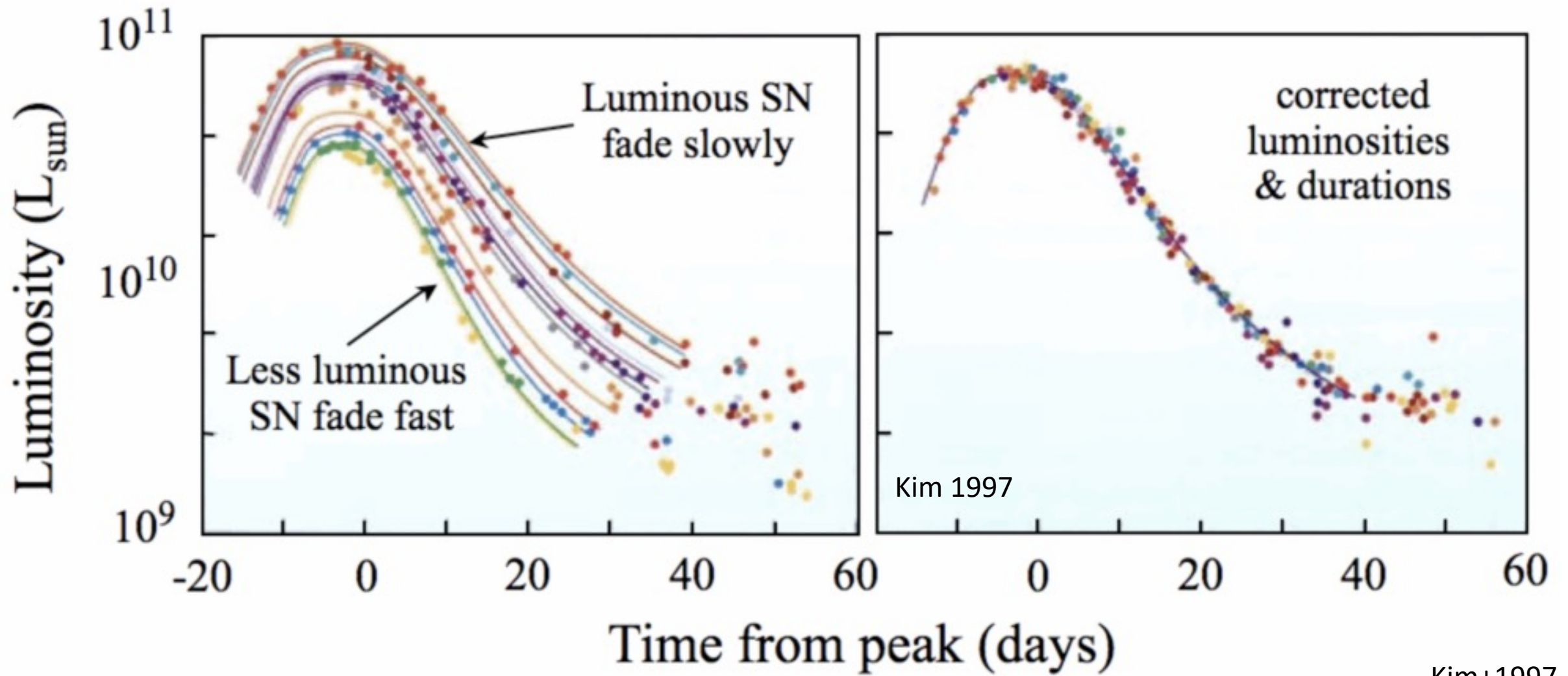


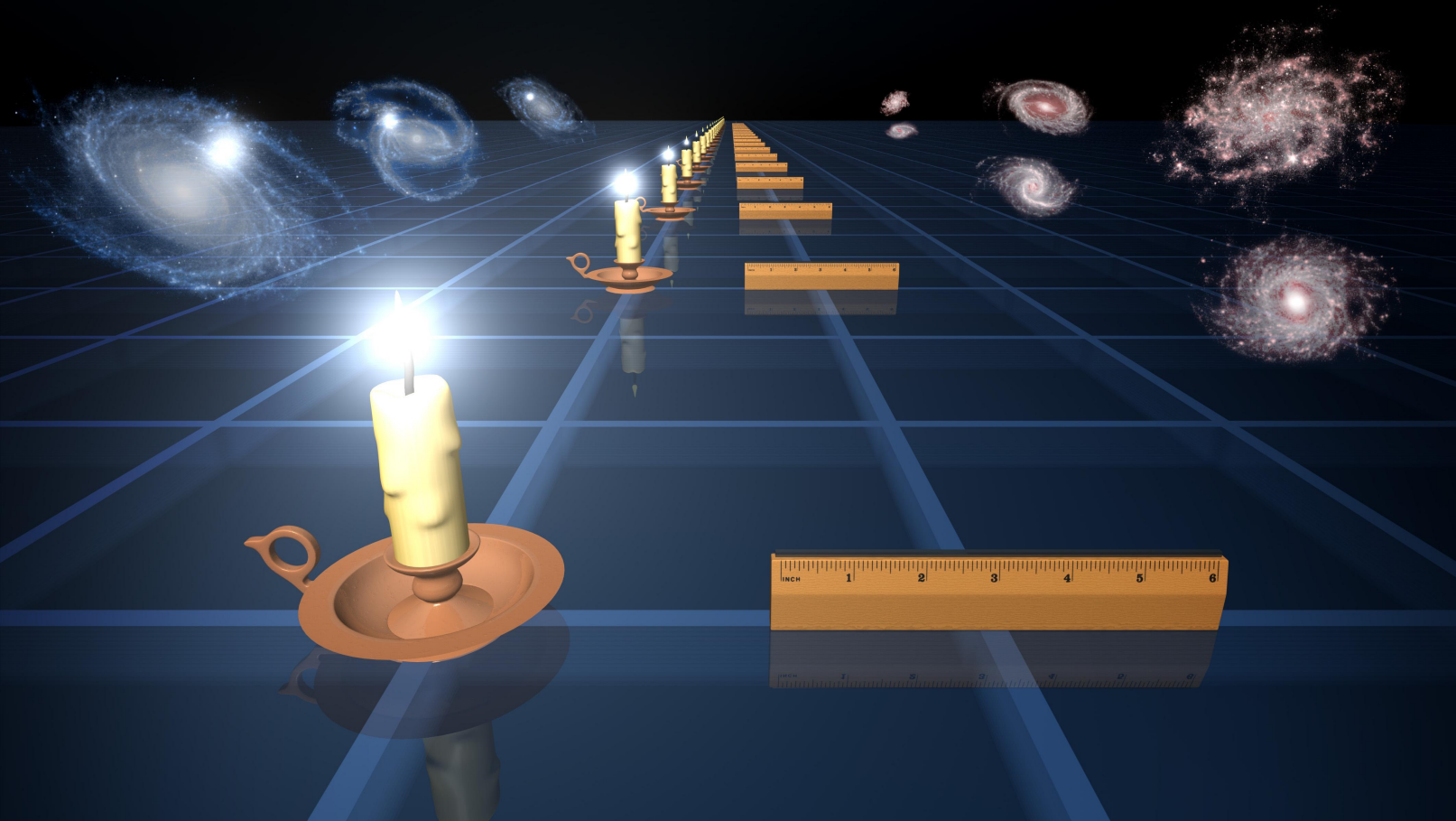
