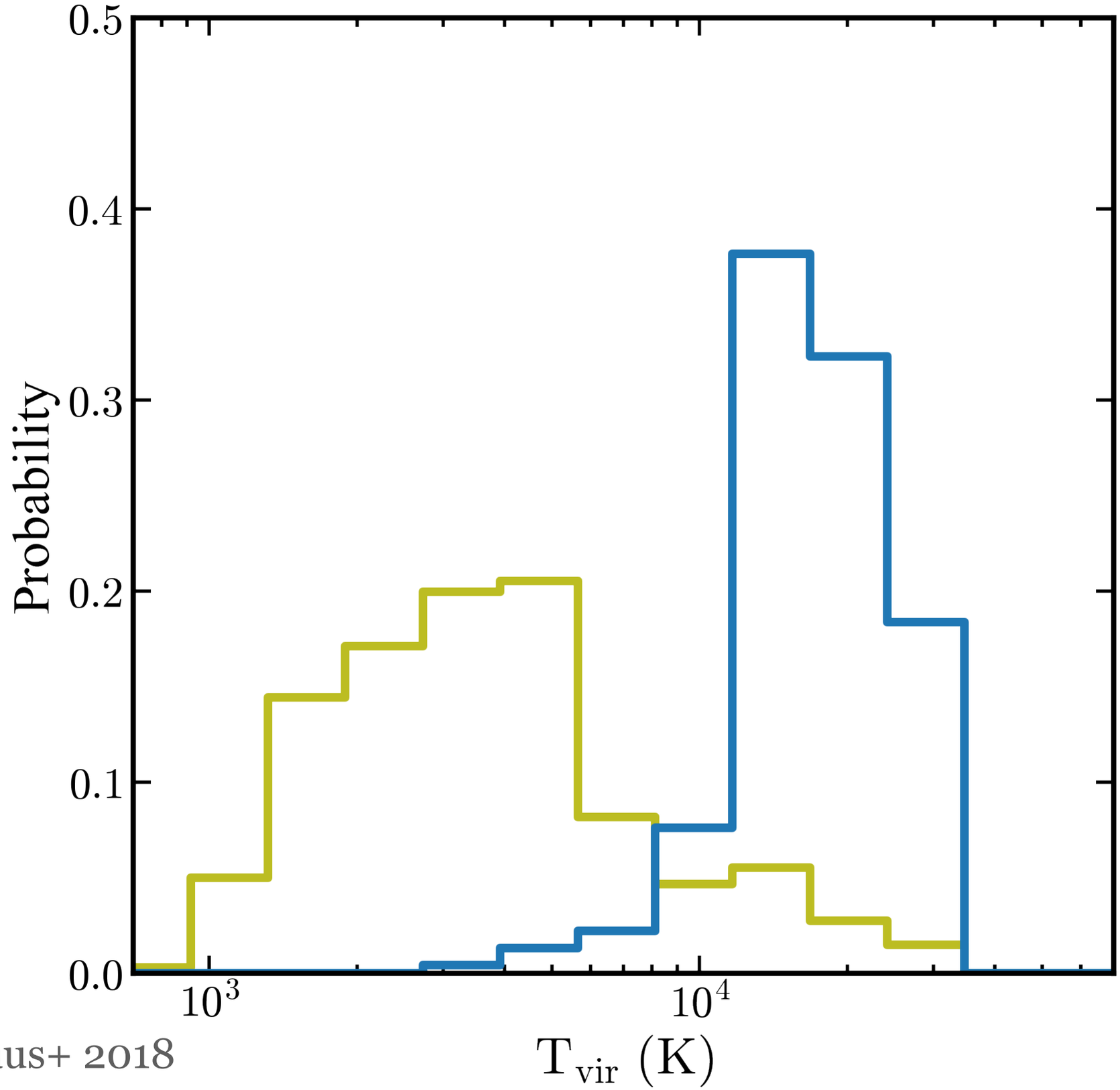

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