Family Trees of Black Holes

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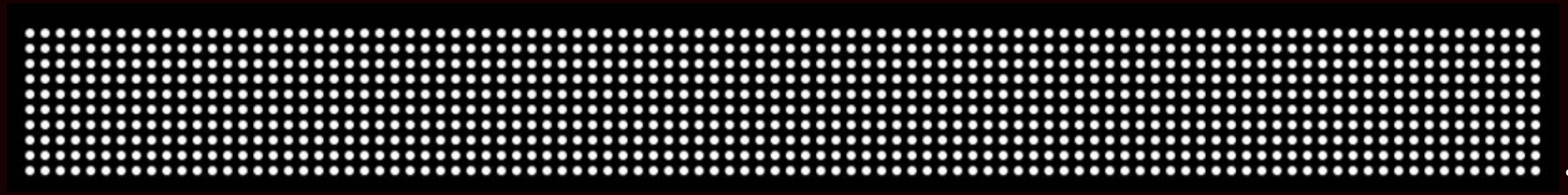
Introduction

- The Big Bang generates Hydrogen and Helium
- Population III stars = the first stars
- Population III stars are extremely massive
- What is the mass distribution?

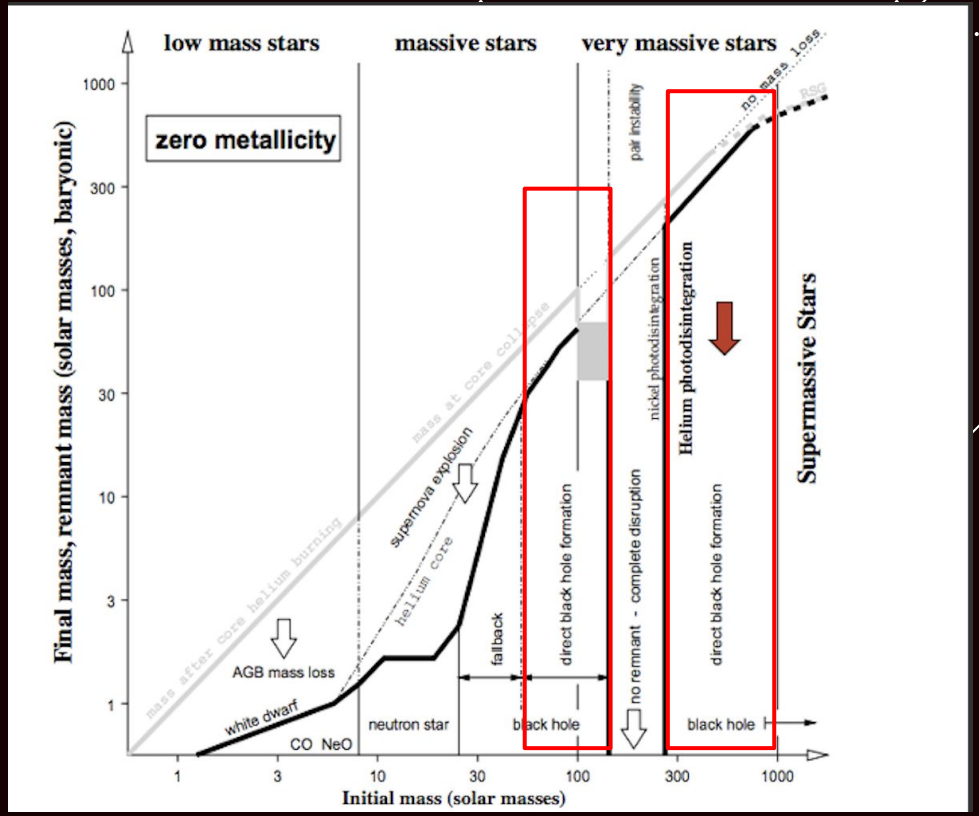


Methods

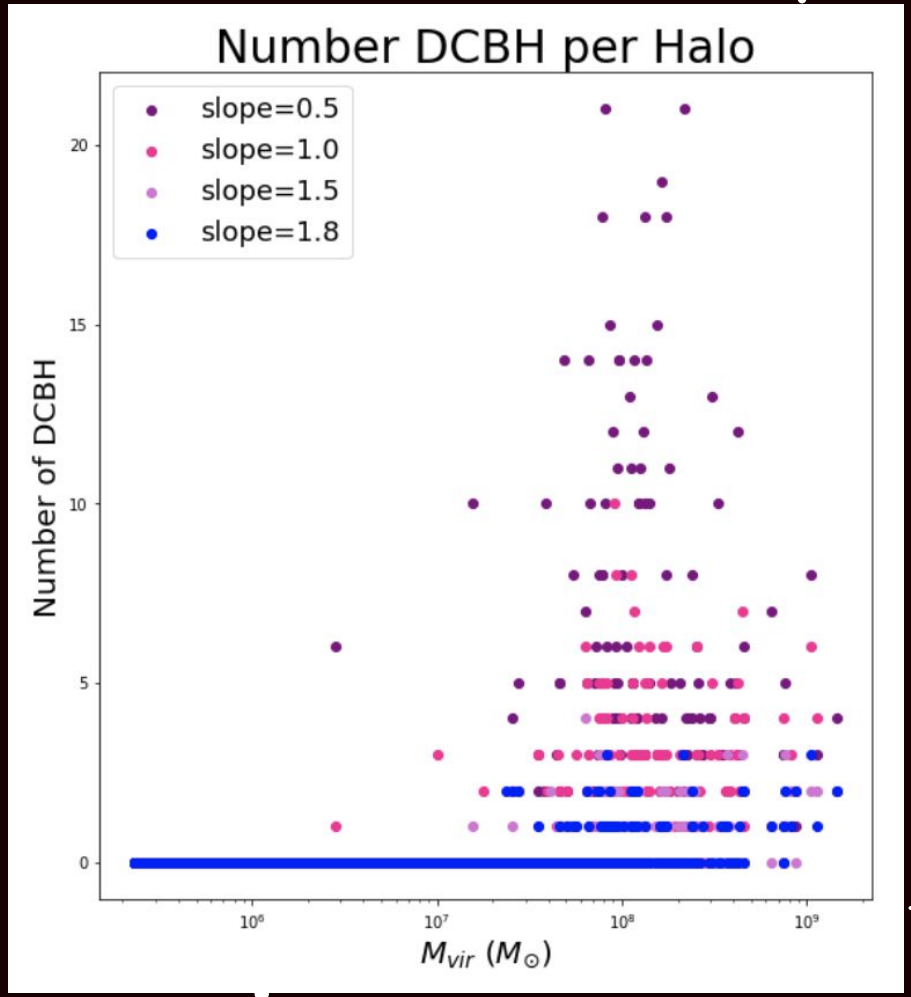
Supernova Explosions push heavy elements into the universe.