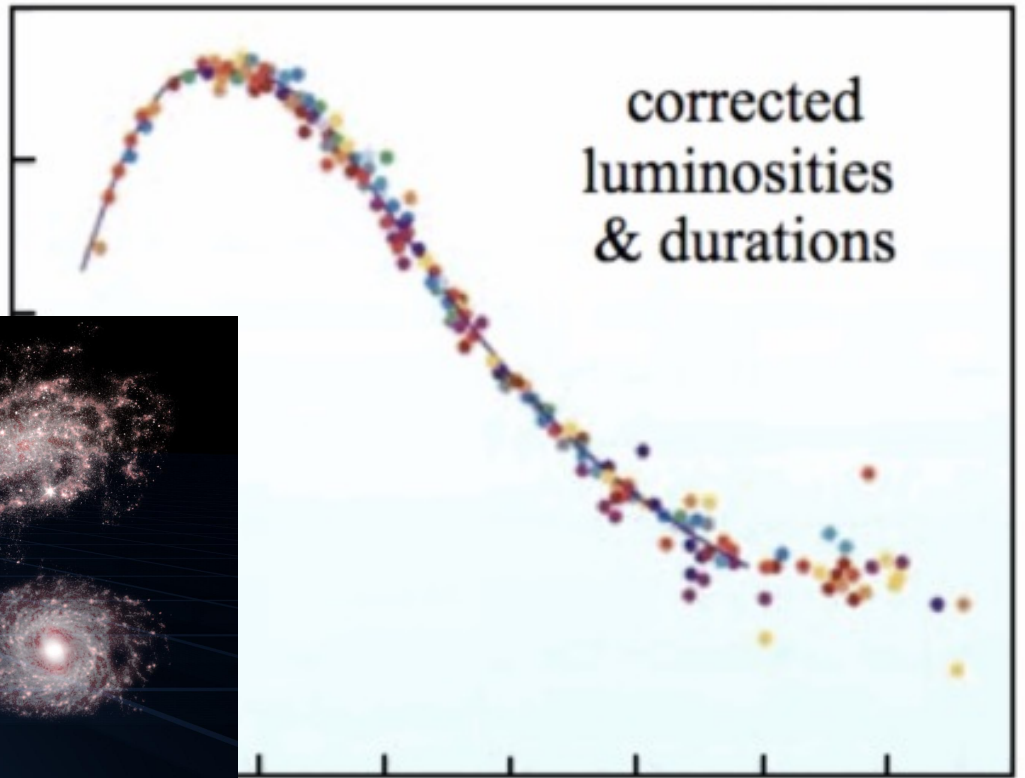
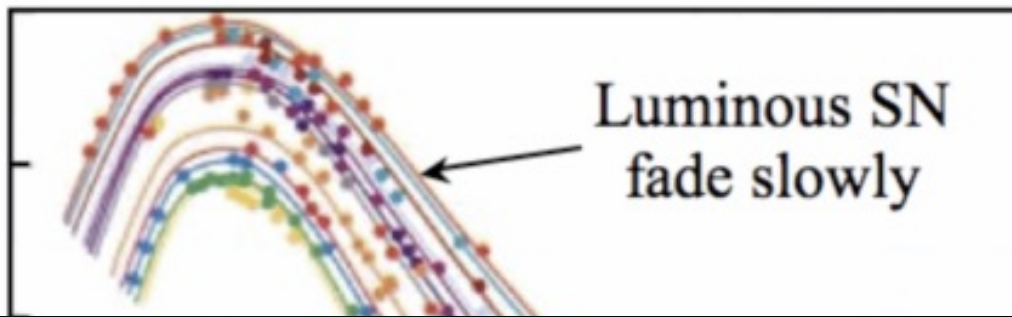
ERROR: Donor Star Not Found