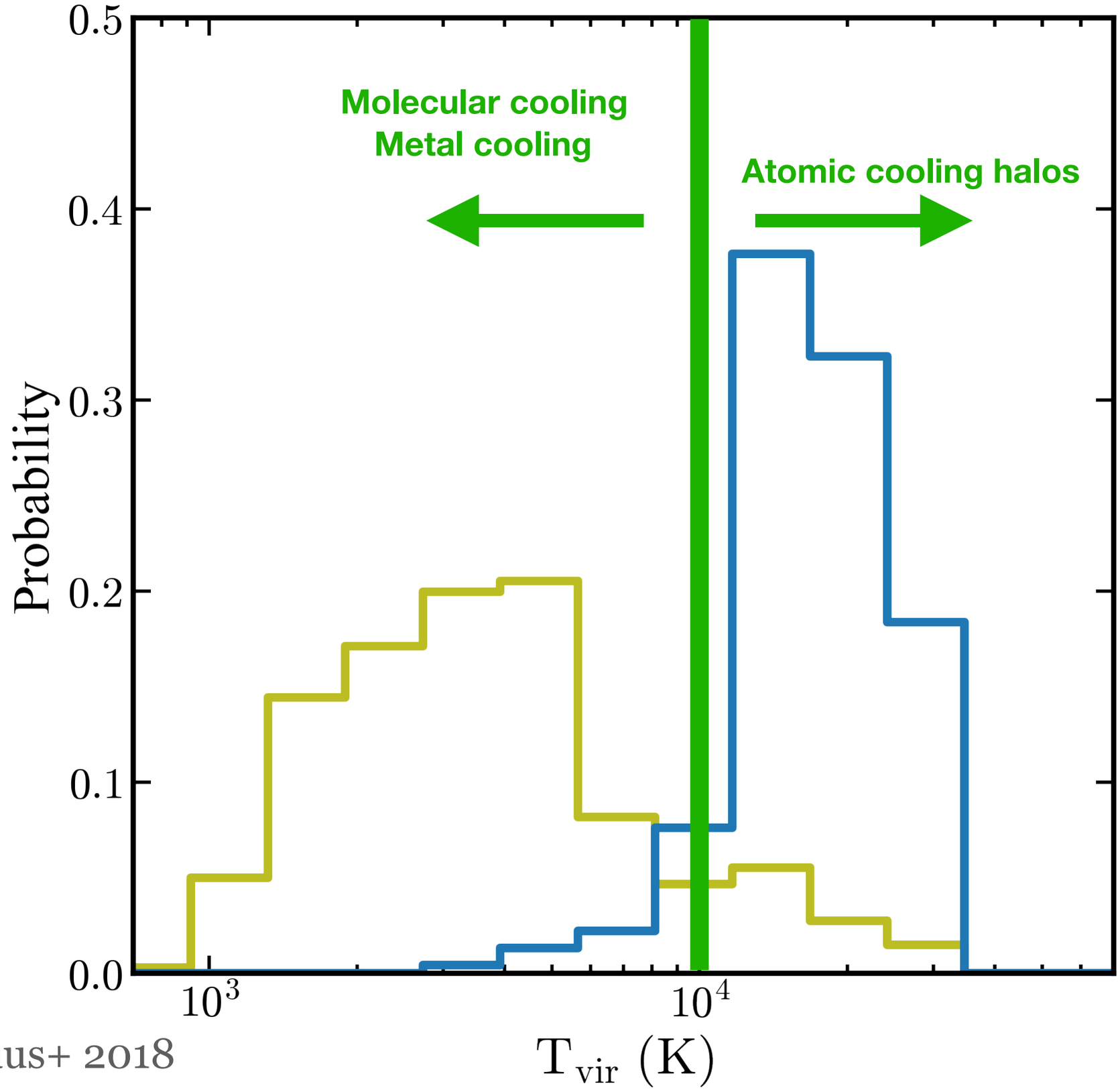
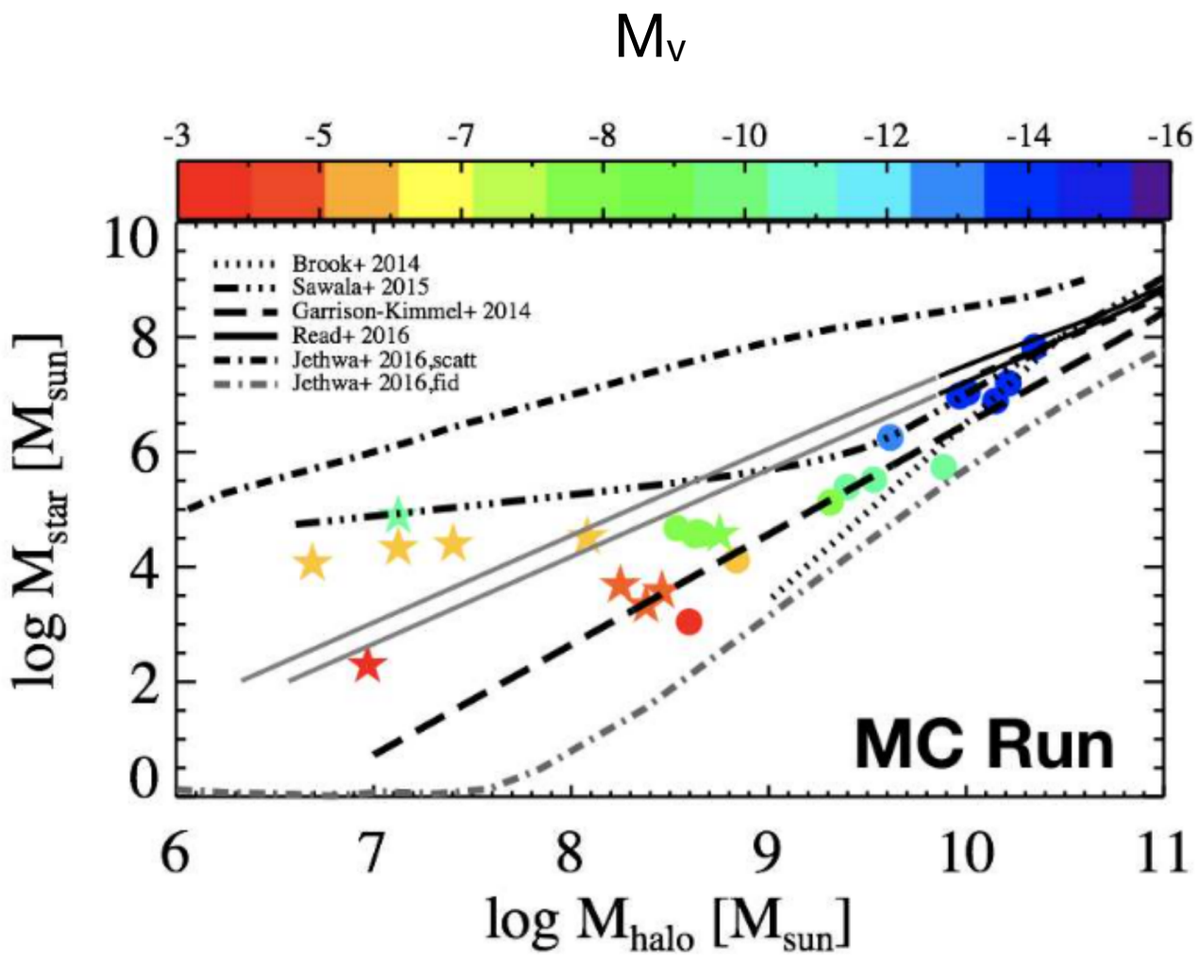
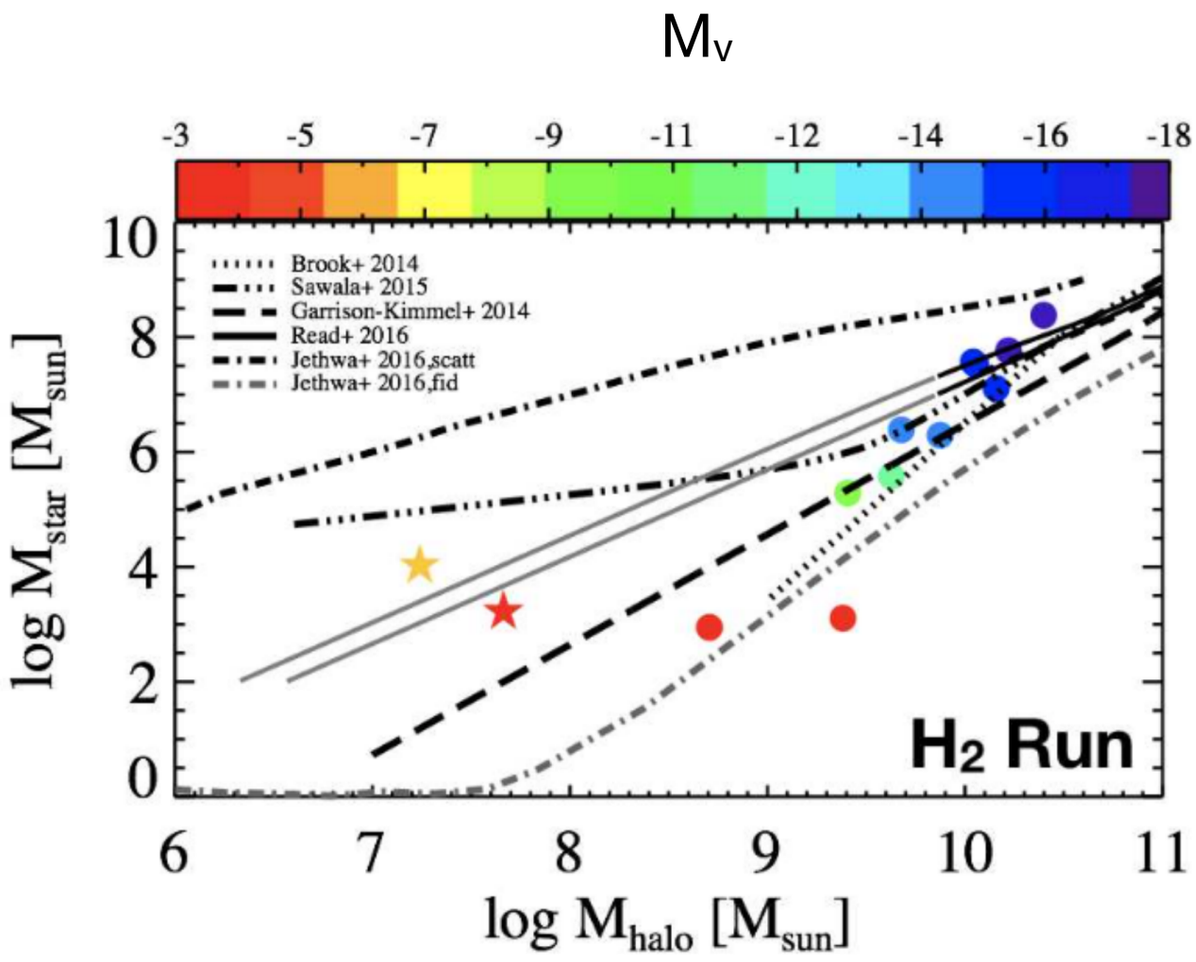


