

The Cosmic Rate of type IIa Supernovae

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Outline

- Introduction
- What is a type II_n supernova?
- Motivation
- Results
- Summary & Conclusion



Dana Berry, Skyworks Digital, SWIFT, NASA

Introduction

- PhD Student - Final year
- DARK, NBI
- Main Supervisor is Jens Hjorth
- Main research on interacting SNe
- Vice-chair PhD Committee of SCIENCE 2021+2022
 - Leading group investigating prevention and handling of sexual harassment and bullying
 - Pushing for more employed PhD students at SCIENCE
- Member of NPN 2021-2023



PhD Committee of SCIENCE - Summer 2022



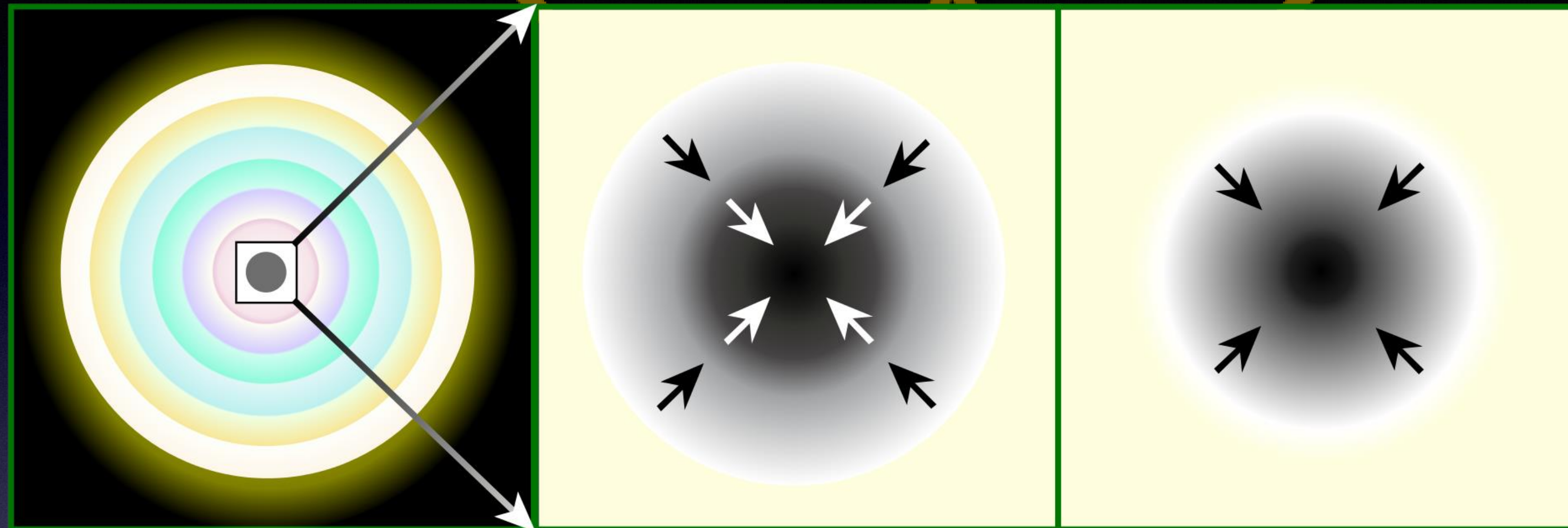
NBI PhD Day 2023



What is a Type IIa Supernova?

