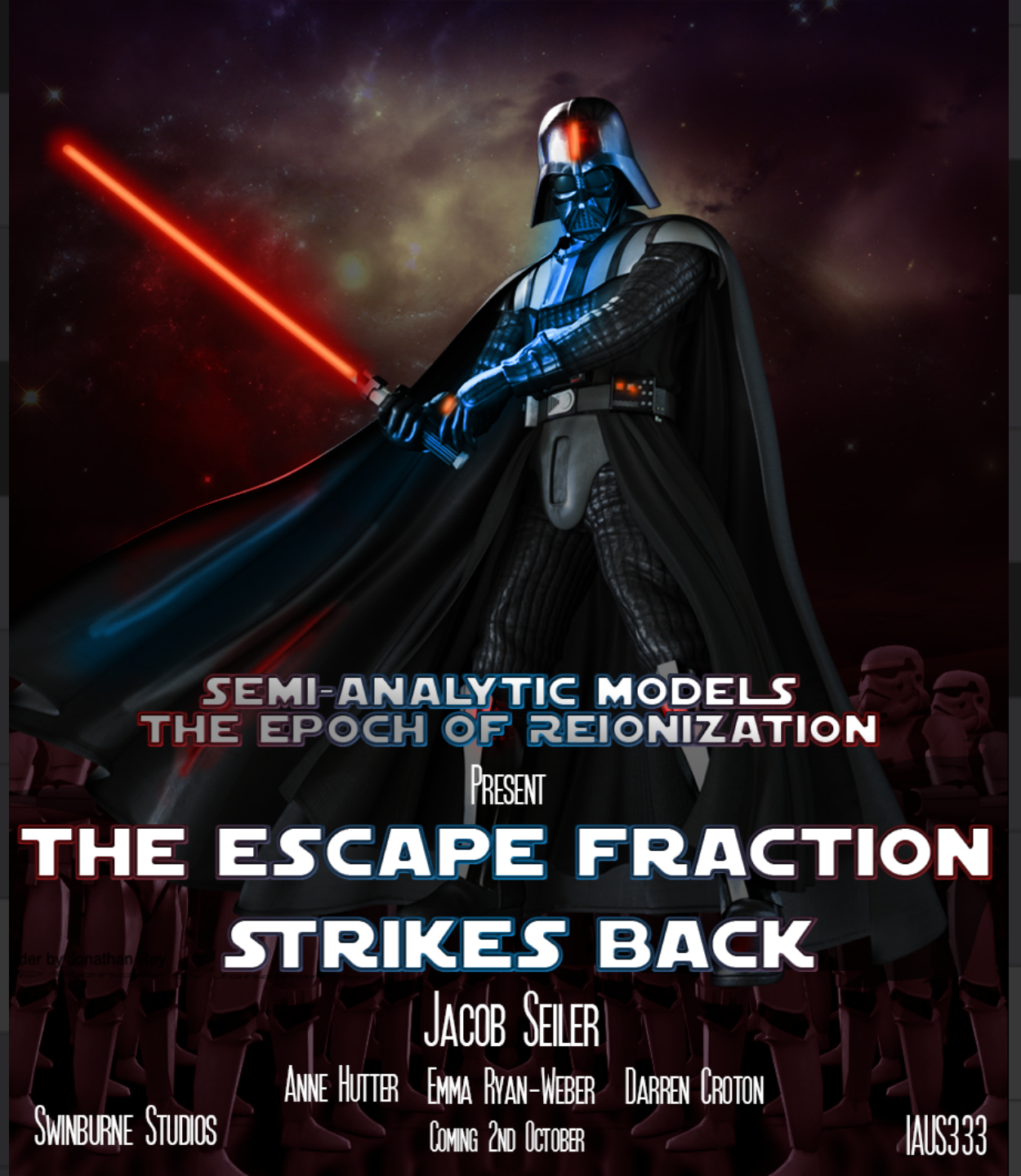