Graus+ 2018

Star formation in small halos

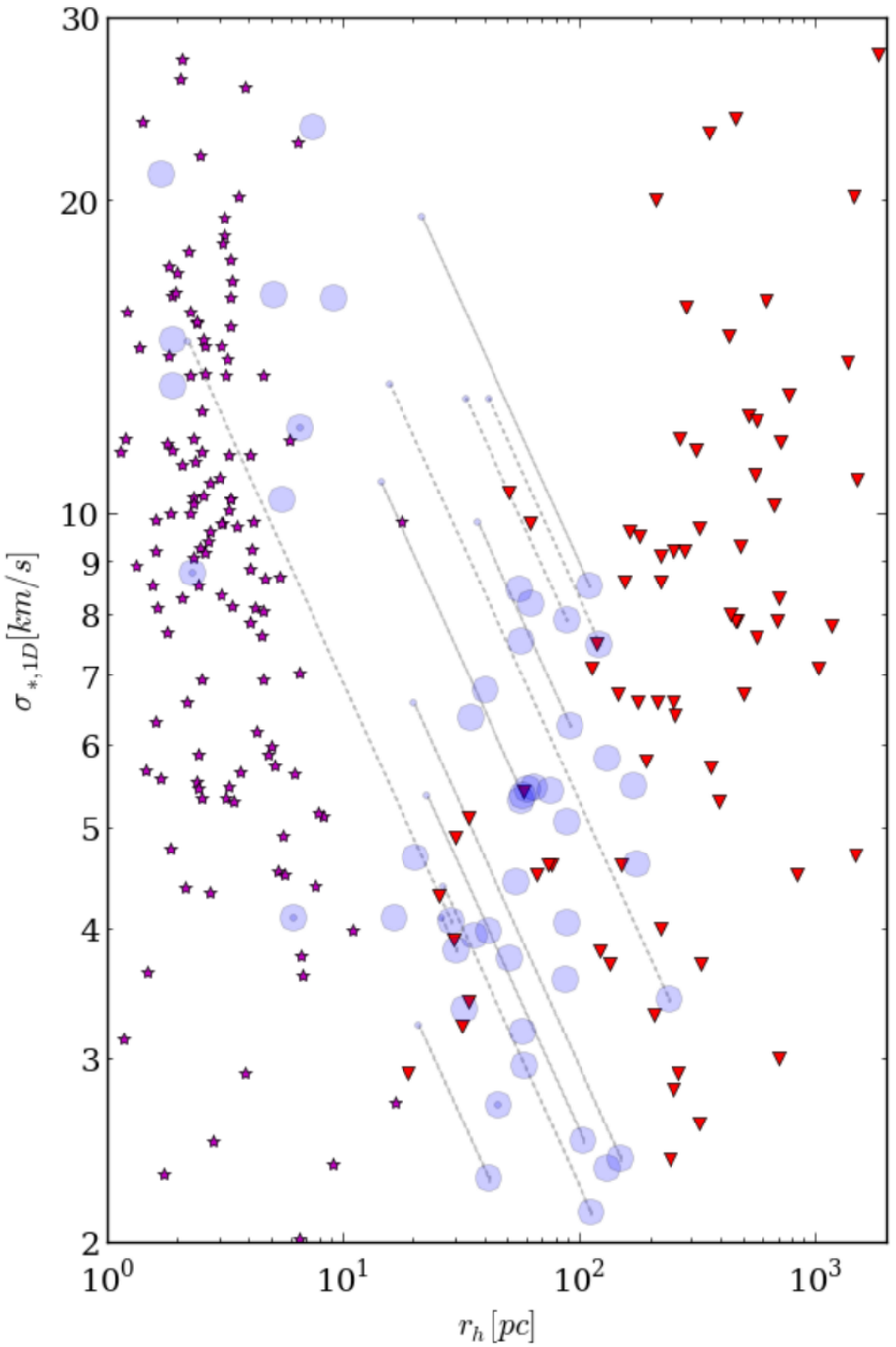
Simulations from CHaNGa

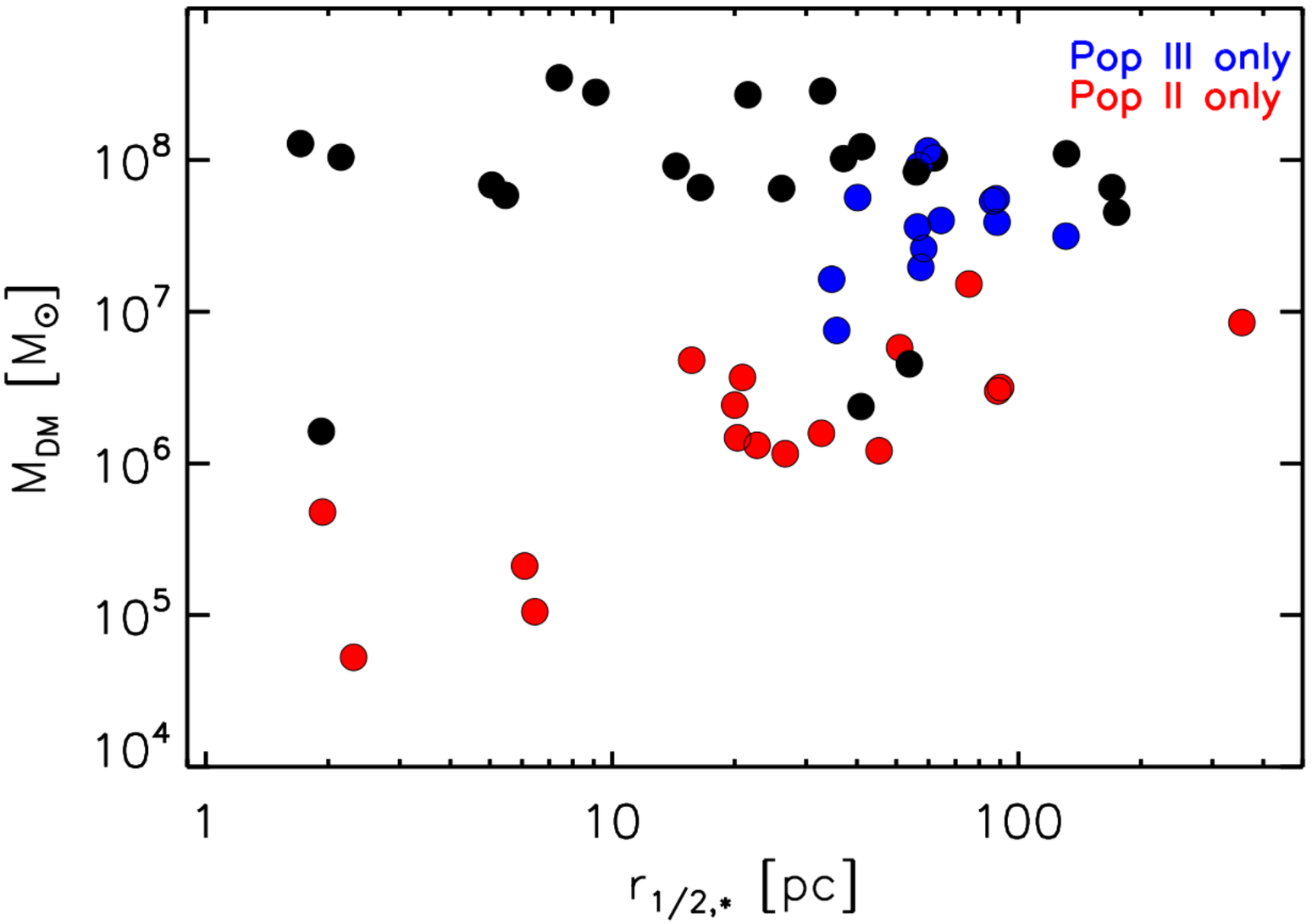




Munshi+ 2018

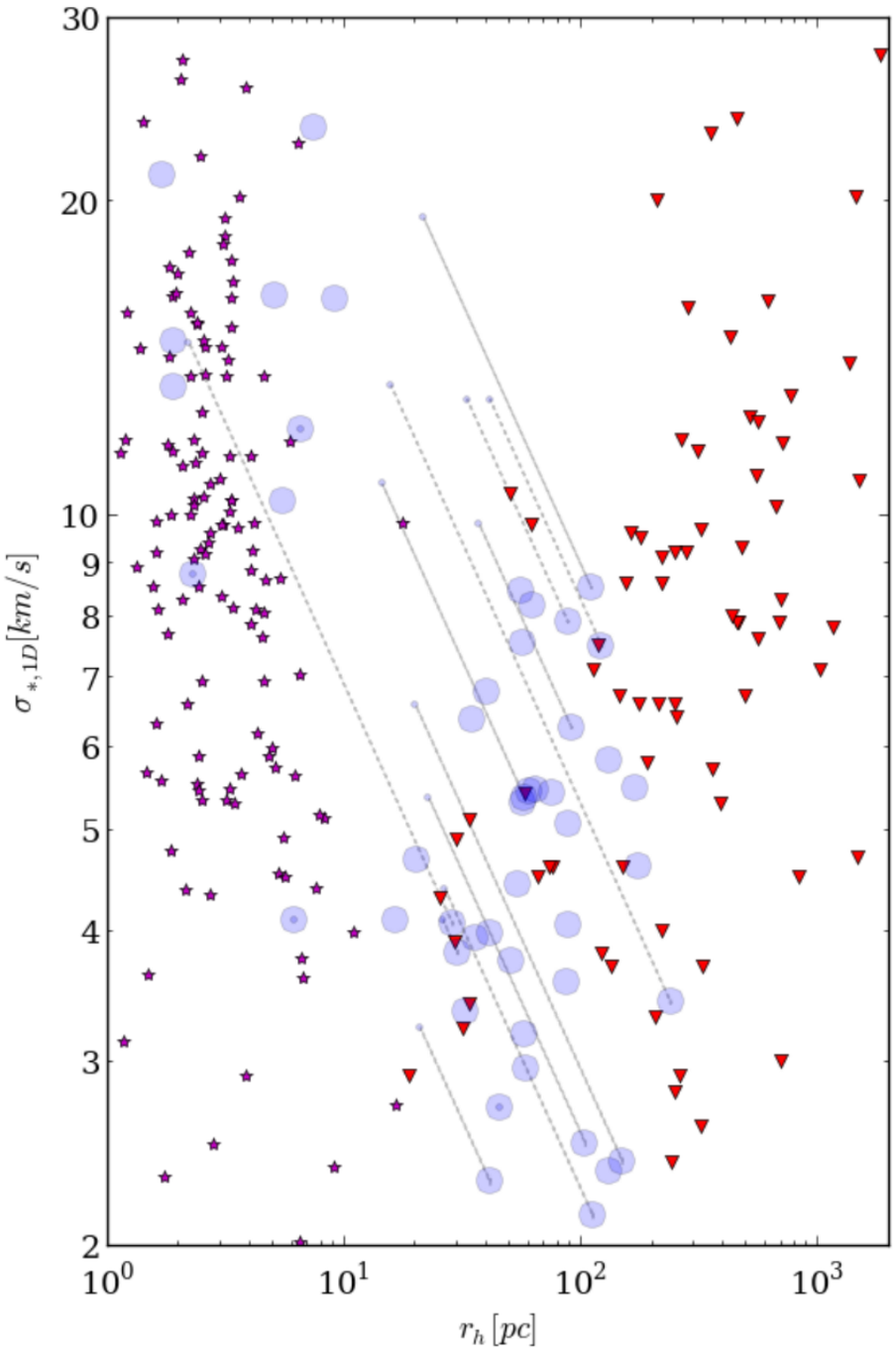
Star formation in small halos