Michael Tucker

CCAPP Fellow









(L_{sun})
 10^{11}



0 20 40 60
days)

Kim+1997





The Origin of the Solar System Elements

1 H	big bang fusion 					cosmic ray fission 					2 He						
3 Li	4 Be	merging neutron stars 					exploding massive stars 					5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	dying low mass stars 					exploding white dwarfs 					13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	
87 Fr	88 Ra																

Credit: Jennifer Johnson (OSU)

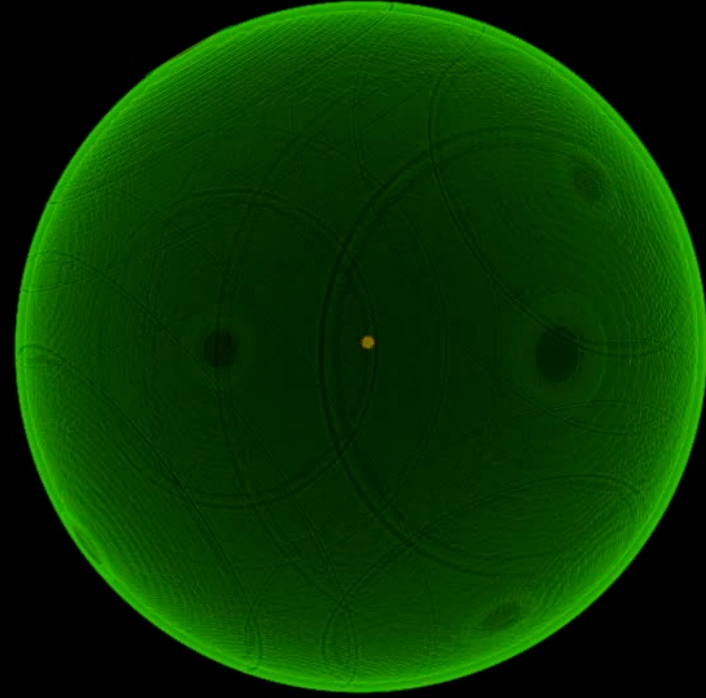
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U											

