

Local Type Ia Supernova Progenitors

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 @ashpags



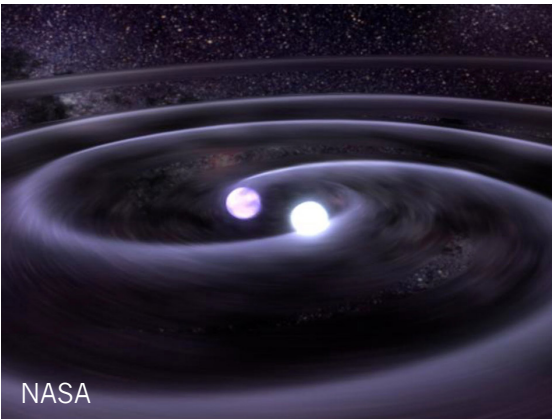
We have the first definitive solution:
SNR 0509-67.5 had a **double-degenerate progenitor**.



NASA/ESA/STScI/AURA/Hughes

There are two main proposed channels to Ia supernovae; we can distinguish between them by looking for “**leftover**” **ex-companion stars**.

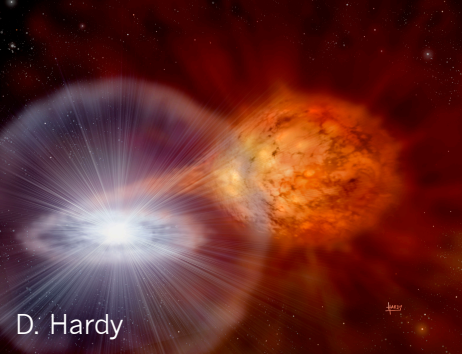
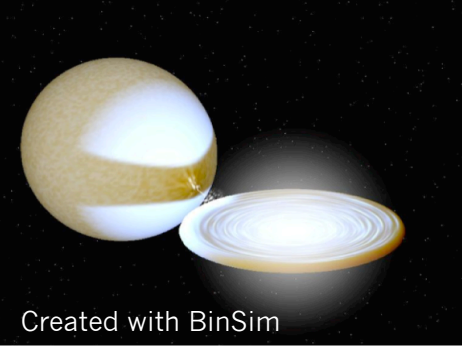
Double-degenerate



Nothing left over!

VS.