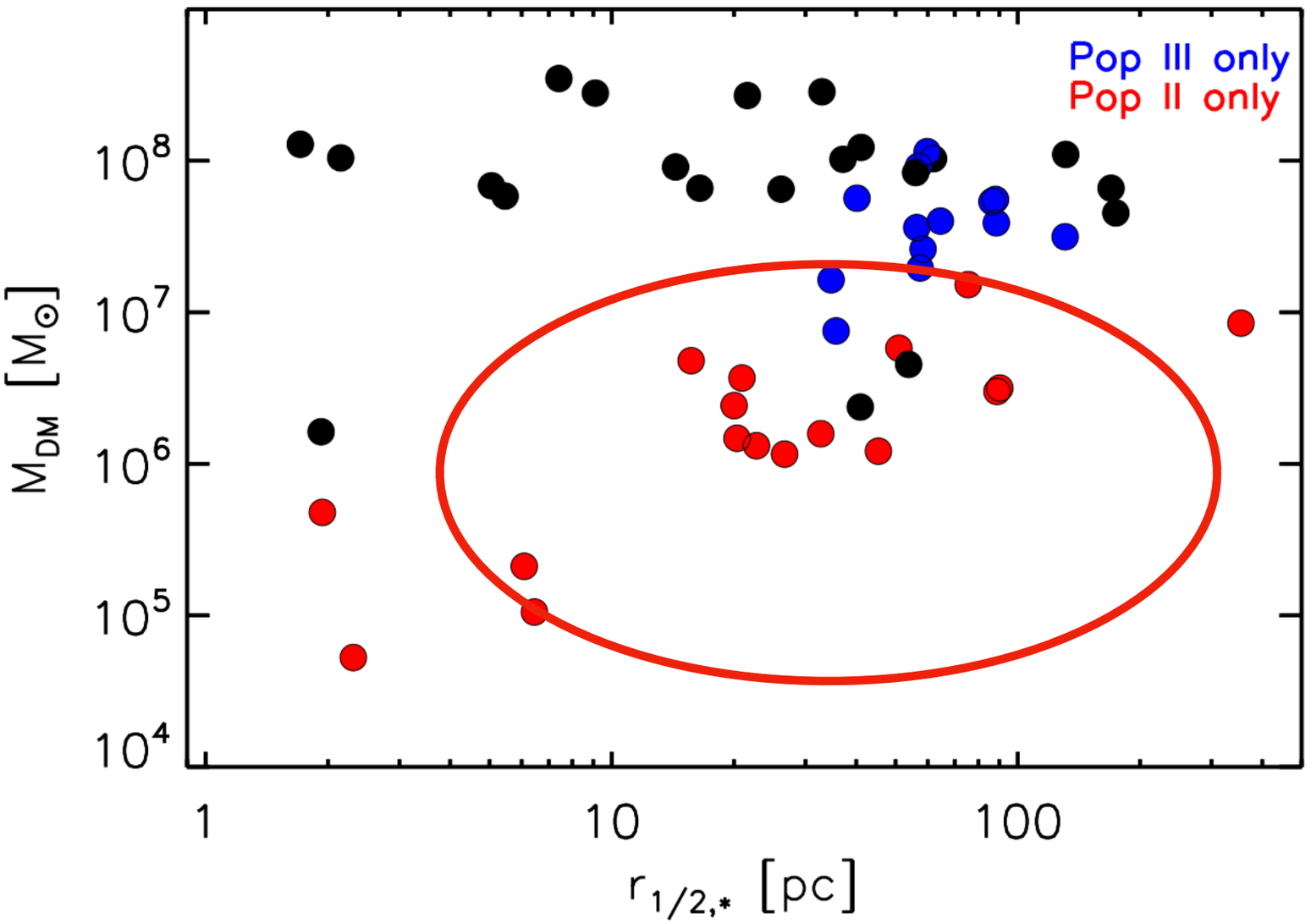




Ricotti + 2016

Star formation in small halos





Pop II galaxies form in low-mass halos

Ricotti + 2016

Conclusions

- The Local Group contains a diverse population of galaxies that can be observed at the level of individual stars.