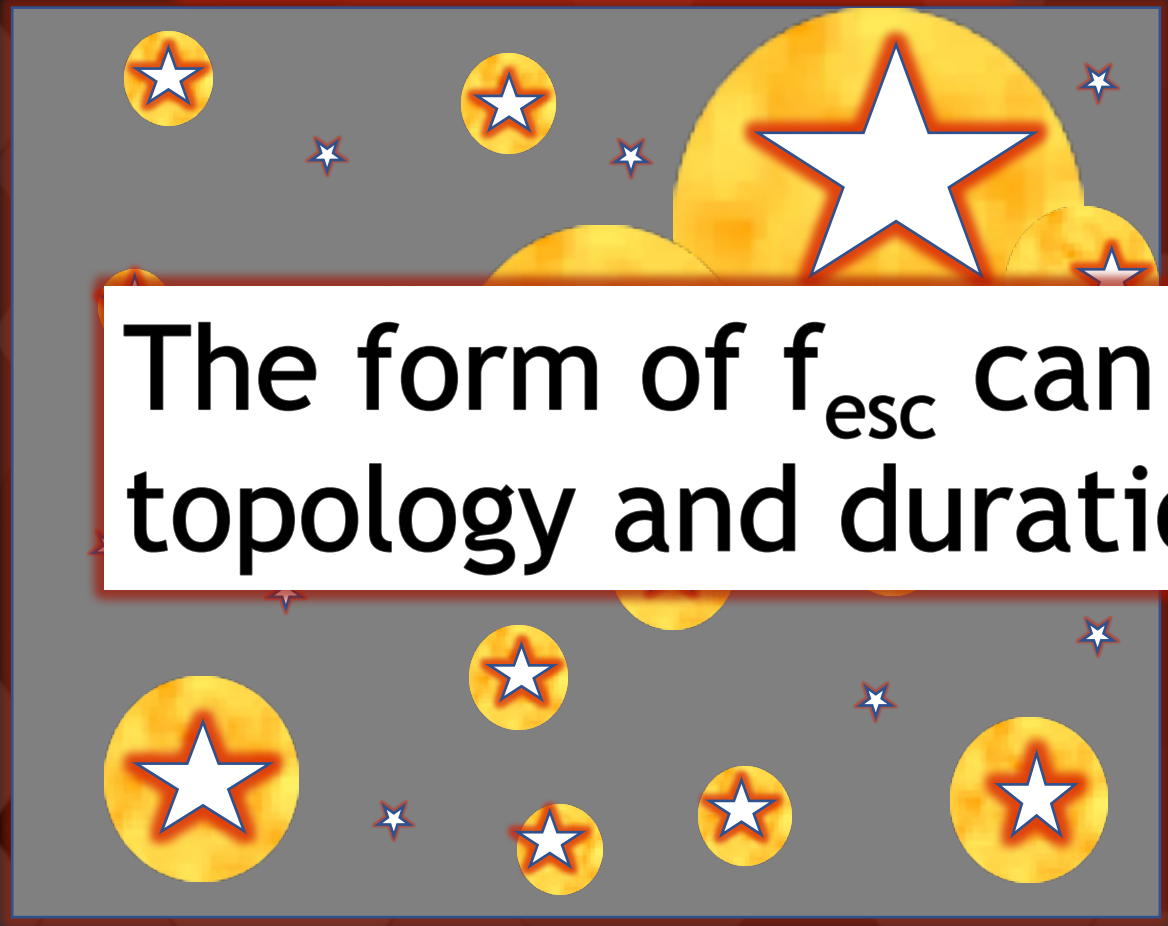