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55 Cs	56 Ba	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	
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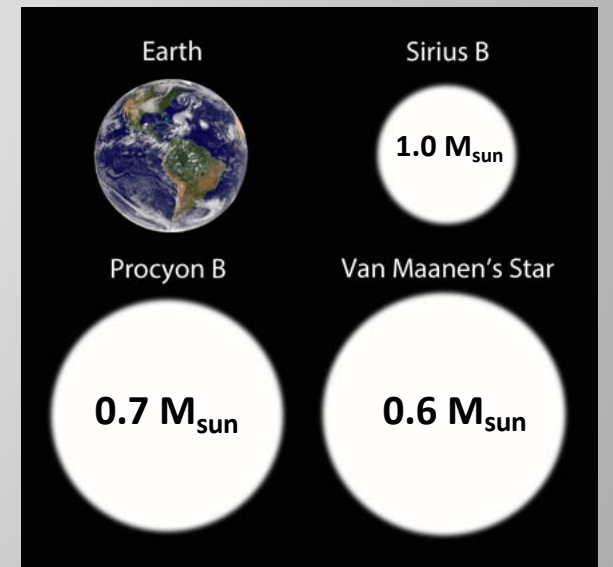
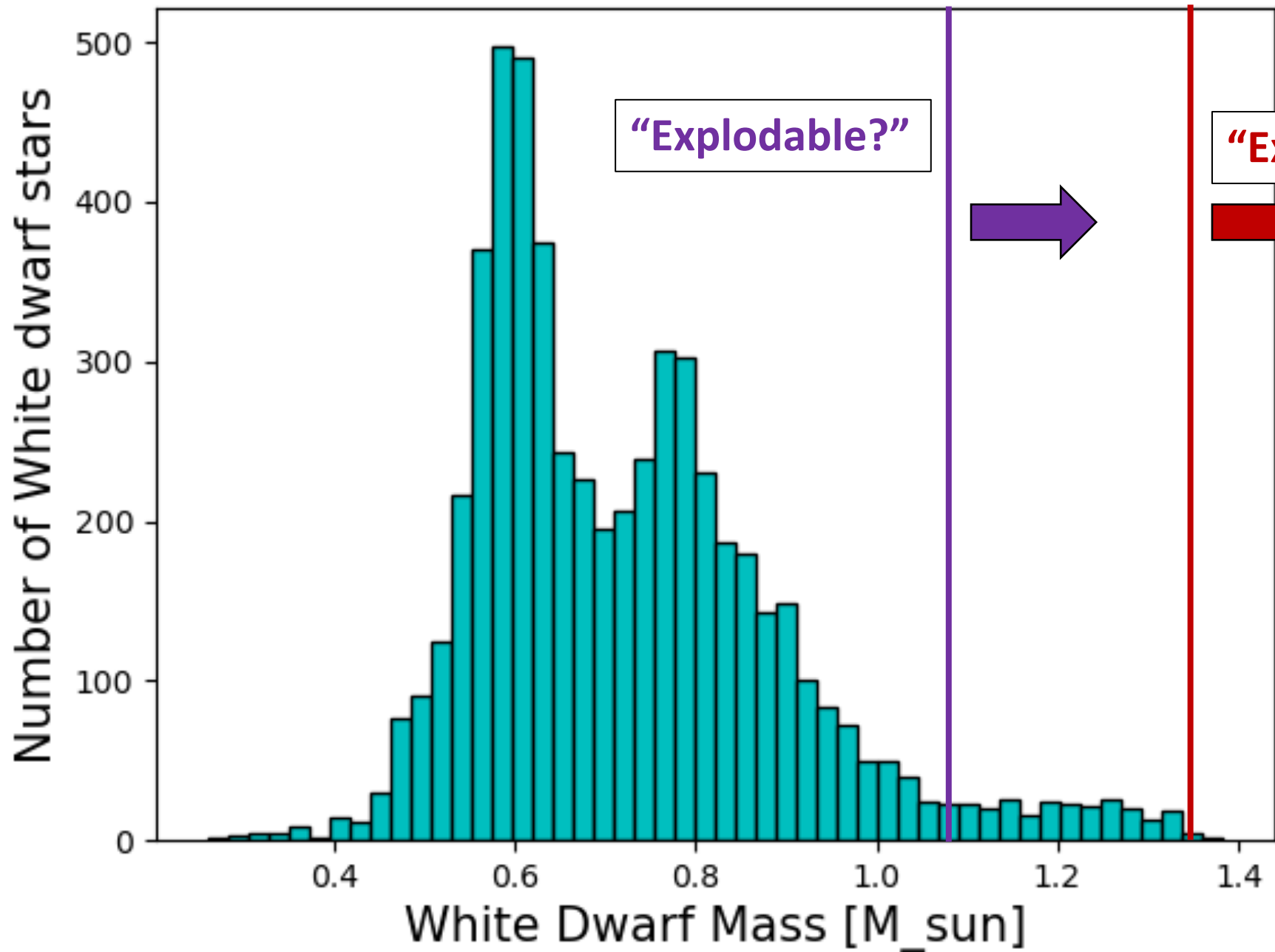
Credit: Jennifer Johnson (OSU)

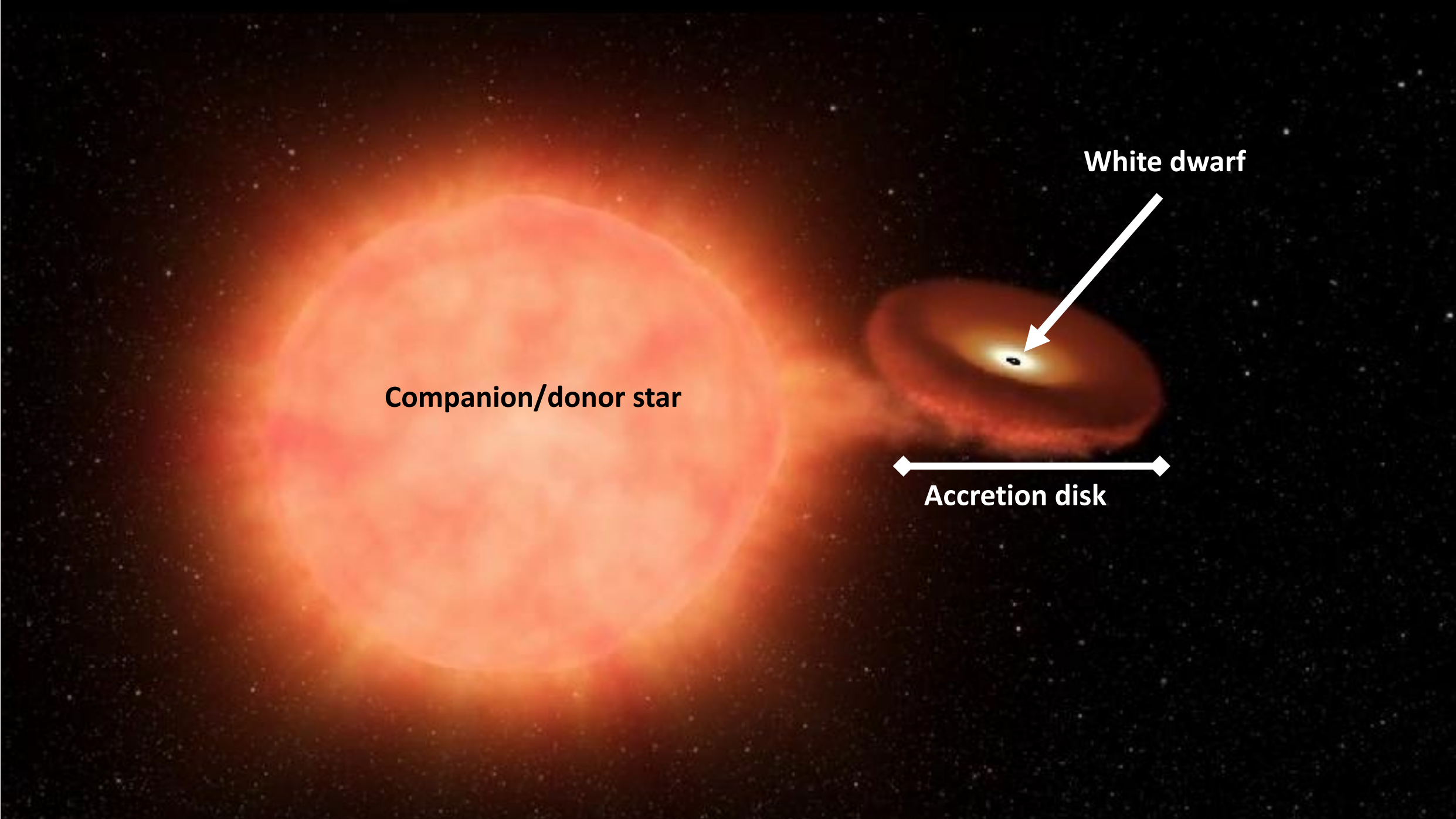
57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
89 Ac	90 Th	91 Pa	92 U											