DARK

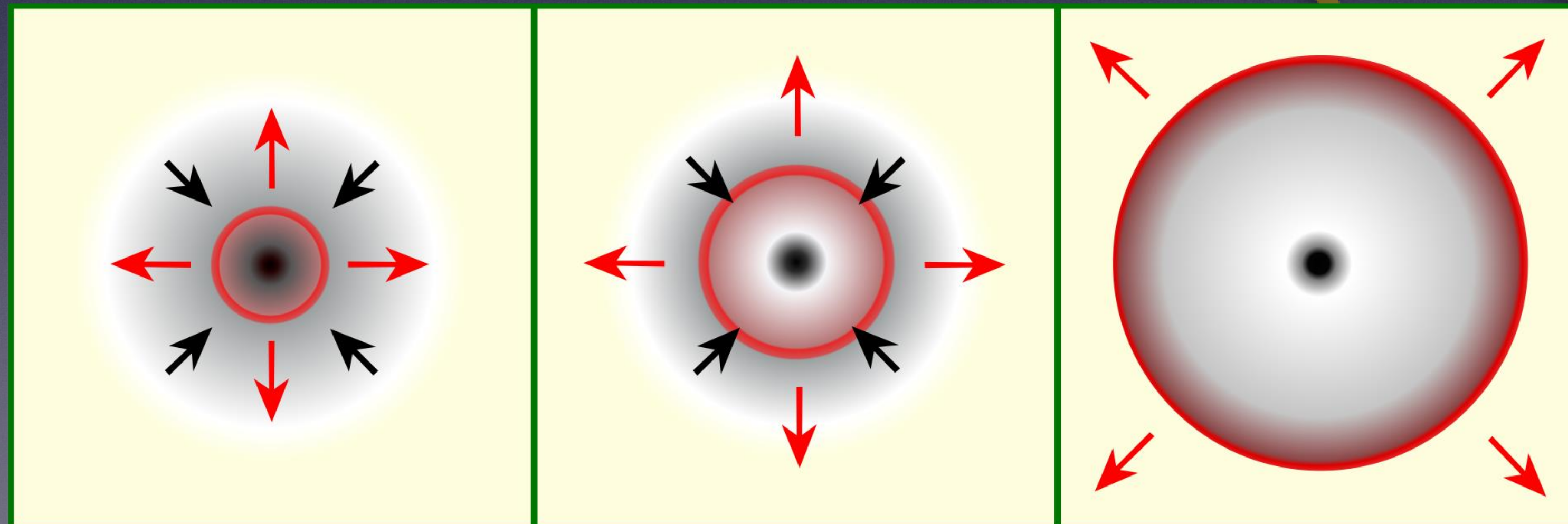
Core Collapse



a

b

c



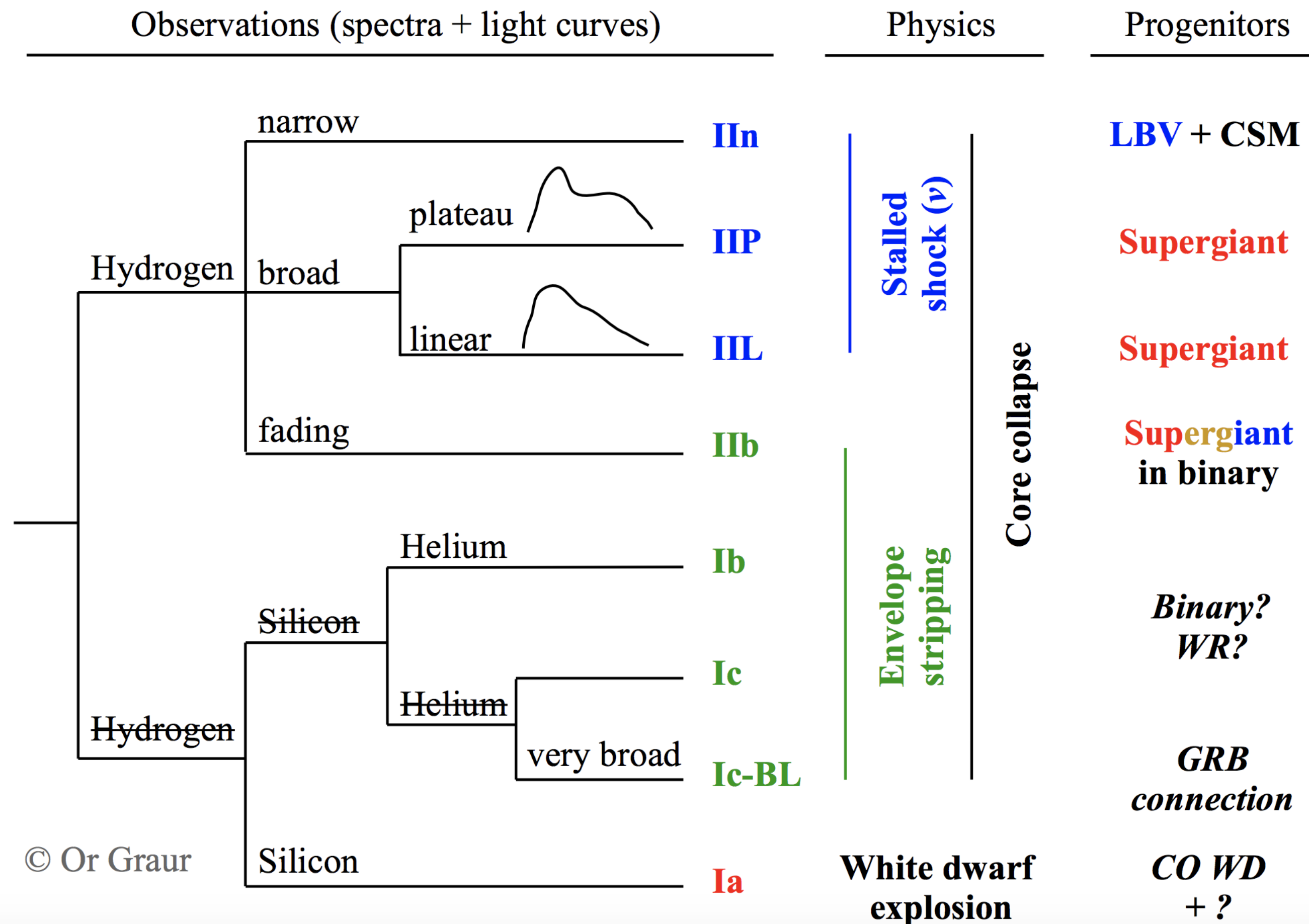
d

e

f

Supernovae

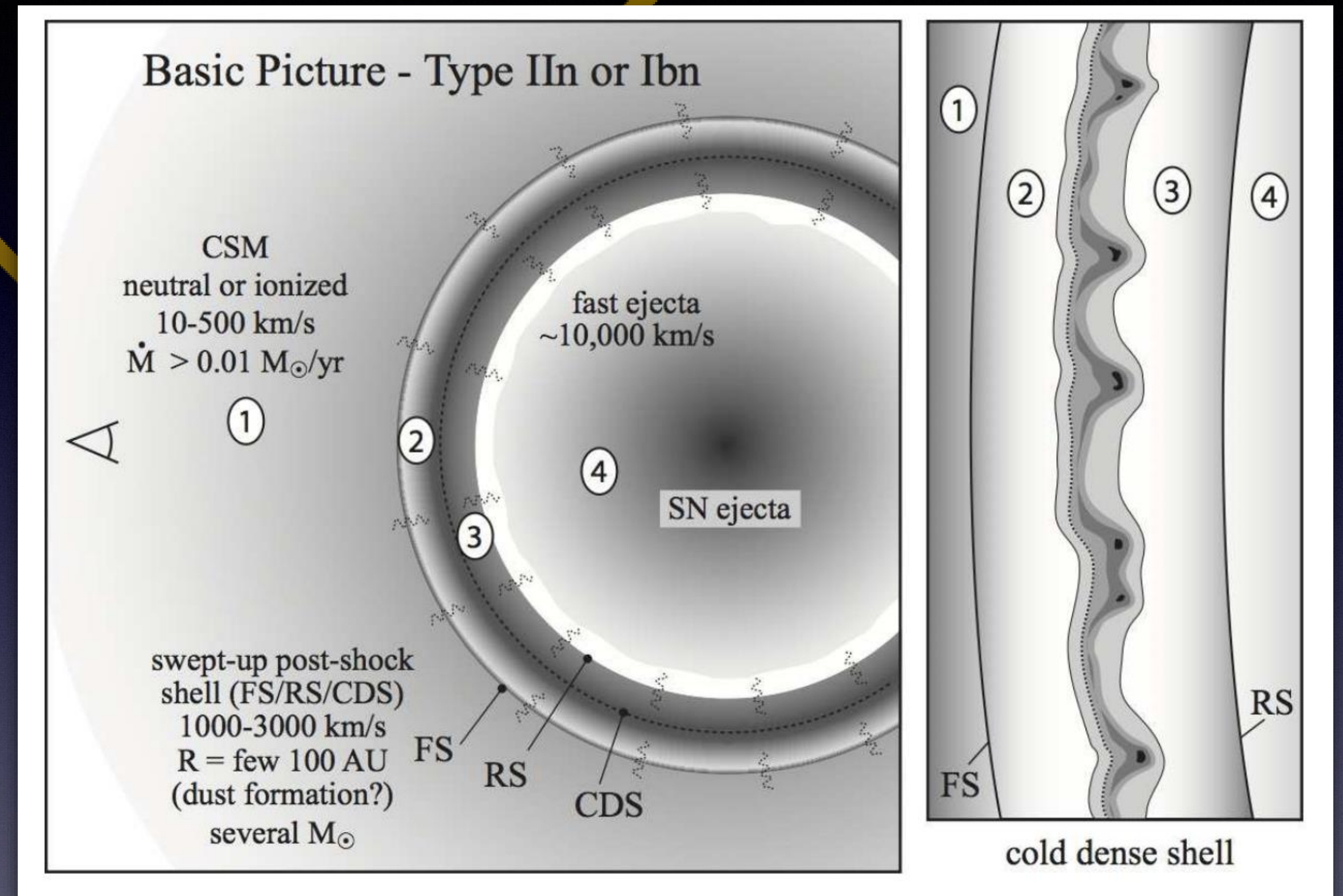
The Supernova Tree of Death



© Or Graur