SEMI-ANALYTIC MODELS
THE EPOCH OF REIONIZATION
PRESENT
THE ESCAPE FRACTION
STRIKES BACK
JACOB SEILER
ANNE HUTTER EMMA RYAN-WEBER DARREN CROTON
SWINBURNE STUDIOS
COMING 2ND OCTOBER
IAUS333

# Why is $f_{esc}$ Important?

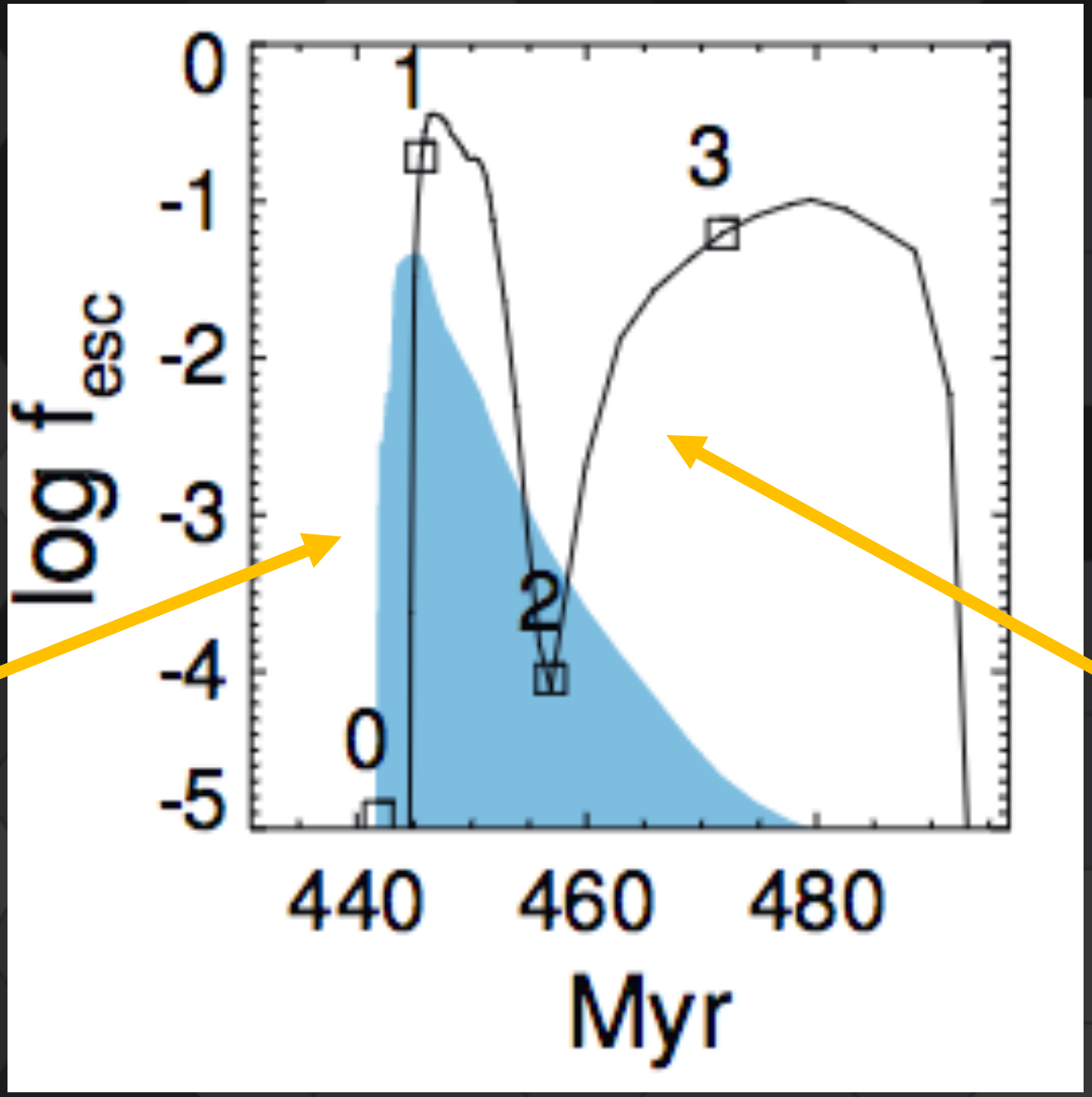
$f_{\rm esc} = \text{Constant}$



$f_{\rm esc} \propto \text{Mass}^{-1}$

The form of $f_{esc}$ can drastically affect the topology and duration of reionization.

# $f_{esc}$ Depends On Galaxy Processes




Radiation Feedback

SN Blowout

(Kimm et al., 2017)

# My Question

How does implementing a **physically motivated** $f_{esc}$ affect the evolution of ionized hydrogen? How does this interplay affect galaxy properties?

- How does the topology of reionization change?
- How does the duration change?

# Semi-Analytic Models

- Describes the flow of baryons within a galaxy.