- Reionization can also impact the star formation history of dwarf galaxies by limiting gas accretion or preventing star formation entirely

- The large number of galaxies found by DES along with reduction of subhalos at small radii seen in simulations potentially points to star formation being necessary in halos below the atomic cooling limit.

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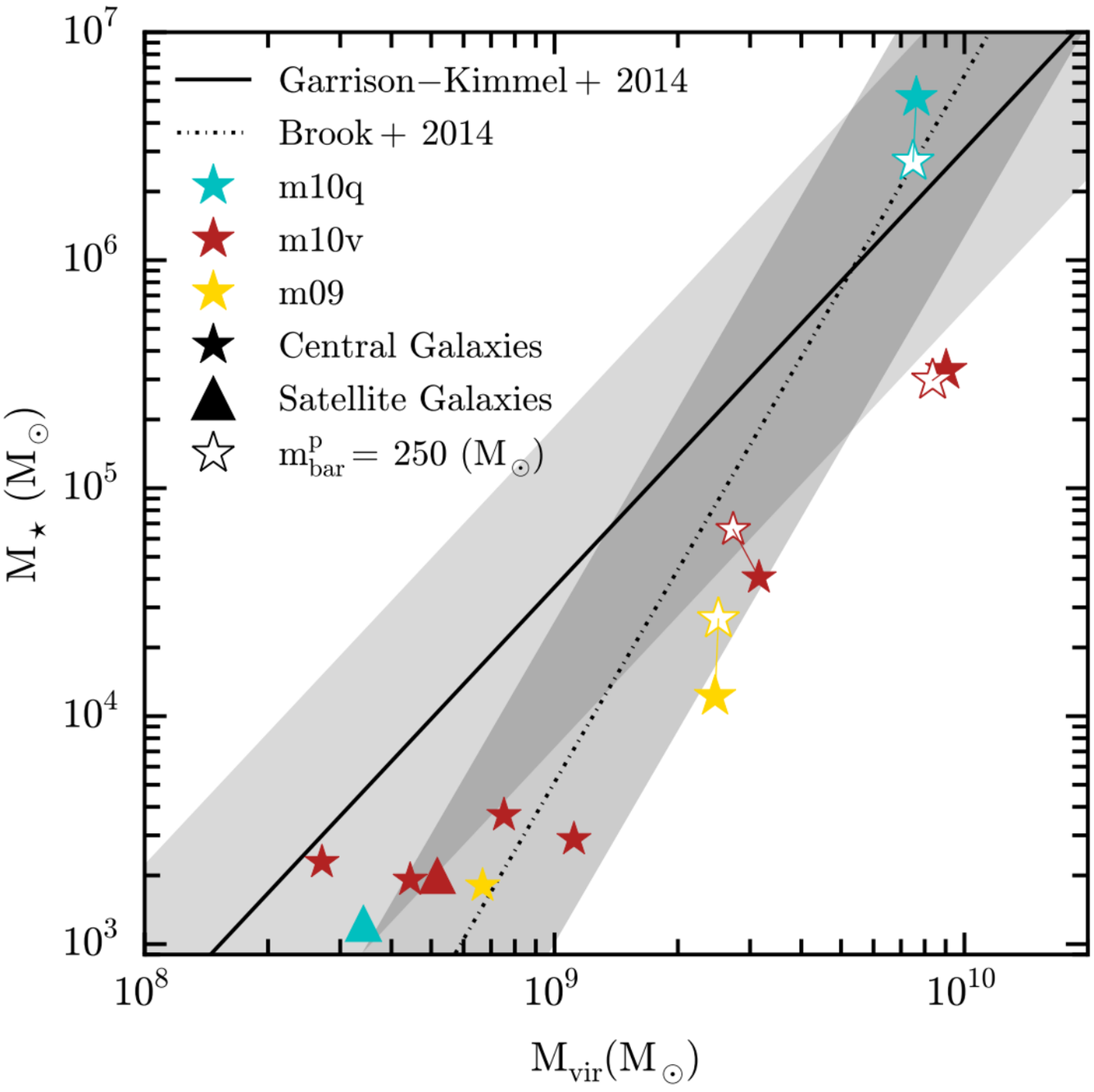
Thanks!

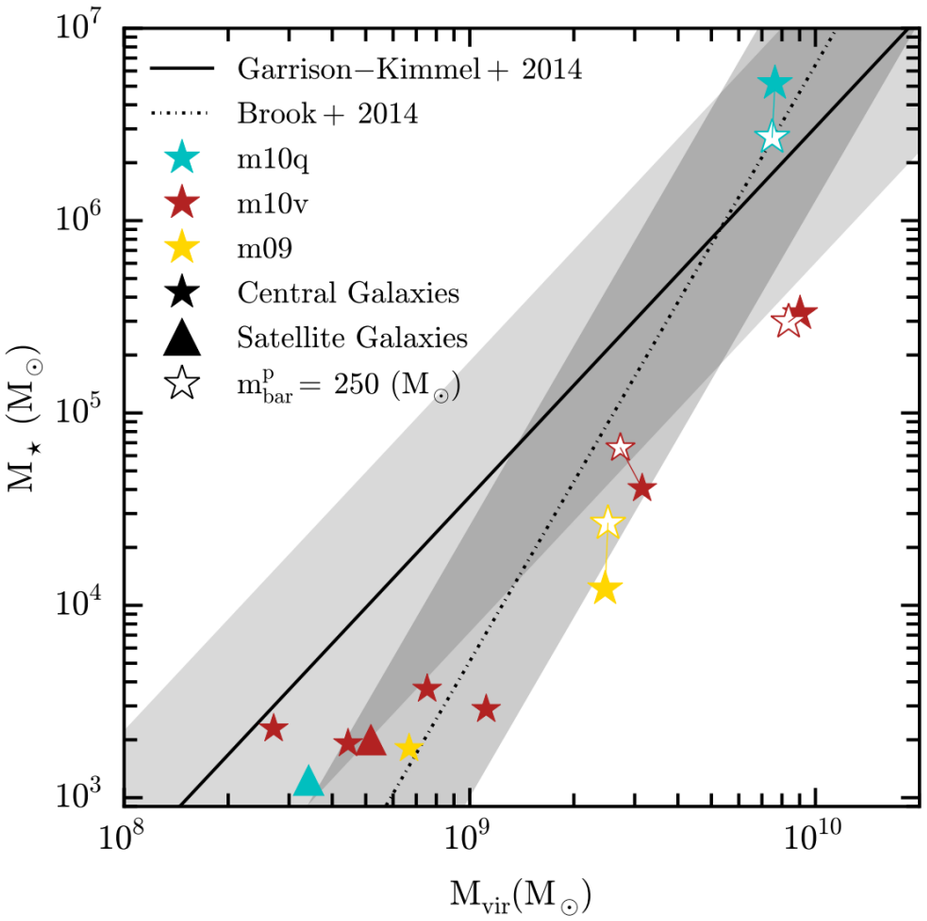
Star formation in small halos



Very high resolution simulations of small dwarfs (star particles of 30 $M_\odot$)