**Need 10^9 g/cc to ignite carbon fusion
(about 36 million pounds per cubic inch)**

Credit: U Chicago FLASH
Computing Center

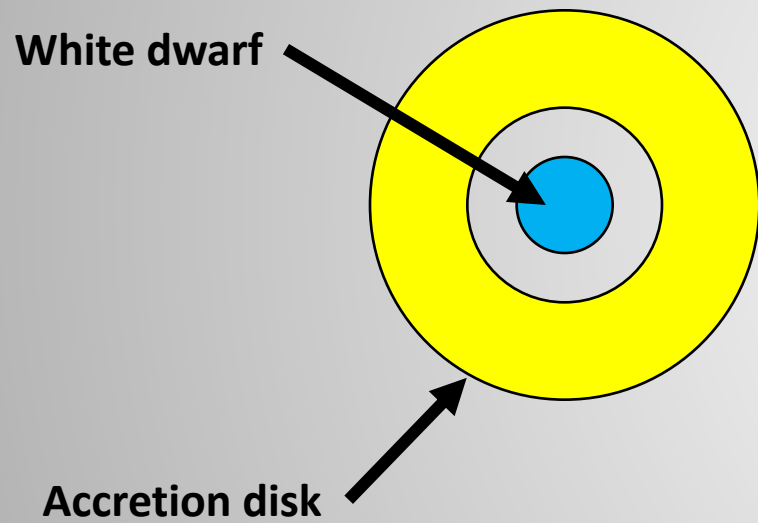


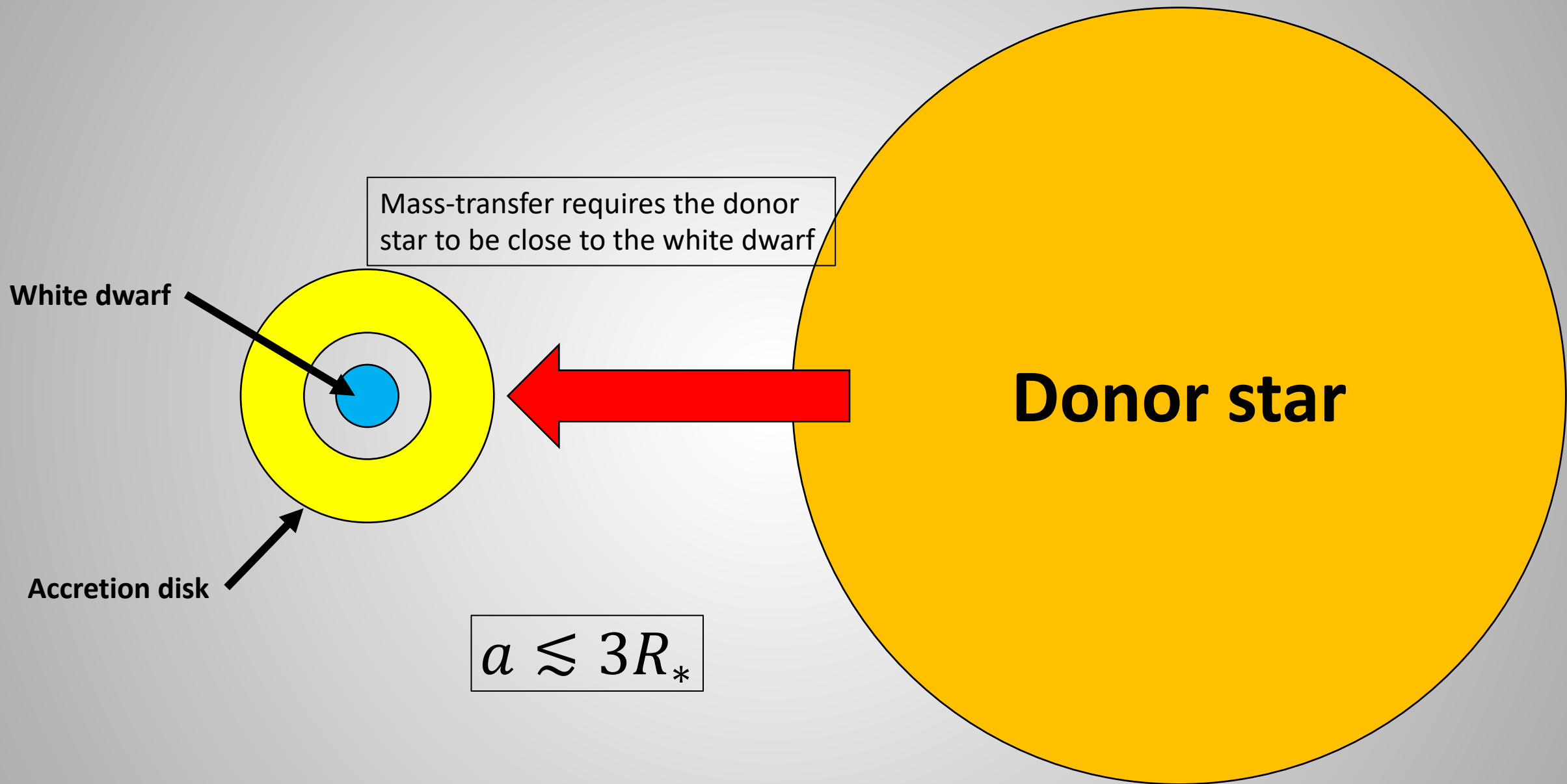


Companion/donor star

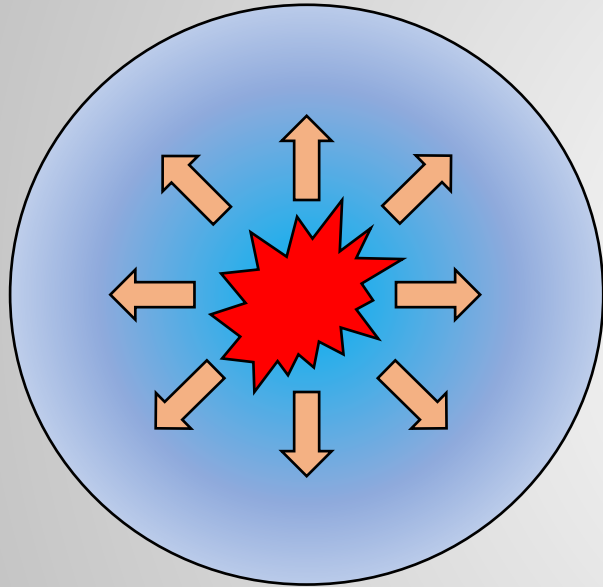
White dwarf

Accretion disk