  Hot gas cools : Move gas from hot to cold.
  Cold gas collapses : Move gas from cold to stars.
  Stars explode : Cold gas reheated + hot gas ejected.
  Etc...etc...etc...

- Modular. Perfect for testing specific galaxy evolution prescriptions.
- Fast (compared to hydro). Perfect for finding rare events within large volumes.

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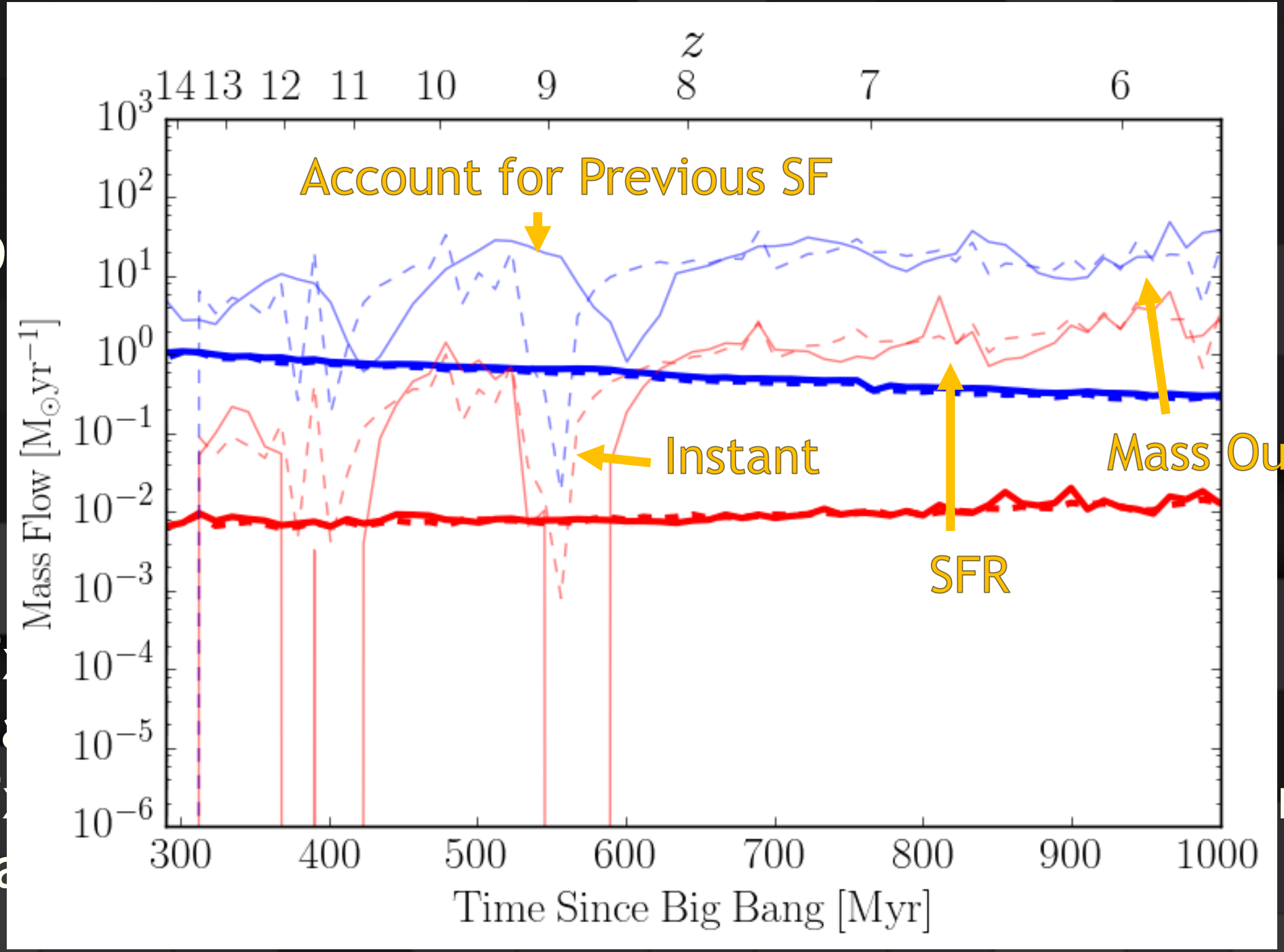