Wheeler + 2018

Star formation in small halos



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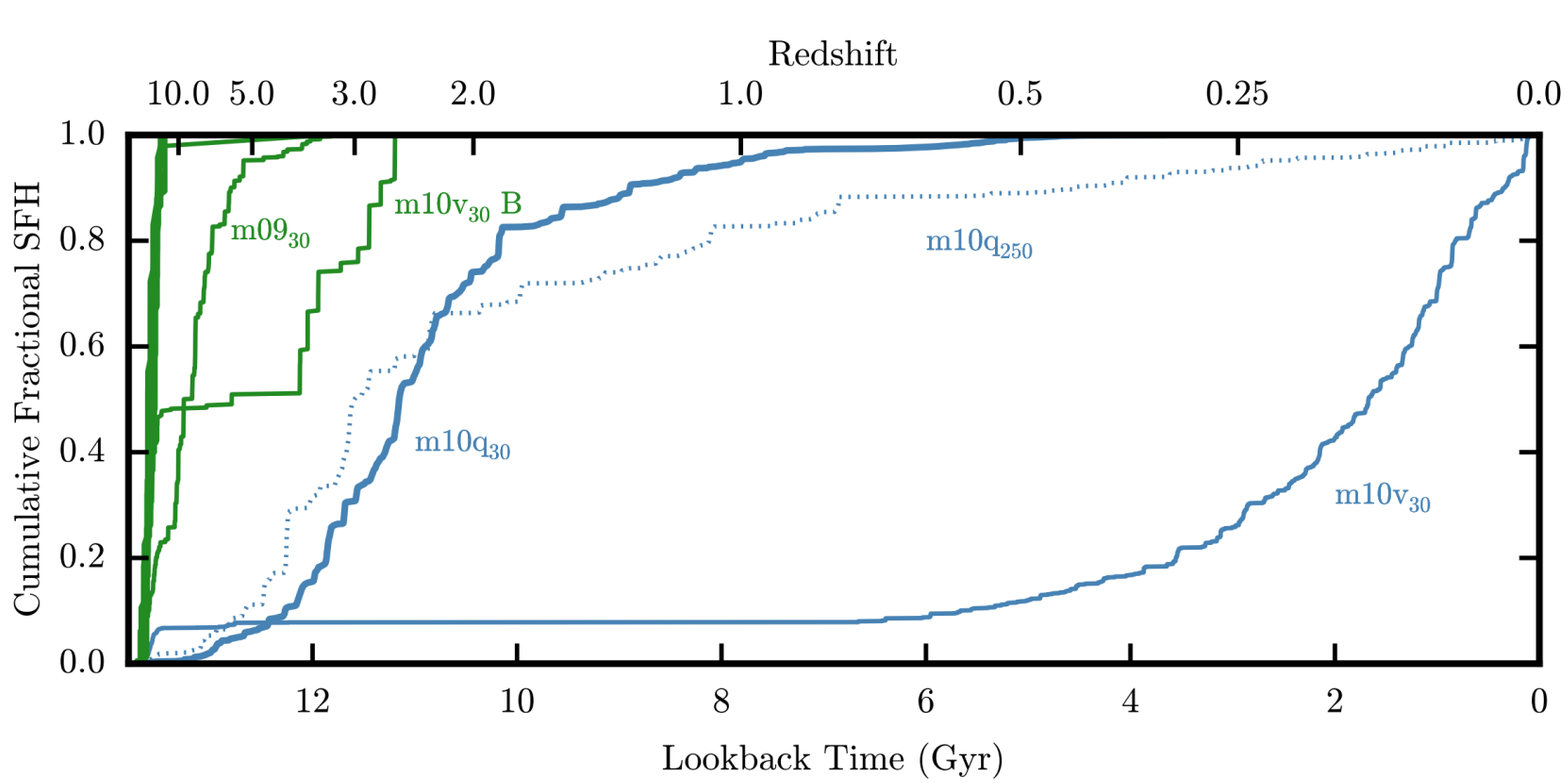
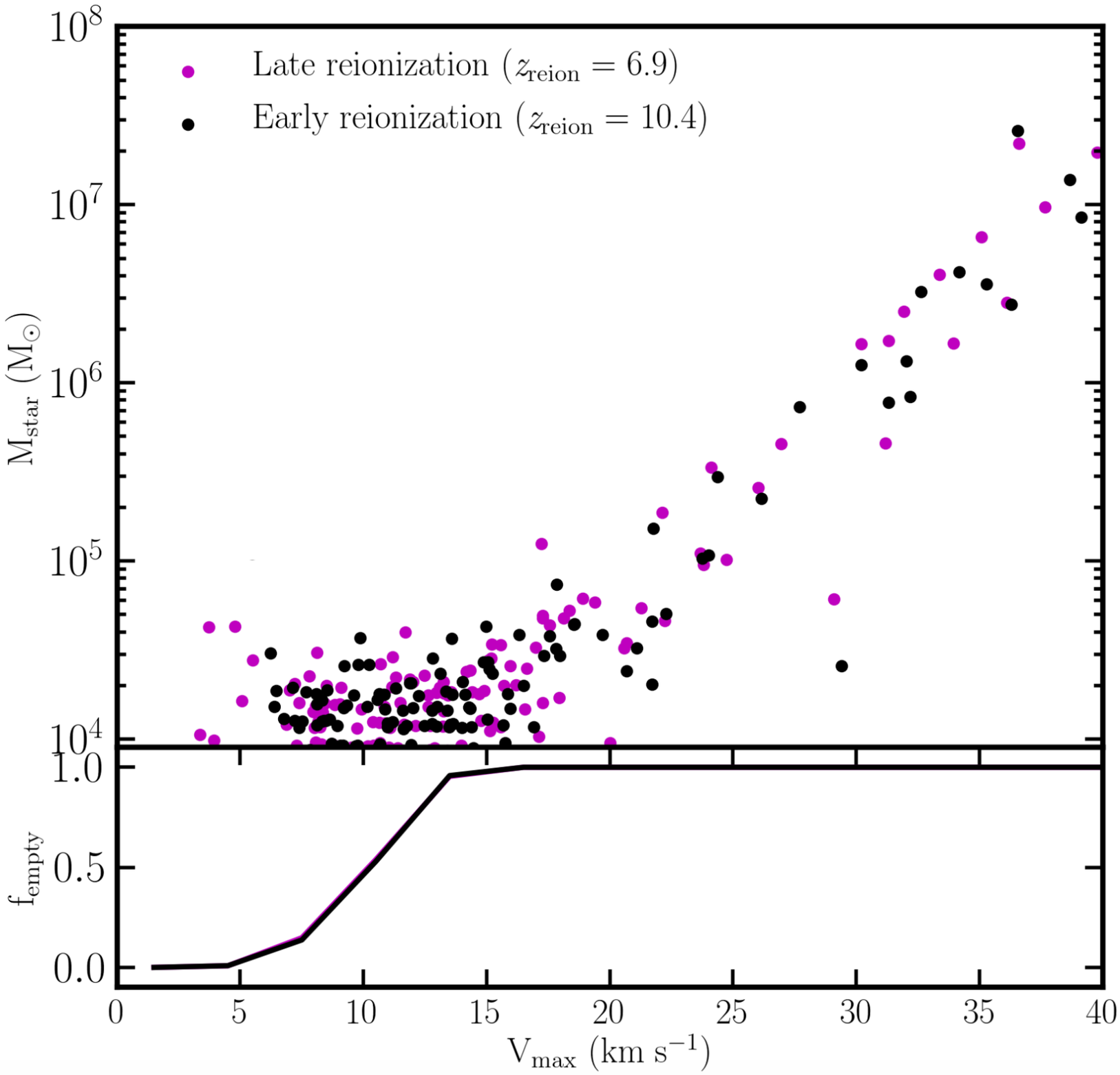