Single-degenerate

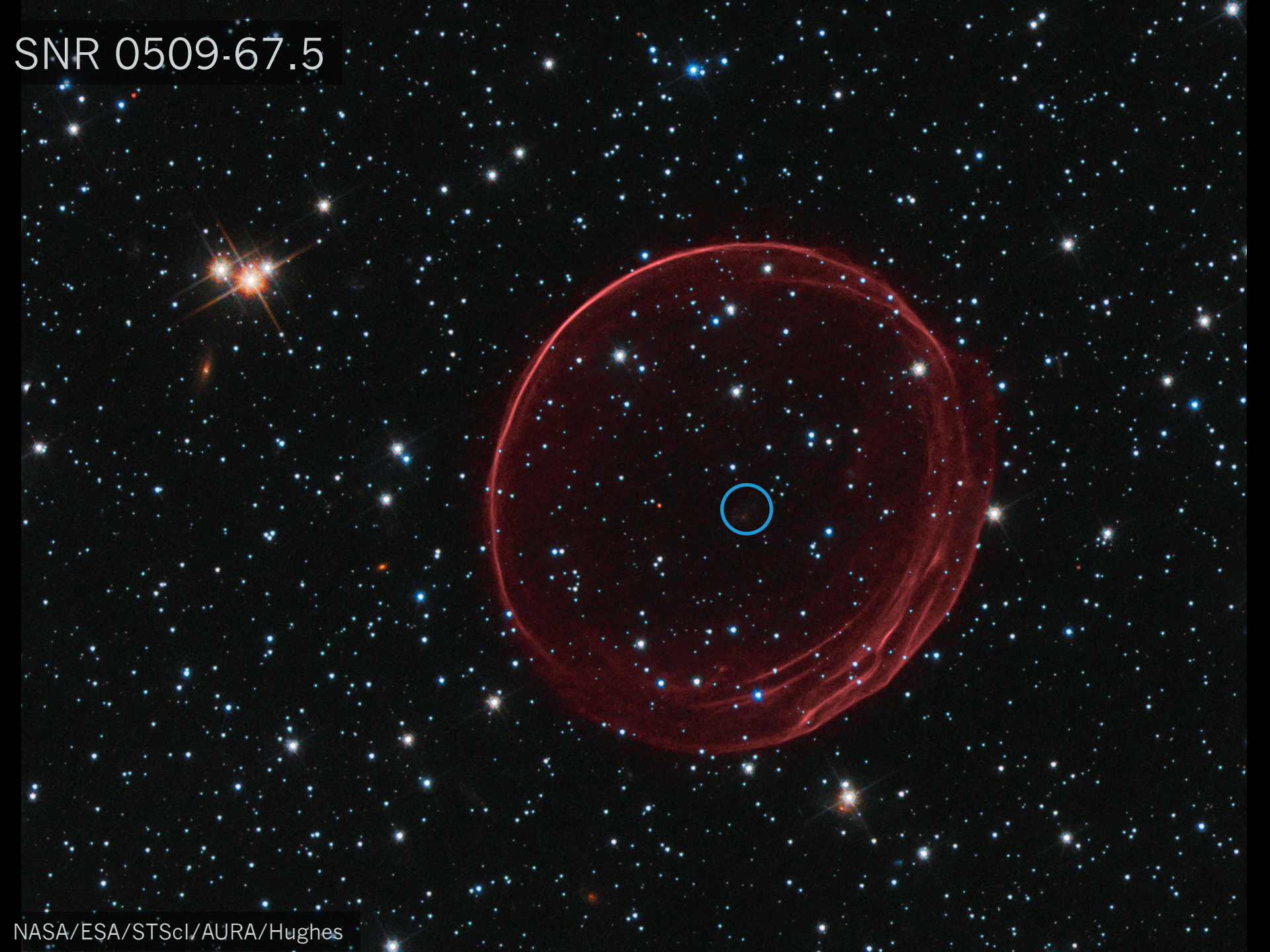


Single-degenerate

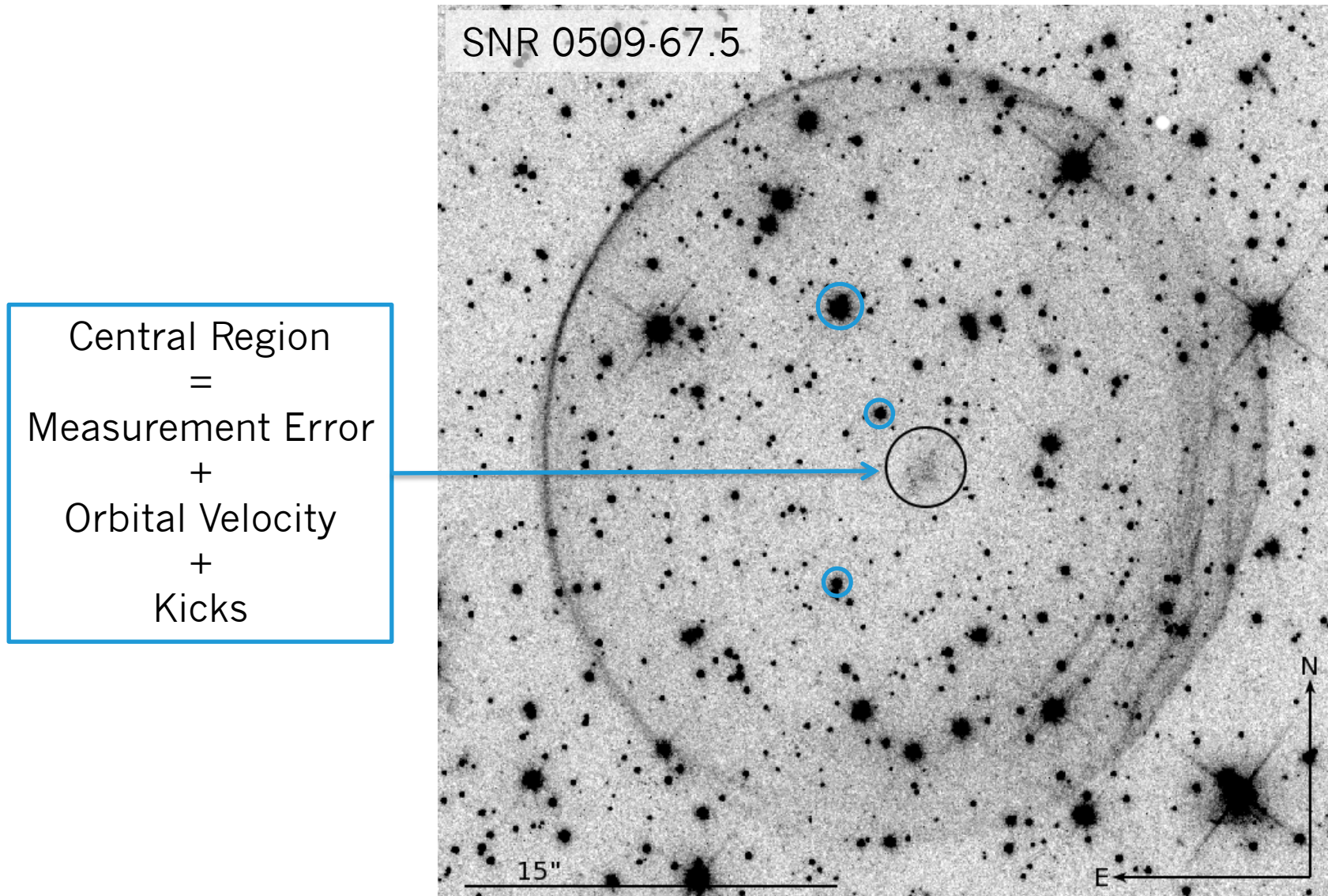


- Main Sequence Star (MS Mass > 1.16 M_⊙)
- or
- Subgiant
- or
- Red Giant

SNR 0509-67.5



The final error circle is **empty of stars** to a limiting mag of $V=26.9$, which corresponds to an absolute mag of $M_V=8.4$.



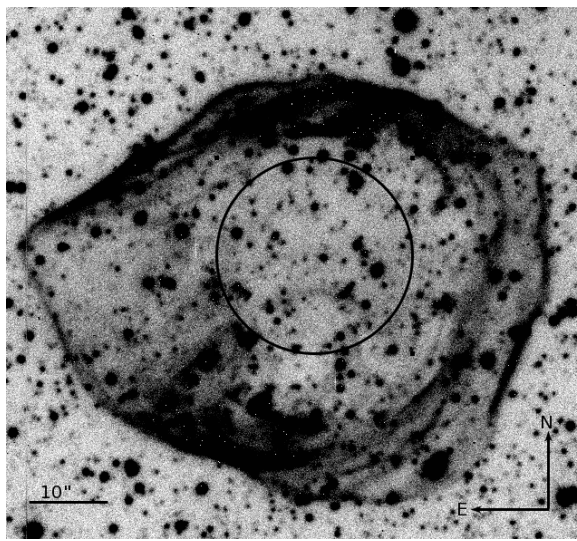
This particular Type Ia SN (SNR 0509-67.5)