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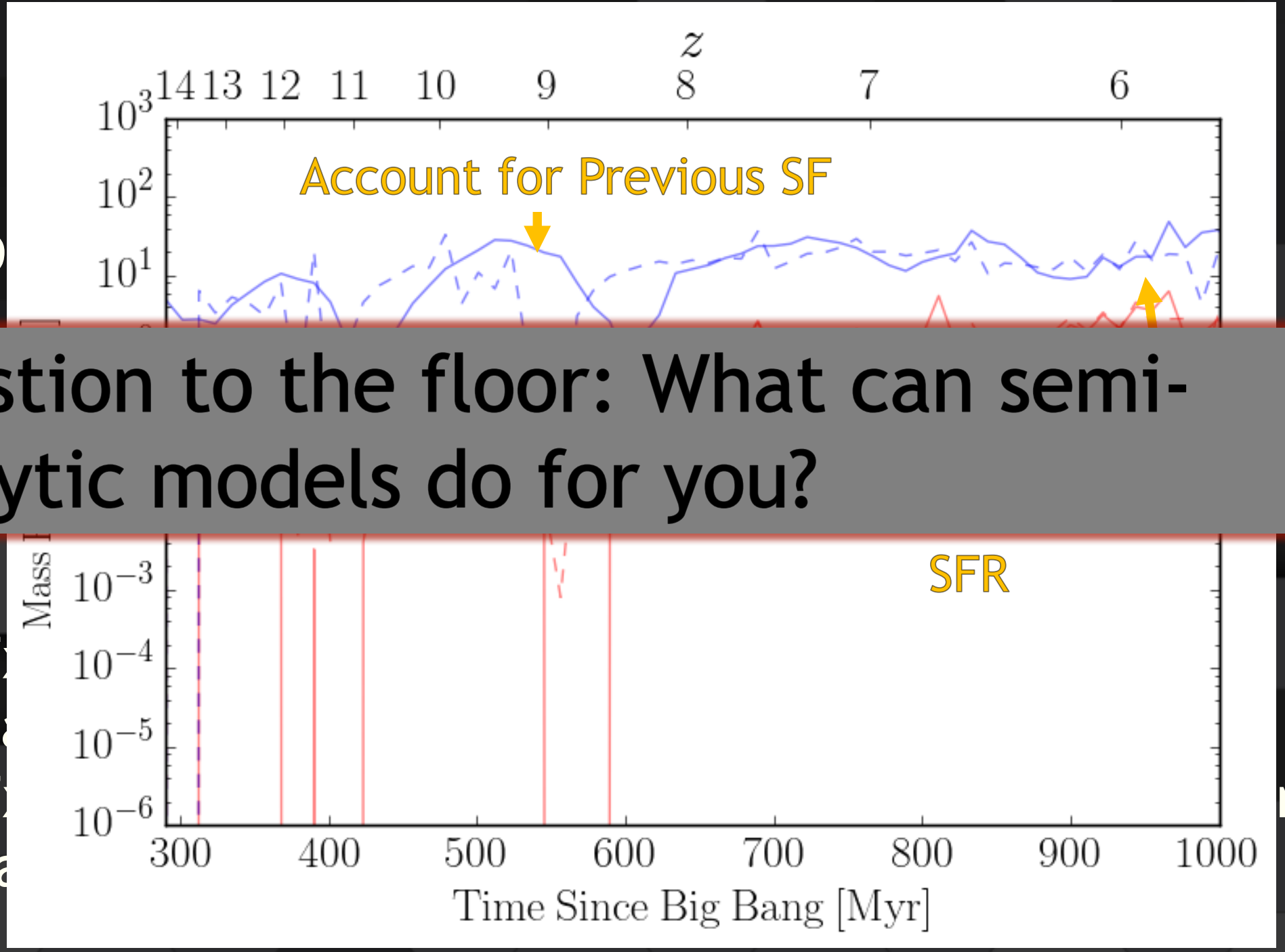