Type II_n Supernovae

- Interacting type
- Circumstellar material
- Dust
- Narrow lines
- Luminous Blue Variable progenitor
- Bright events



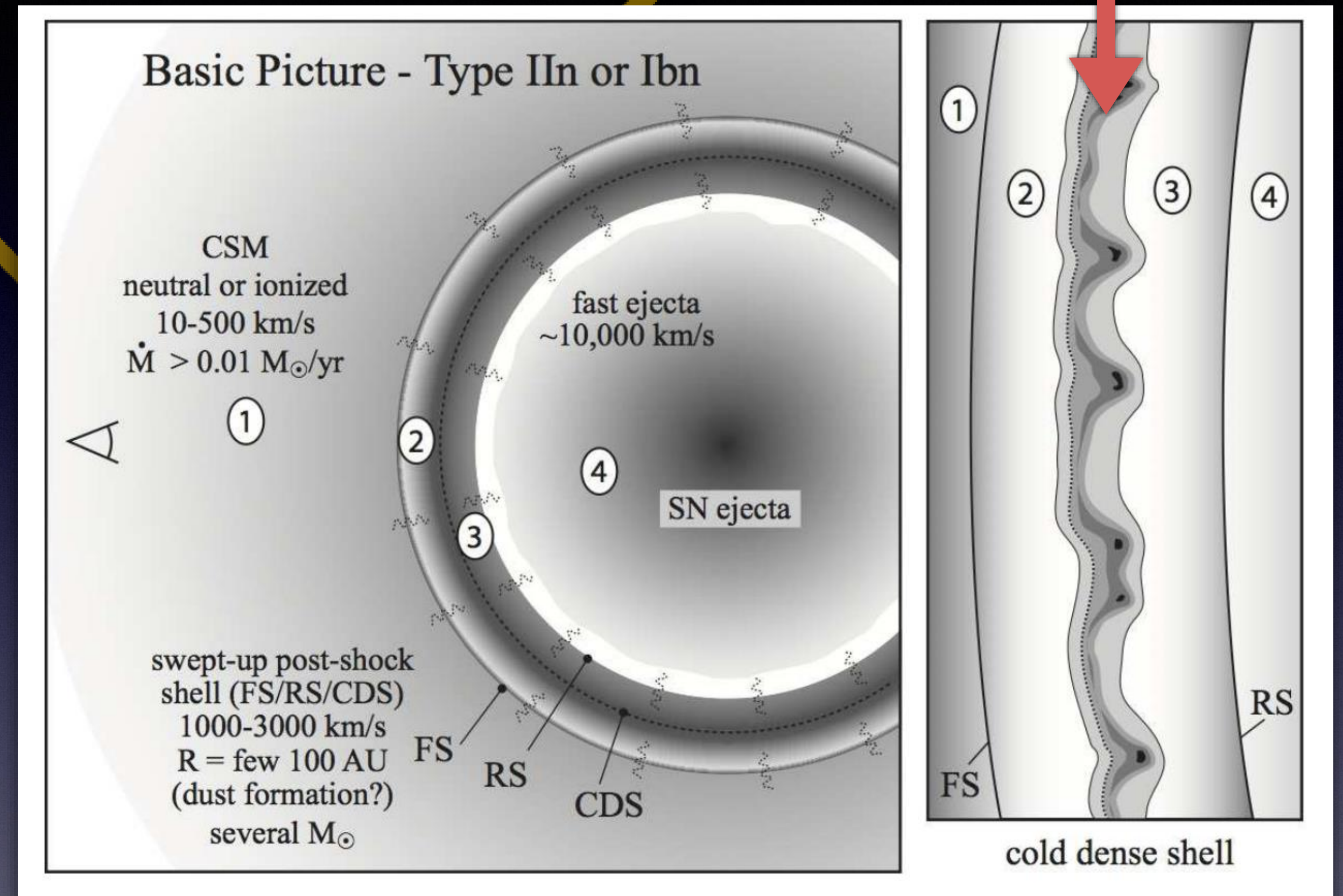
Smith 2017

- Zone 1. The unshocked CSM outside the forward shock (photoionized).
- Zone 2. The swept-up CSM that has been hit by the forward shock.
- Zone 3. The decelerated SN ejecta that have encountered the reverse shock.
- Zone 4. The freely expanding SN ejecta.