had a **double-degenerate progenitor**.

Candidate Class	Surviving Companion
Double-degenerate	None
Recurrent Nova	Red Giant or Subgiant
Symbiotic Star	Red Giant
Persistent Supersoft Source	Subgiant or $> 1.16M_{\odot}$ MS
Helium Star Donor	Red Giant or Subgiant Core
Spin-Up/Spin-Down	Red Giant or Subgiant Core

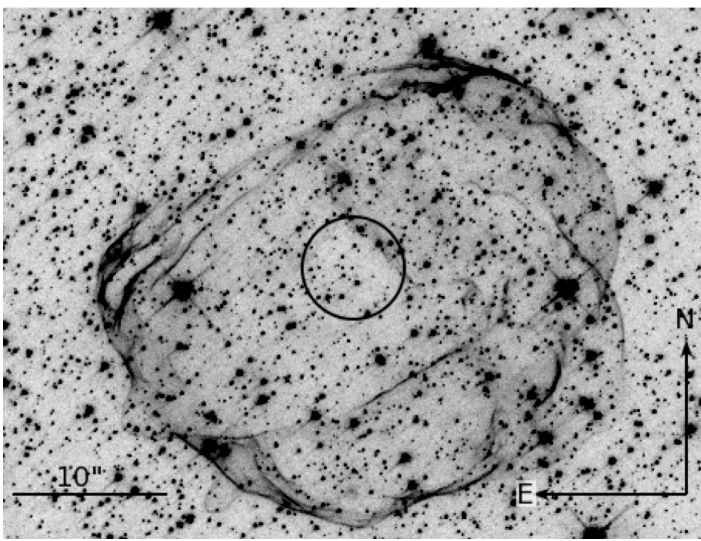


We can also look at the **other nearby Ia supernova remnants**.