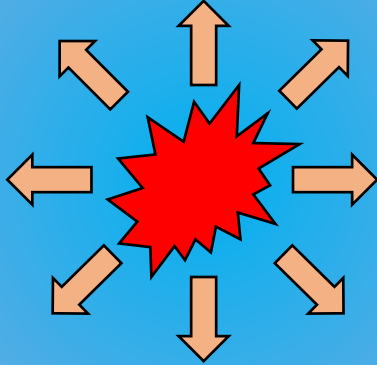




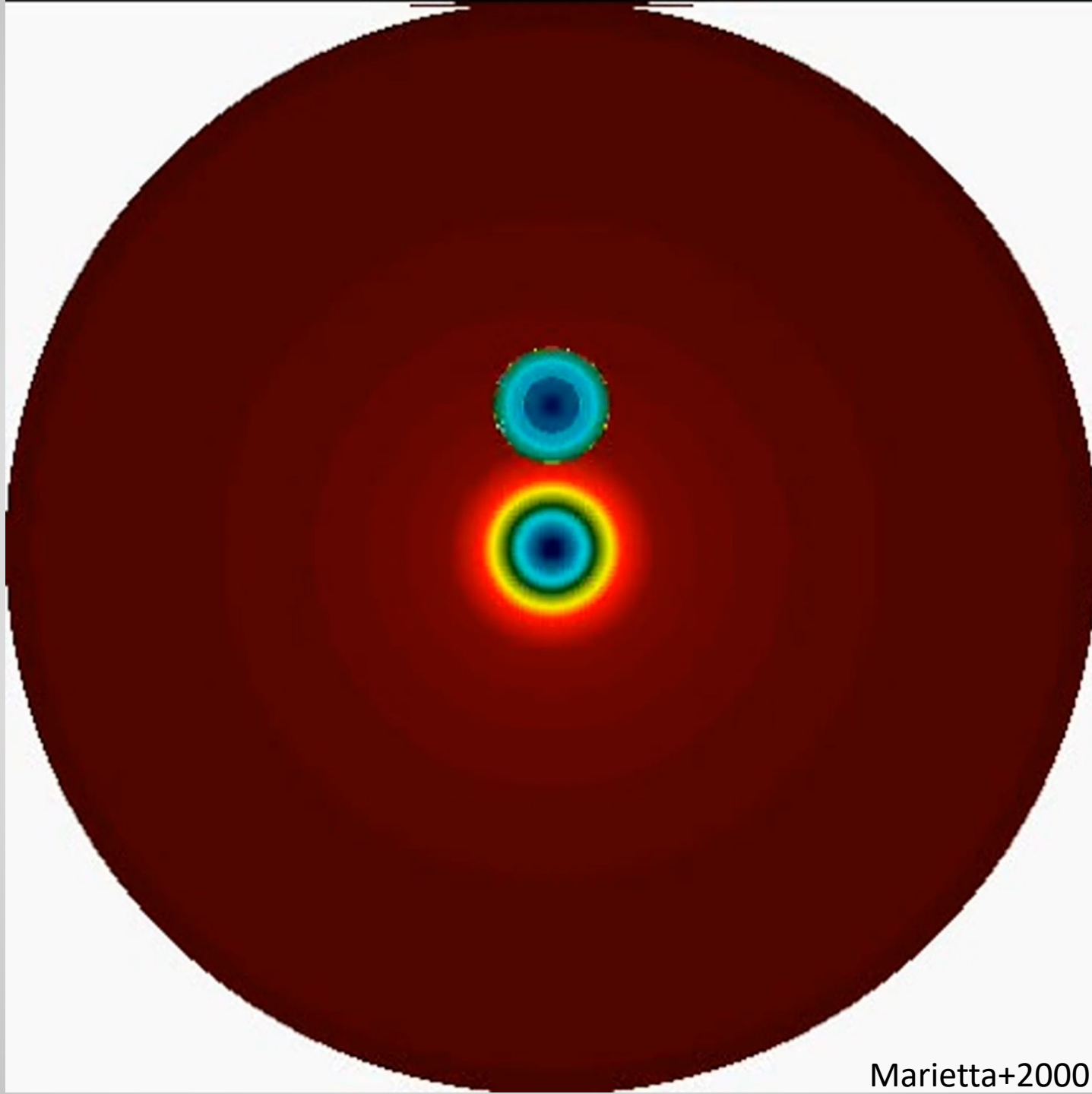
White dwarf explodes as a supernova,
ejecting material at 30,000 km/s



White dwarf explodes as a supernova,
ejecting material at 30,000 km/s

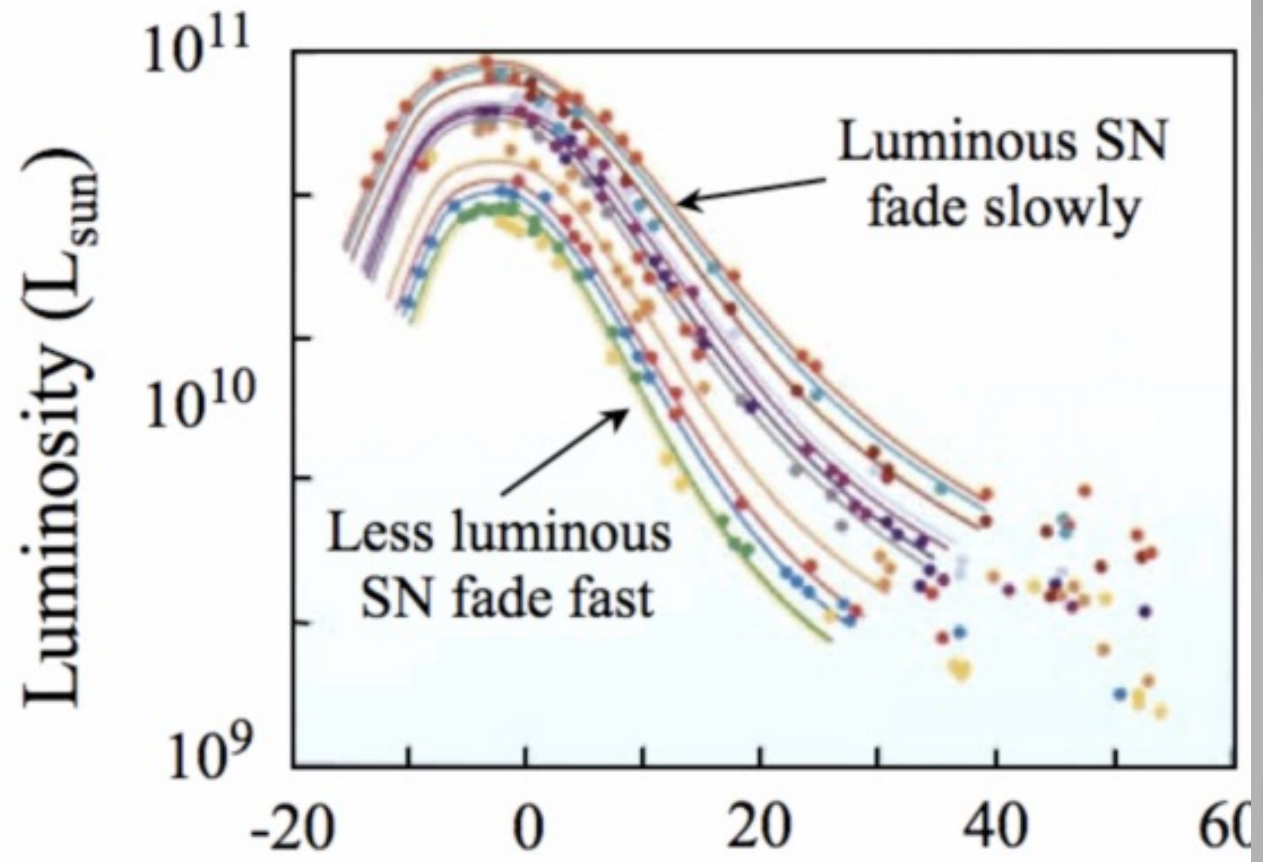
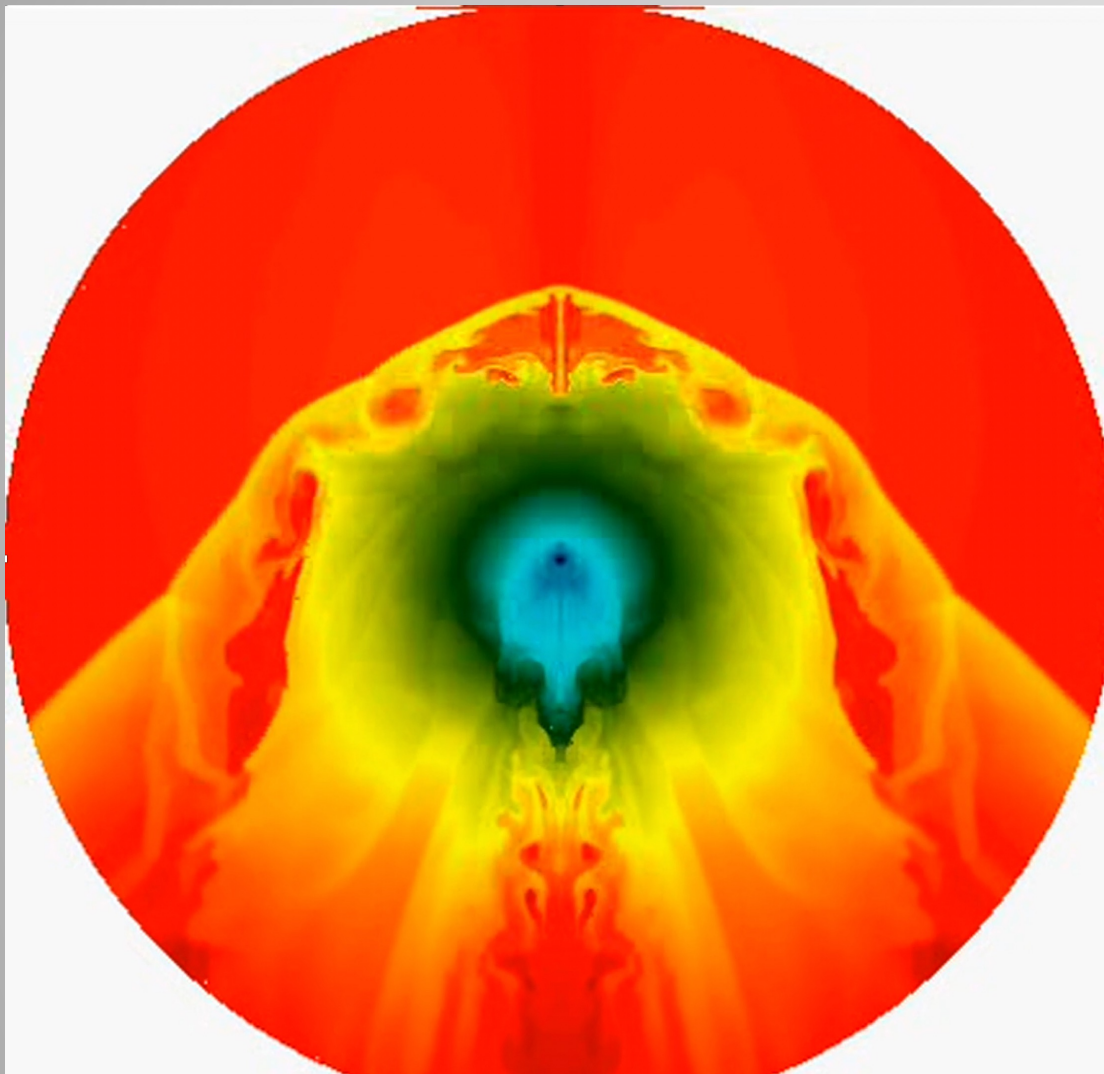