Type II_n Supernovae

Dust production?

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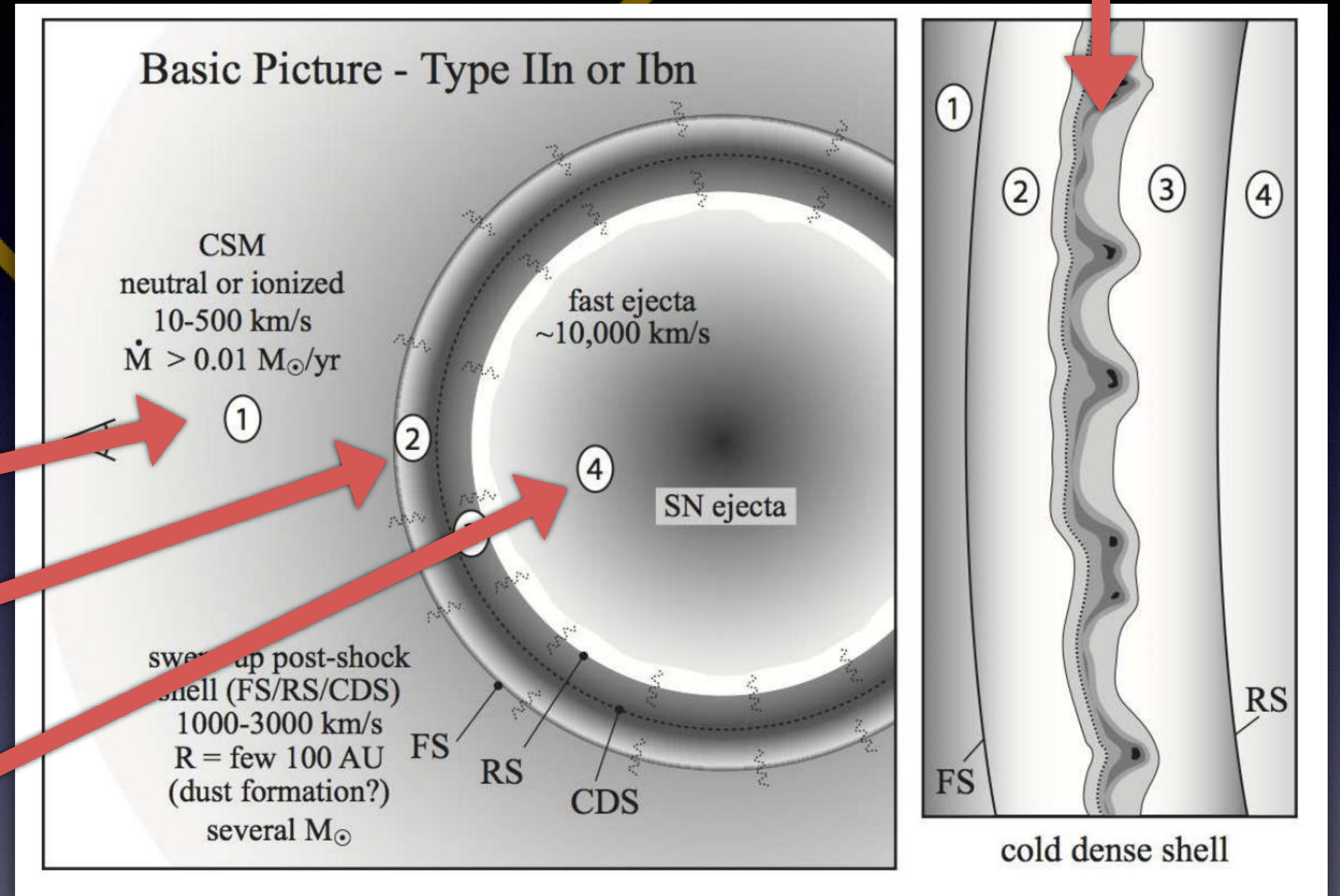
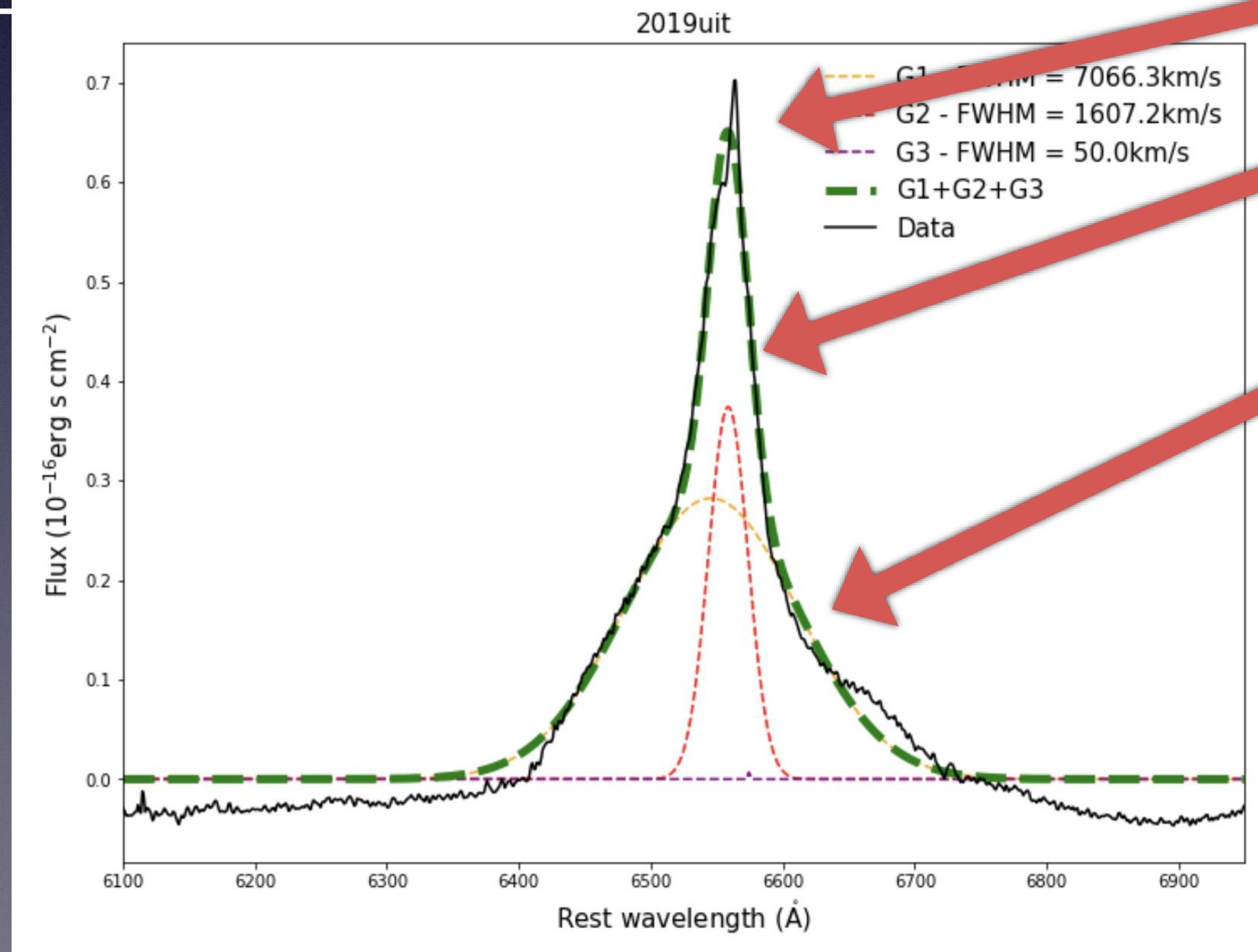
Smith 2017