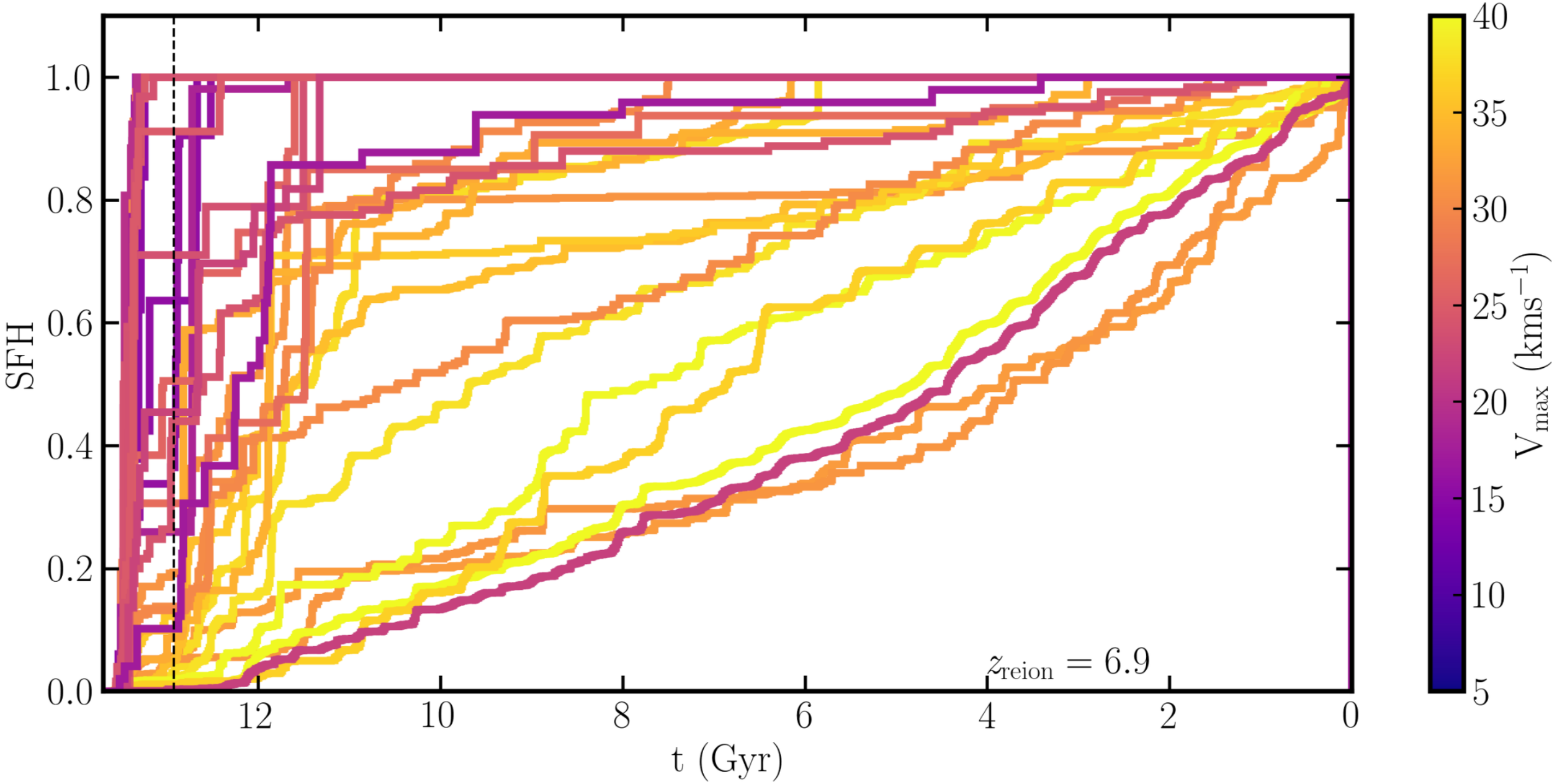
Wheeler + 2018

Star formation in small halos



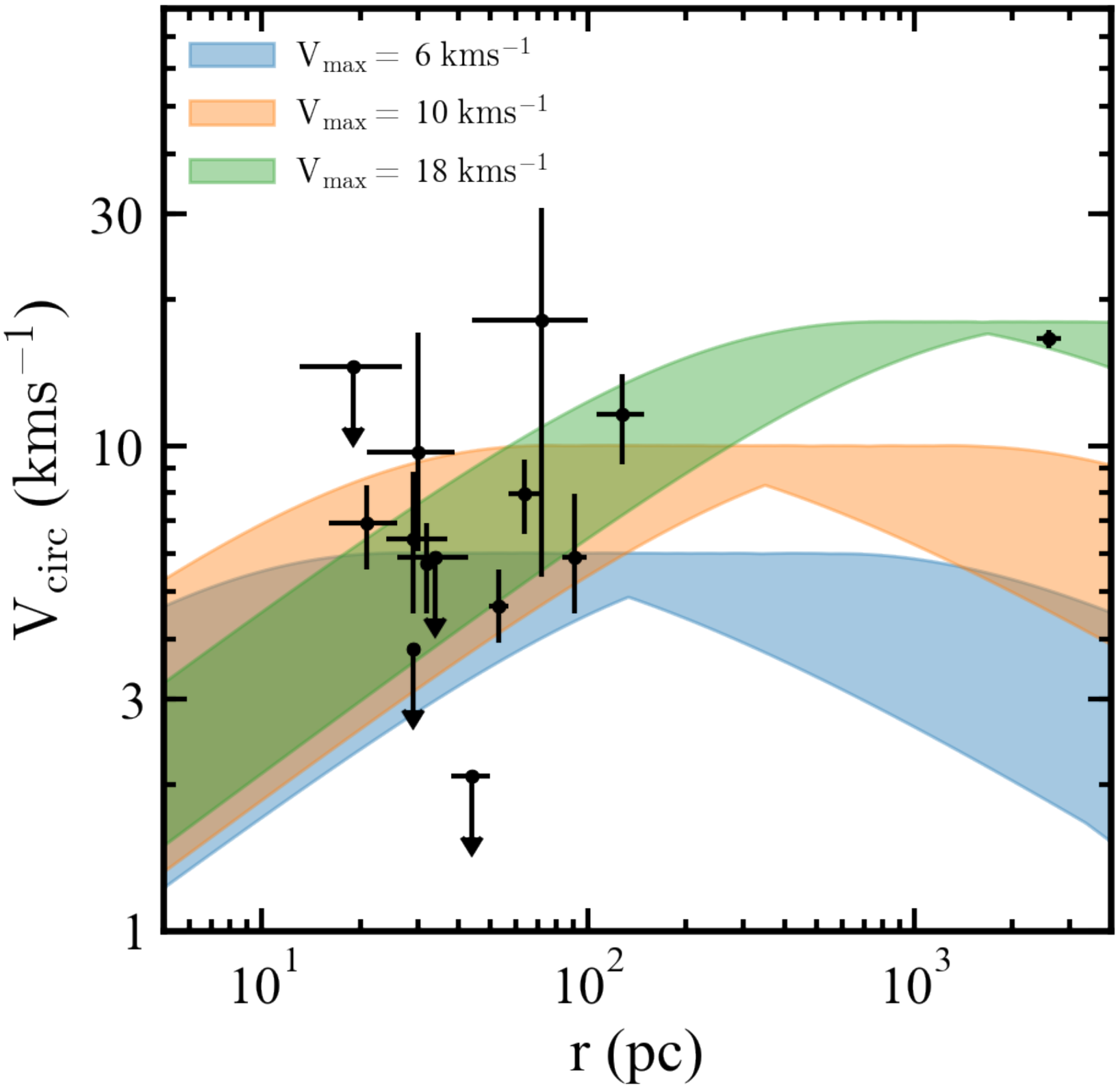
Preliminary!