Donor star



Marietta+2000

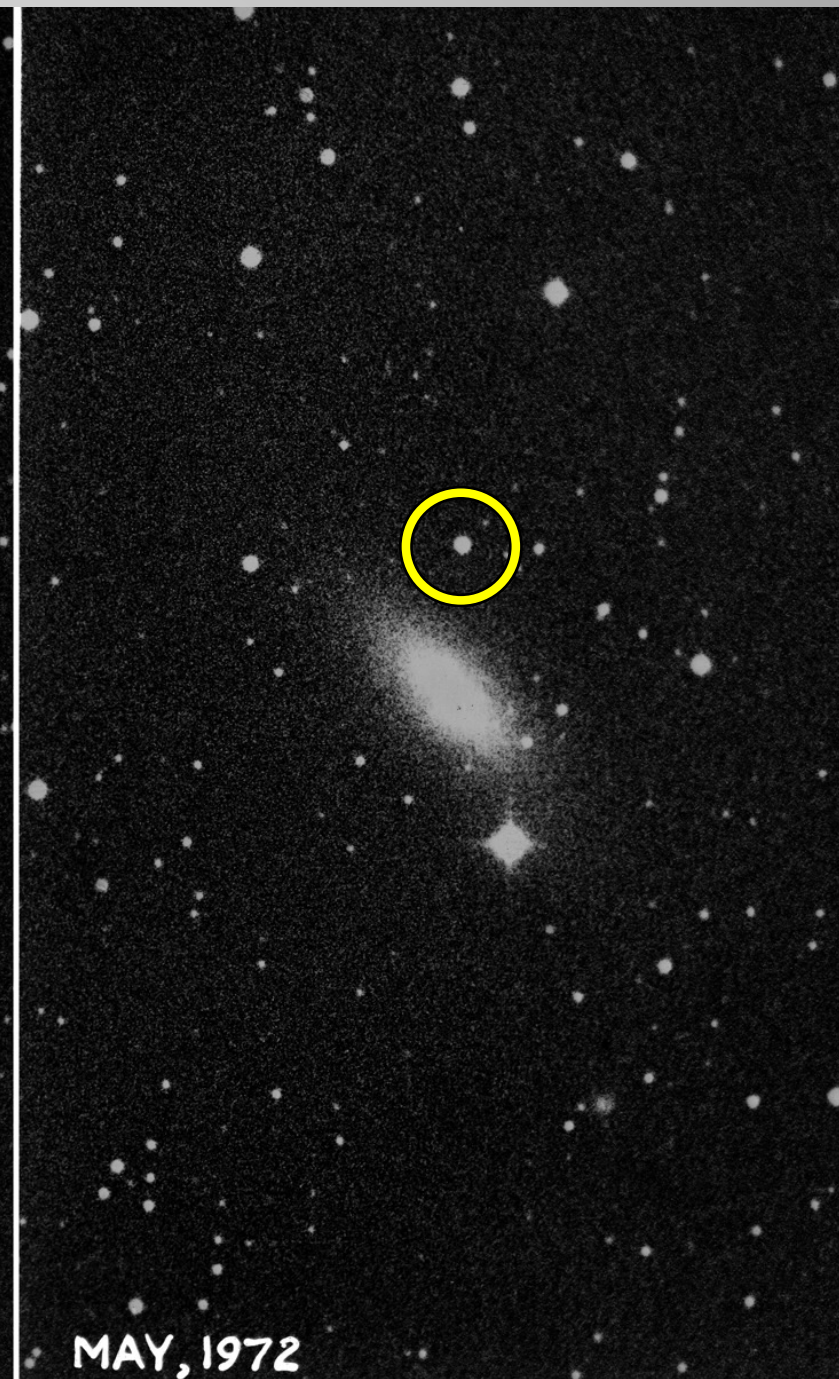
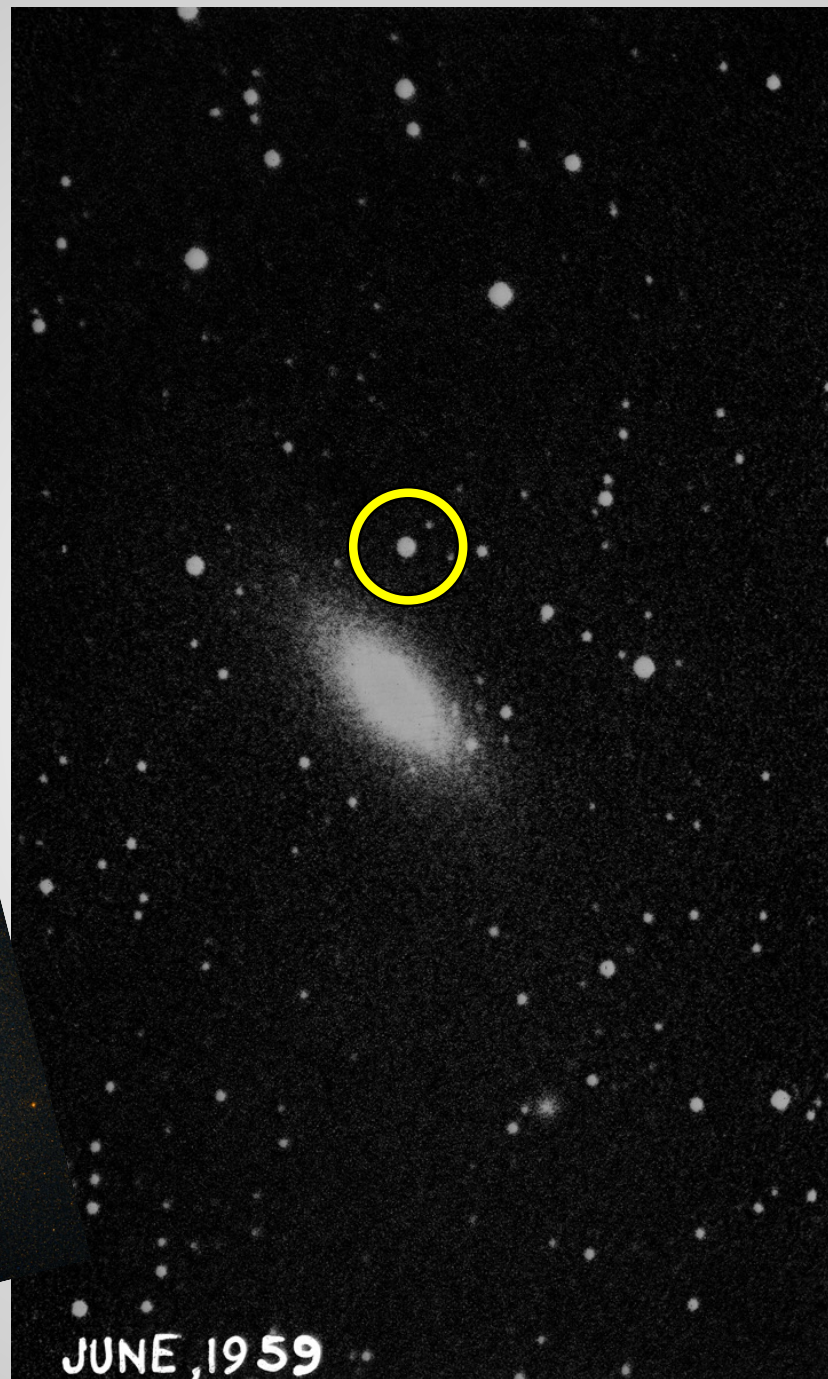
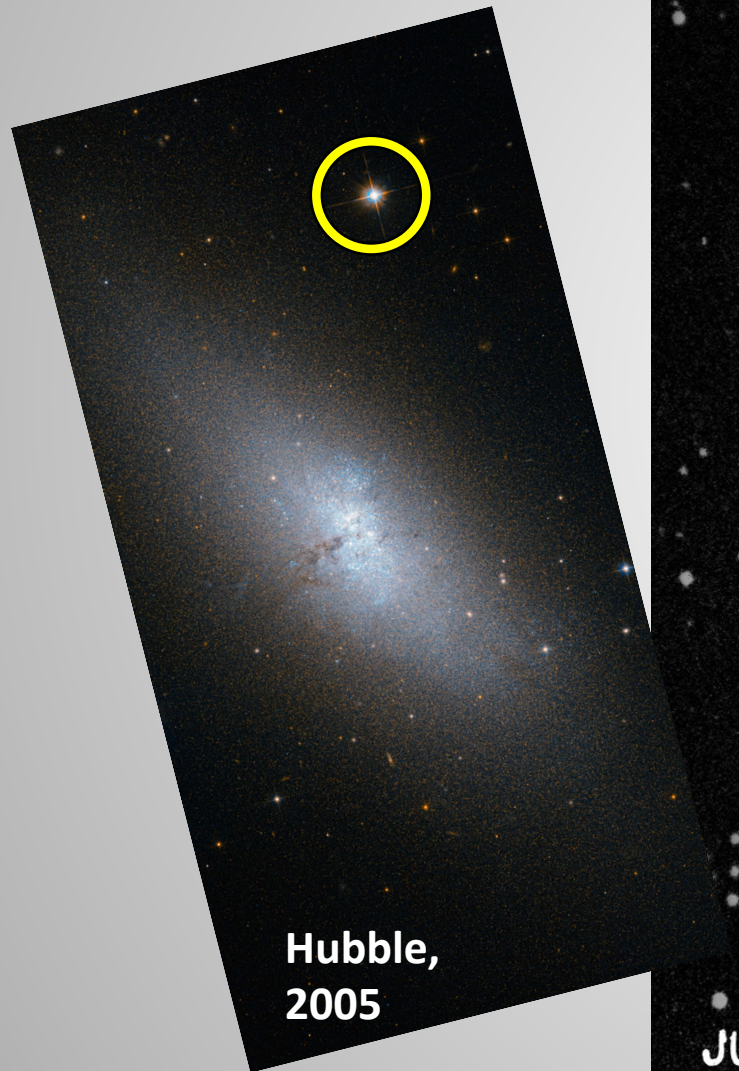
$L \approx 10,000 L_{\text{sun}}$