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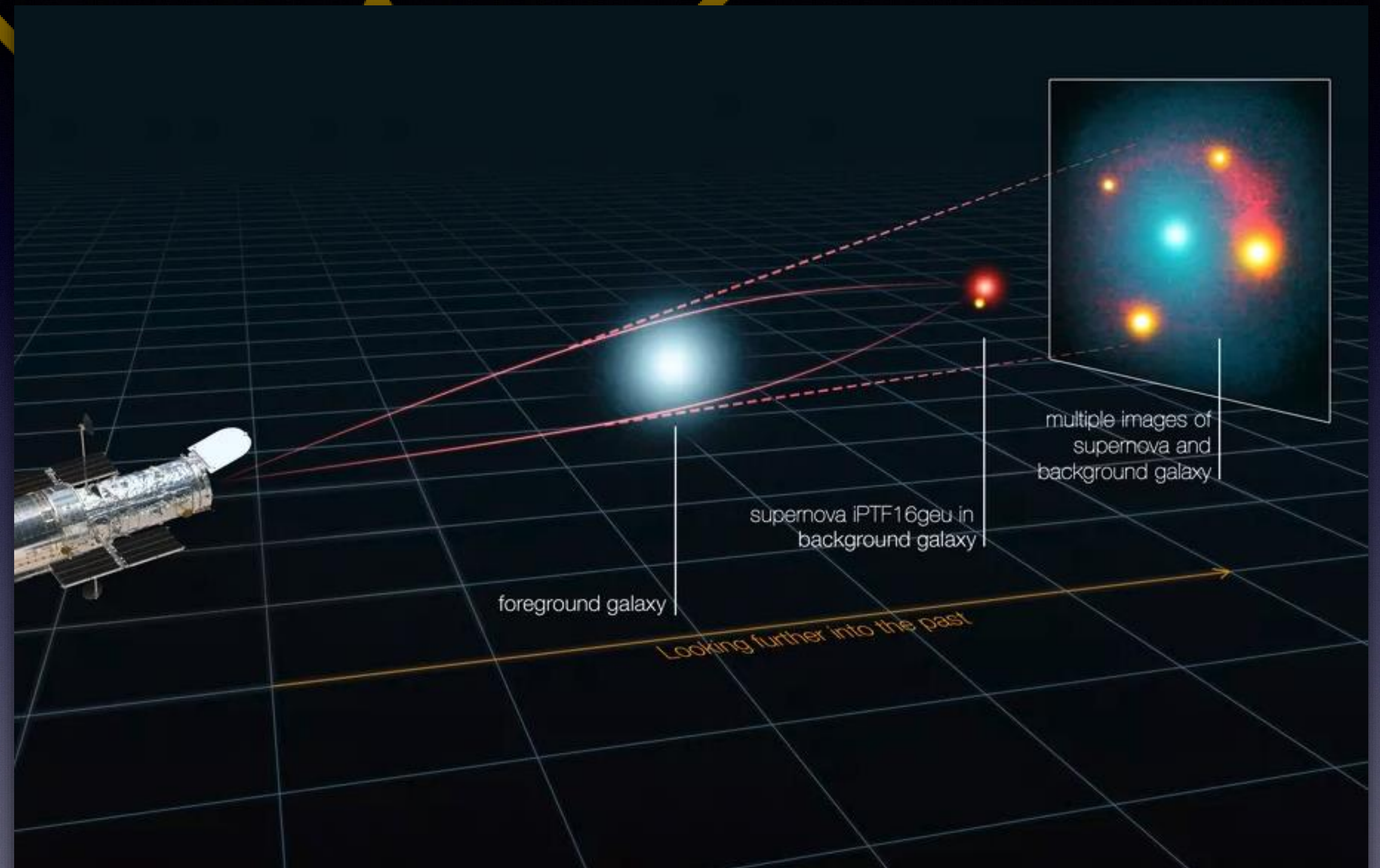


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Gravitational Lensing

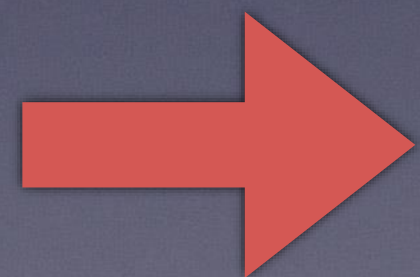
- It will be common among lensed supernovae
- Bright events: easier to observe at a distance
- What is lensing?
- Time delay between images
- Constrain cosmology
- Local expansion rate, Hubble Constant
- Hubble tension



ALMA (ESO/NRAO/NAOJ), L. Calcada (ESO), Y. Hezaveh et al., edited and modified by Joel Johansson

Why Do We Care About the Rate of IIn?