**Question to the floor: What can semi-analytic models do for you?**

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# Escape Fraction Parameterization

$$f_{\mathrm{esc}} = \mathrm{Constant}$$

$$f_{\mathrm{esc}} \propto M_{\mathrm{H}}^{\beta}$$

$$f_{\mathrm{esc}} \propto f_{\mathrm{Ejected}}$$

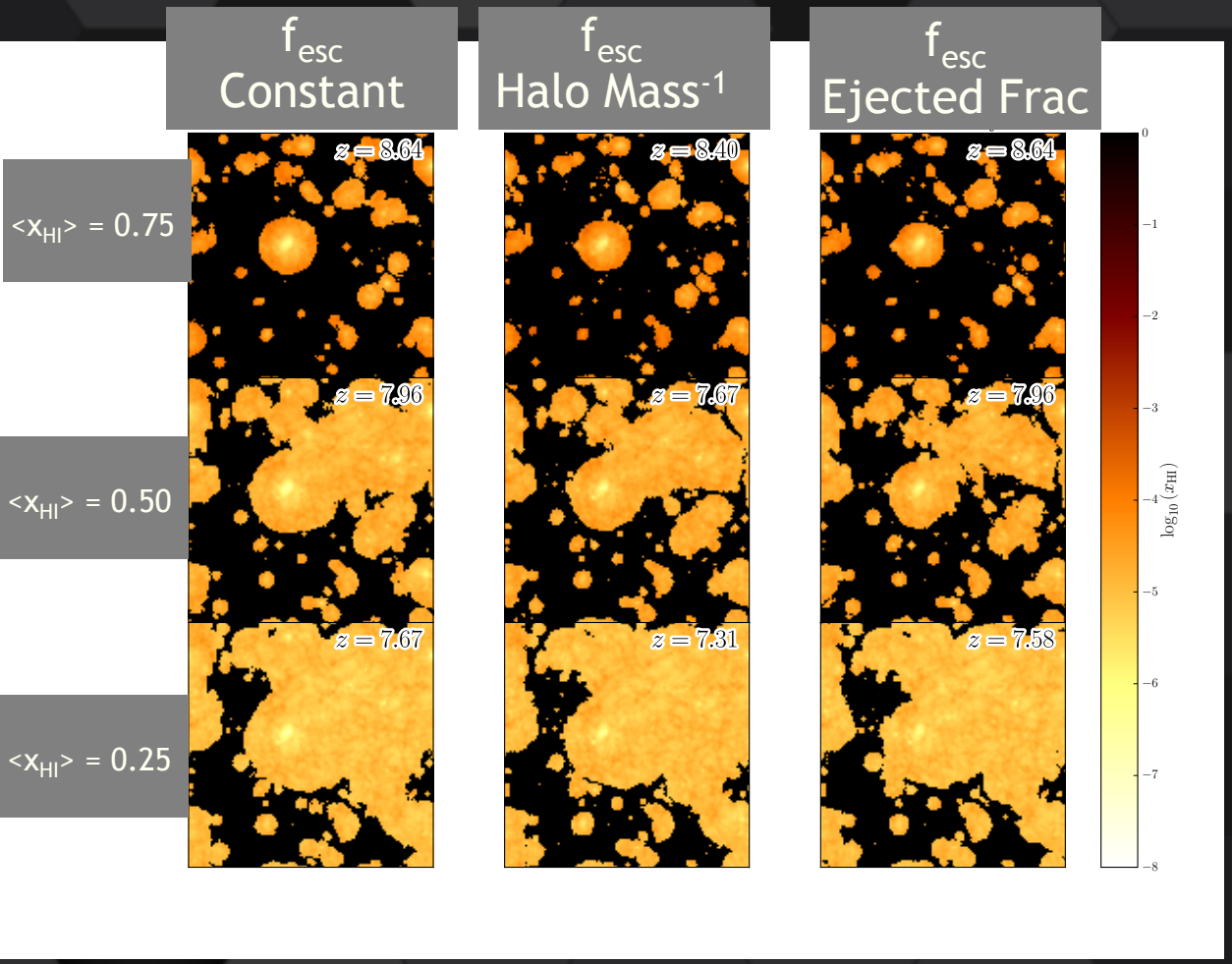
# Escape Fraction Parameterization

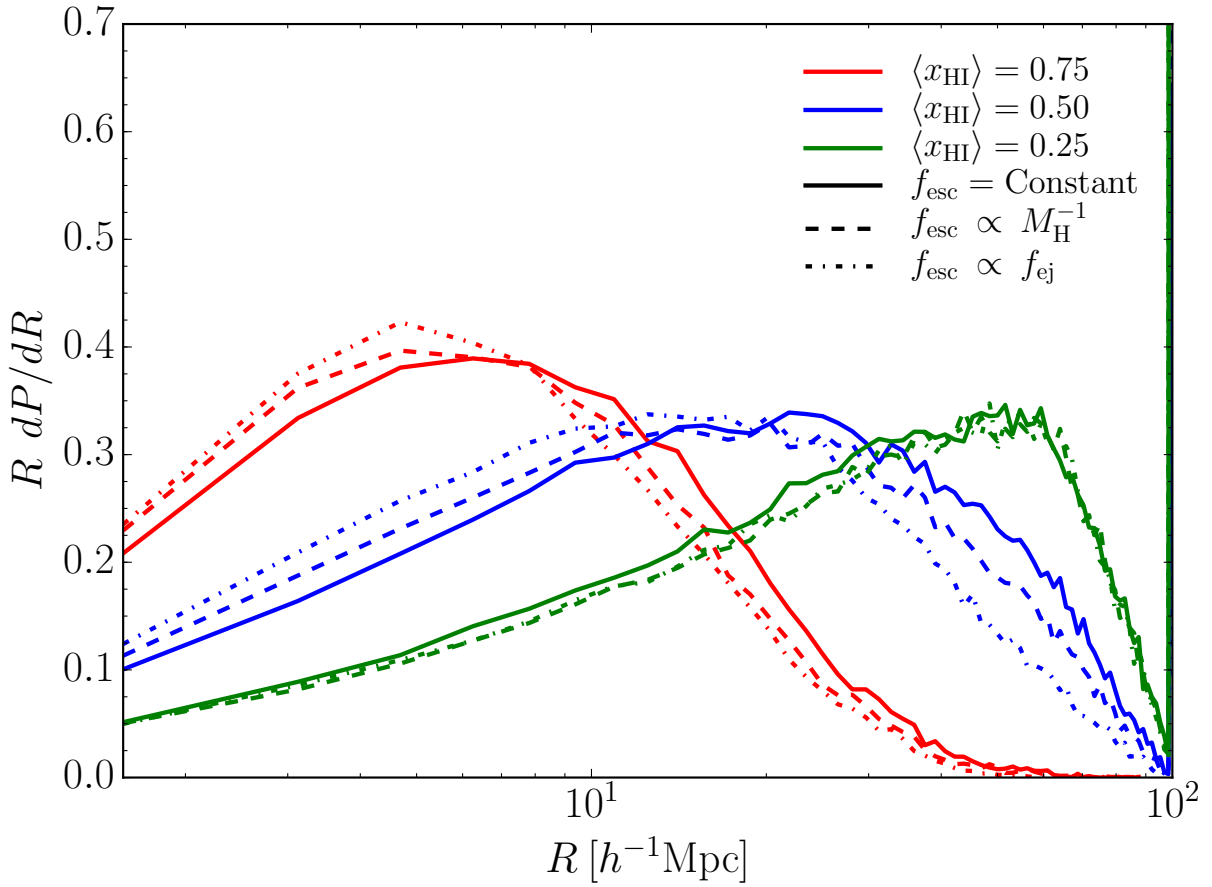
$$f_{\mathrm{esc}} = \mathrm{Constant}$$

Question to the floor: What galaxy properties/processes impact $f_{esc}$ the most?

$$f_{\mathrm{esc}} \propto f_{\mathrm{Ejected}}$$

# Modelling Reionization



# Summary

- $f_{esc}$ is a complex combination of parameters depending upon galaxy properties.

- Semi-Analytic Models offer the ability to compare different galaxy evolution prescriptions with cheap computational time.
  - What can they do for you?

- Linking $f_{esc}$ to galaxy properties can have a noticeable effect on reionization topology. How does this couple into galaxy evolution?