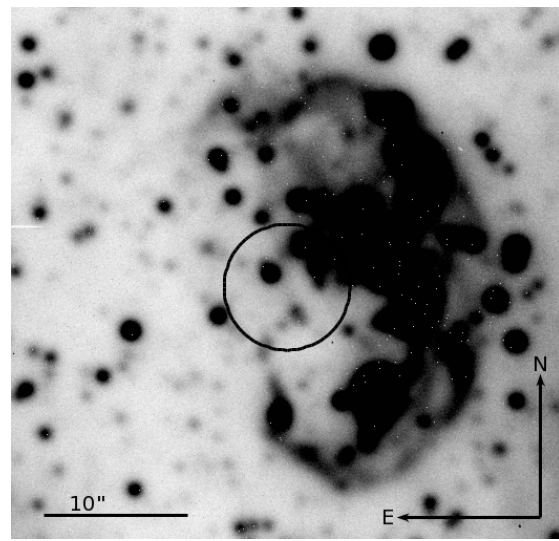
SNR 0505-67.9



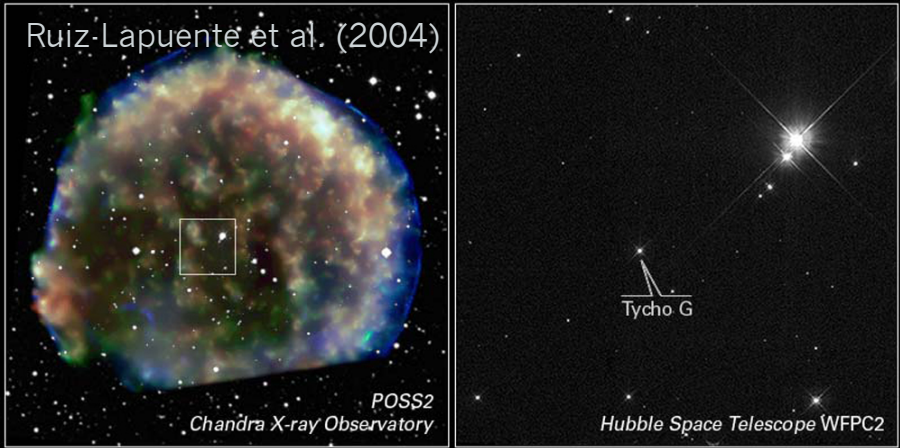
SNR 0519-69.0



SNR 0509-68.7



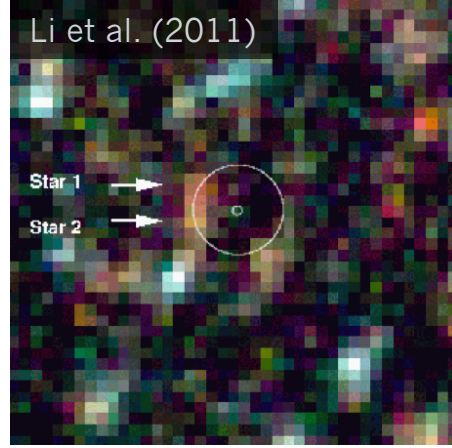
SN 1572 (Tycho)



SN 1006



SN 2011fe



Combining all local results, we have evidence for the existence of **multiple progenitor channels**.

	Double-Degenerate	Single-Degenerate		
Supernova	White Dwarf?	Main Sequence?	Subgiant?	Red Giant?
LMC SNR 0509-67.5	✓	X	X	X
LMC SNR 0519-69.0	?	?	X	X
LMC SNR 0505-67.9	?	?	?	?
LMC SNR 0509-68.7	?	?	?	?
SN 1006	?	?	X	X
SN 1572 (Tycho)	?	X	✓?	X
SN 2011fe	?	✓?	X?	X



- ✧ **First definitive solution** to the Type Ia Progenitor Problem
- ✧ By looking deep in the center of the remnant SNR 0509-67.5, we can **exclude all but one** possible progenitor model
- ✧ SNR 0509-67.5 had a **double-degenerate progenitor**

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