Direct Collapse Black Holes are what initiated the supermassive black holes that are still around today.

Merger trees act like family trees to follow back generations of black holes.



Heger and Woosley Diagram with modifications



Results

- Using the mass of the dark matter halo and the amount of gas available for star formation
- Look at masses of stars that have formed Direct Collapse Black Holes per halo
- Top heavy initial mass function

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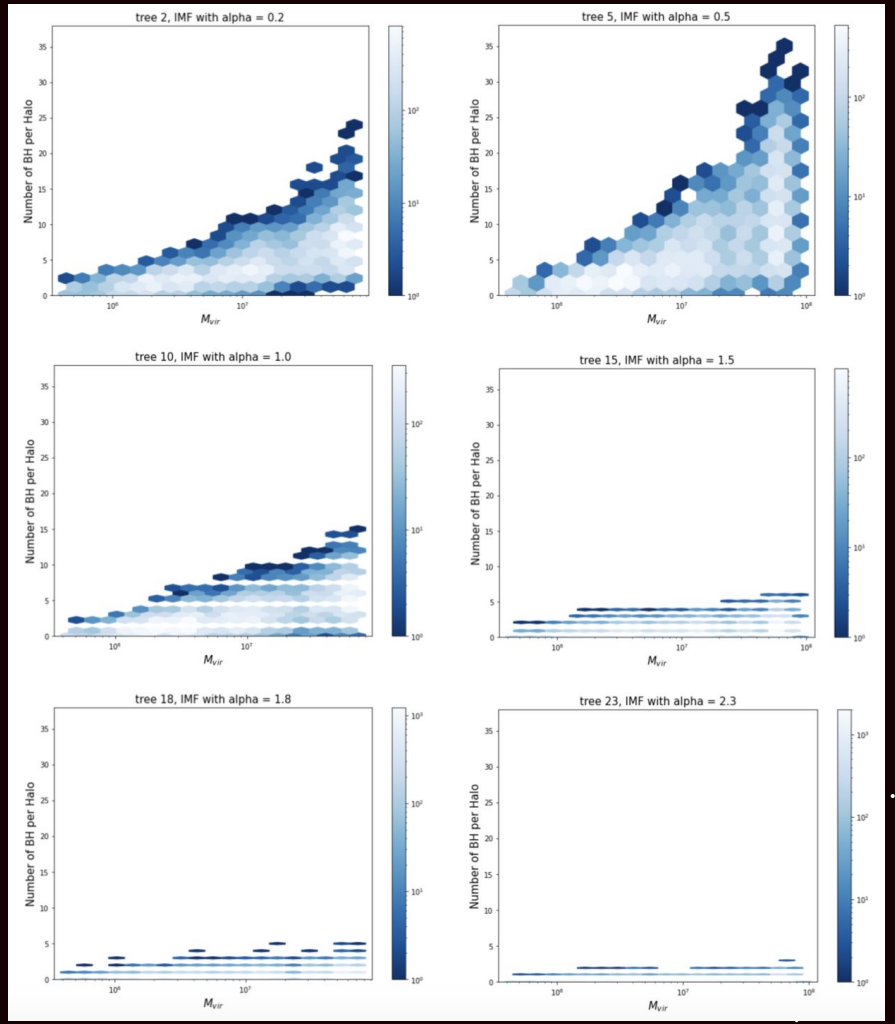
More Results

- Run the simulation numerous time and look for convergence
- By the law of large numbers, more runs means less uncertainty
- Lighter coloring indicates more runs that output a given result



Moving Forward

- The initial mass function is top heavy
- The slope of the initial mass function will become more clear with more simulated runs

Find the Upper Mass Limit

Overview

1

Introduction

Population III stars

2

Methods

Direct Collapse Black Holes

3

Results

Top Heavy Initial Mass Function

4

What's Next?

Upper Mass Limit

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Sci - Com Statement

Everything, the carbon in our bodies and the oxygen we breathe, comes from stars, but what did the *first* stars look like? The Big Bang created hydrogen and helium out of which the first stars formed. The first supernovae explosions catapulted heavier elemental enrichment throughout the cosmos. However, the first stars are too faint to be seen by modern telescopes. Instead, we learn about them from the signatures left behind when the most massive of these stars collapsed directly into black holes. We use simulations of the formation of the first stars to determine where these black holes end up.