Star formation in small halos



Preliminary!

Radial distribution of satellites



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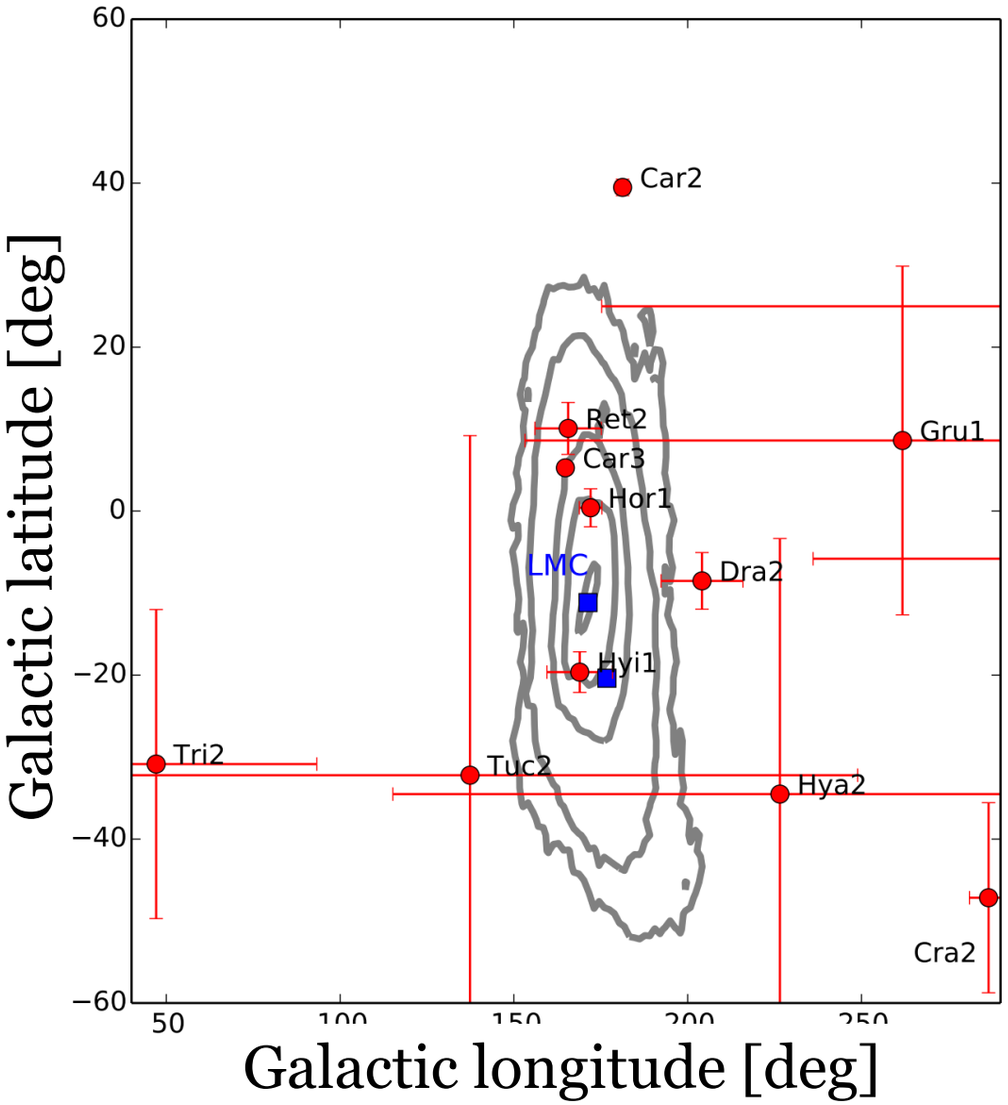
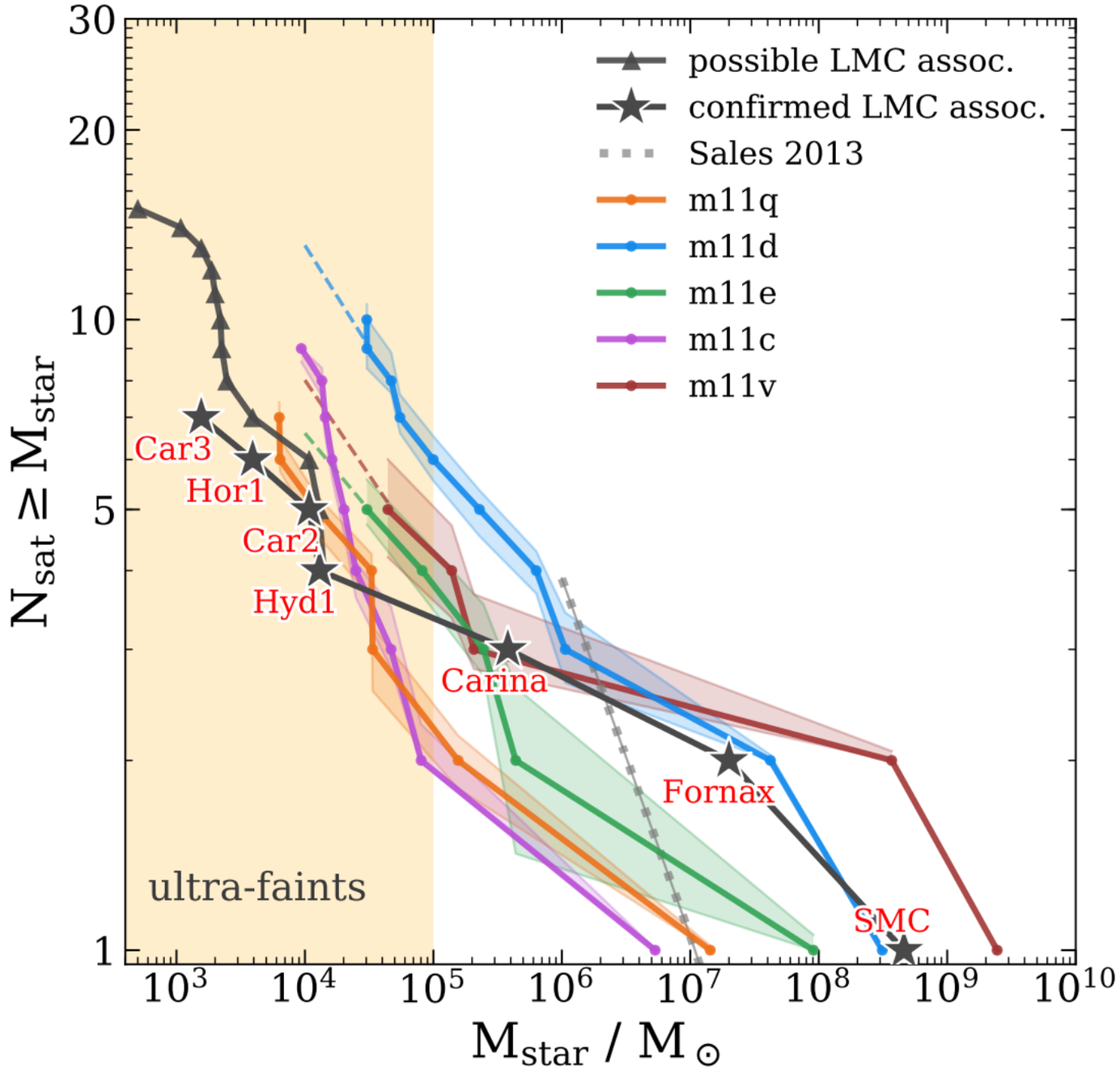


Some of the MW satellites show evidence of accreting with the LMC

Kallivayalil + 2018



Jahn + 2019