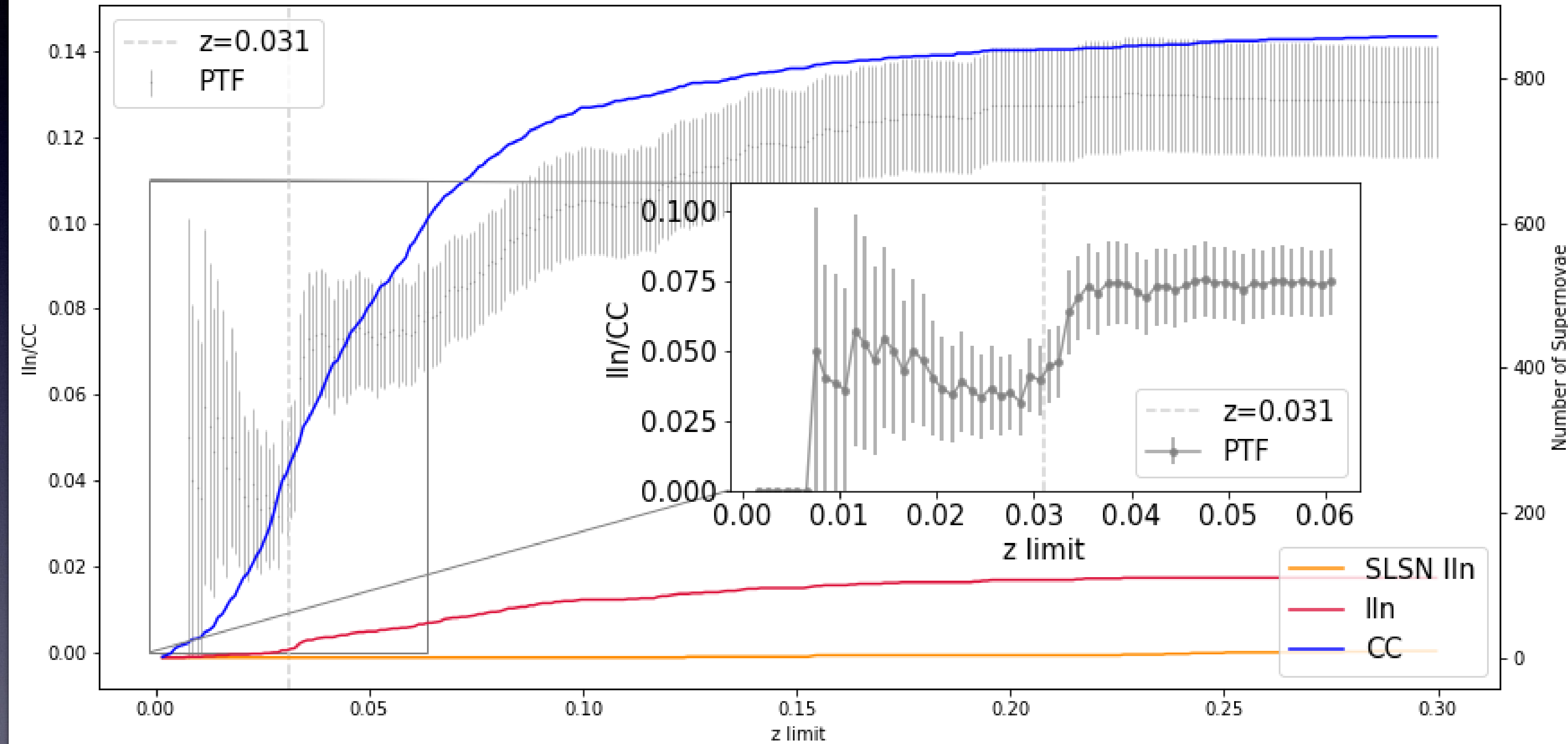
- Understanding Massive Stars
- Dust-production in the Universe
- Gravitational Lensing



Knowing the frequency of type IIn supernovae is key

Updated IIn Rate

- Ratio
- Data contains 111 IIn and 888 CC
- Not complete!
- Cannot make a controlled experiment
- Estimate completeness redshift
- +1 Dataset
- Result: 0.047 ± 0.009
- Rare type



Summary & Conclusion

- Type II_n supernovae are core collapse supernovae interacting with H-rich CSM
- Characterised by narrow Hydrogen lines in spectra
- Massive star progenitors
- Could help explain cosmic dust
- Interaction can create very luminous events
- Many gravitationally lensed supernovae will be II_n
- Intrinsically rare at 4.7% of all core collapse supernovae

Thank you!

DARK