SN1972E



SN1972E

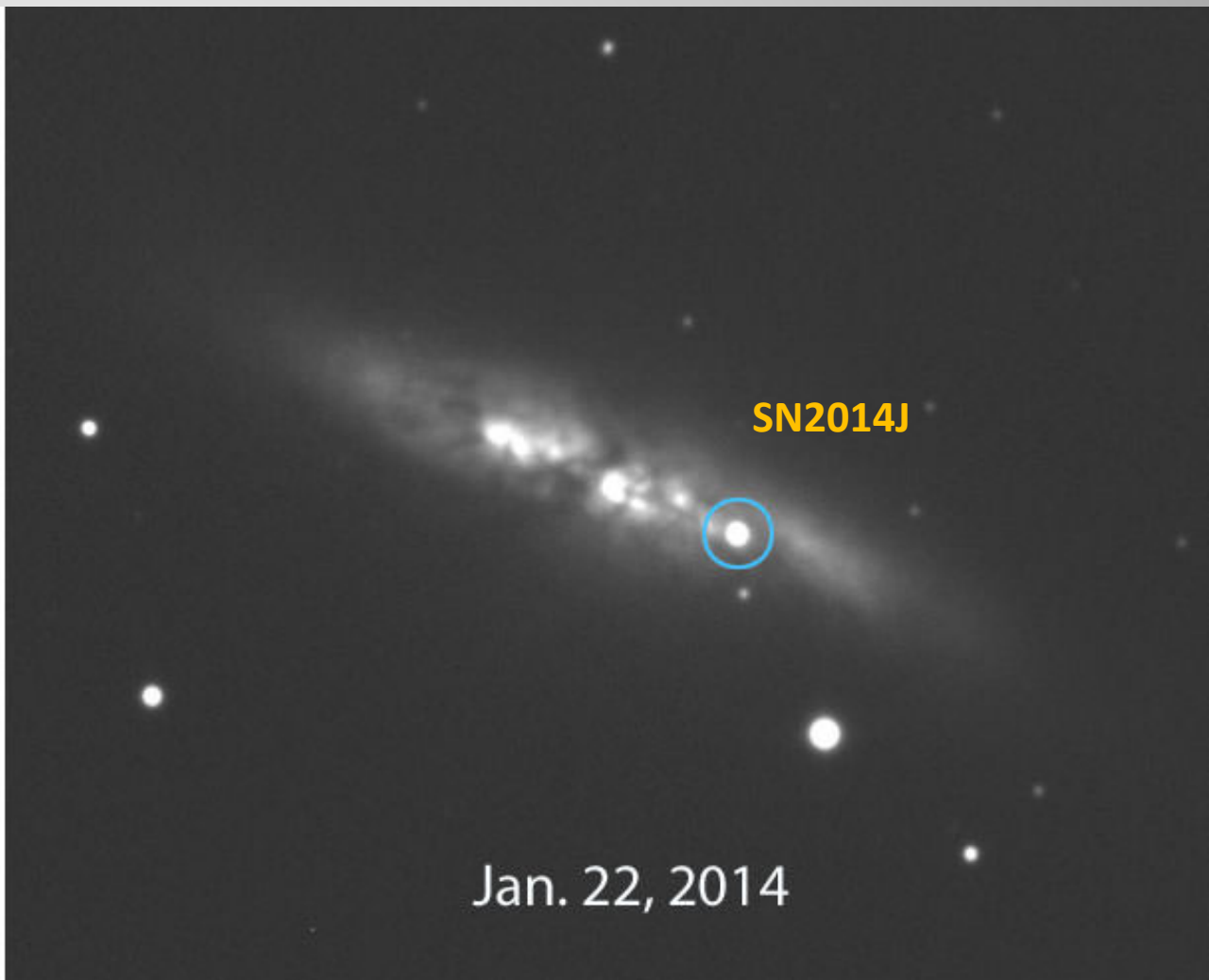
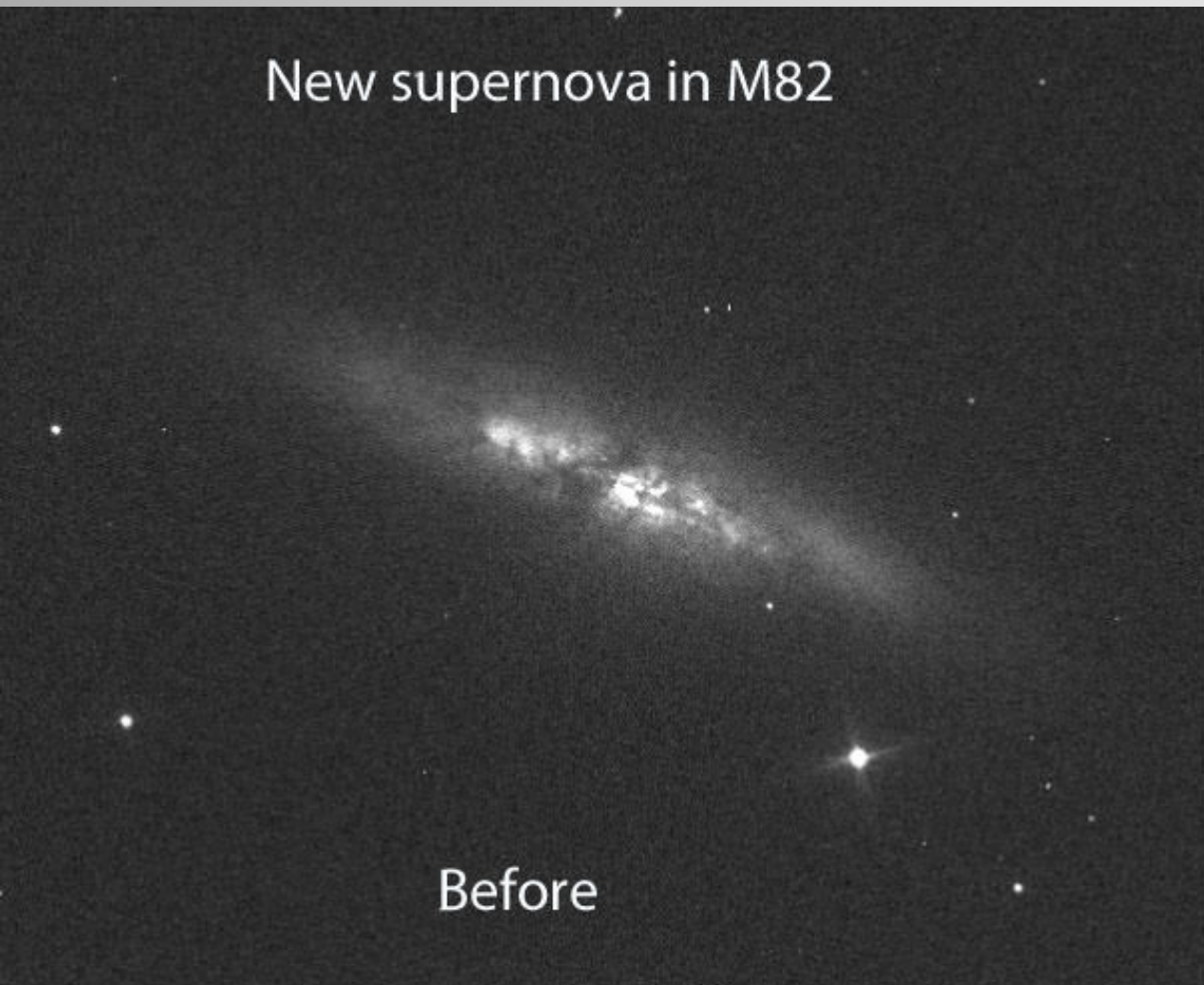


New supernova in M82

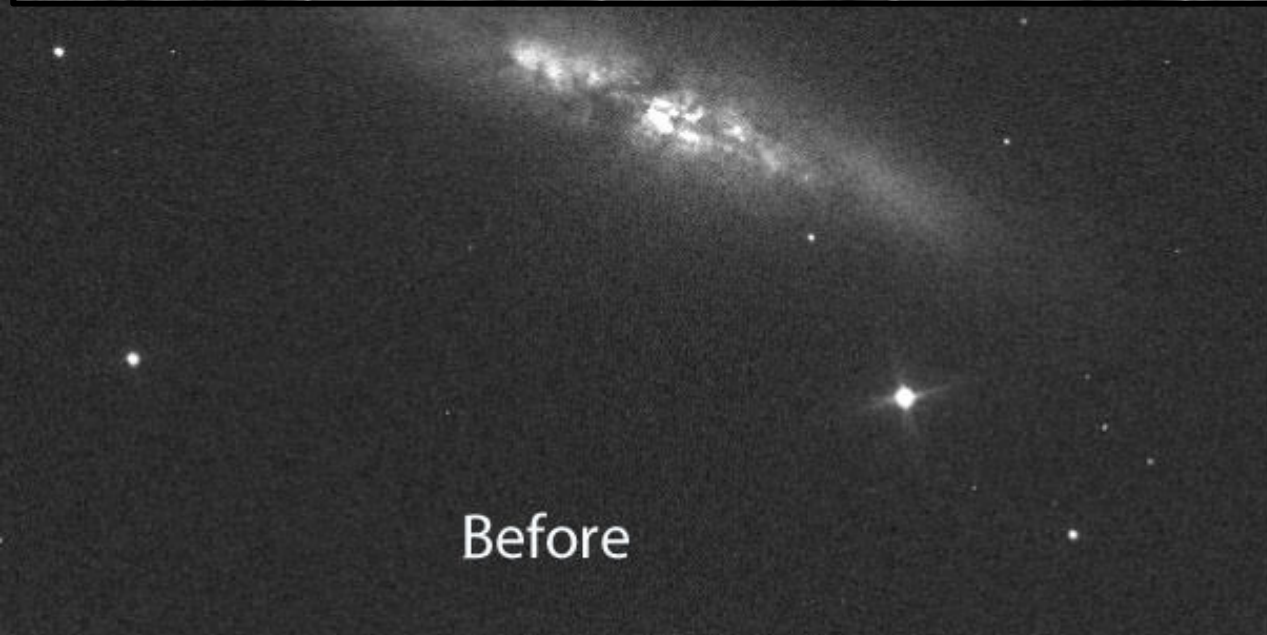
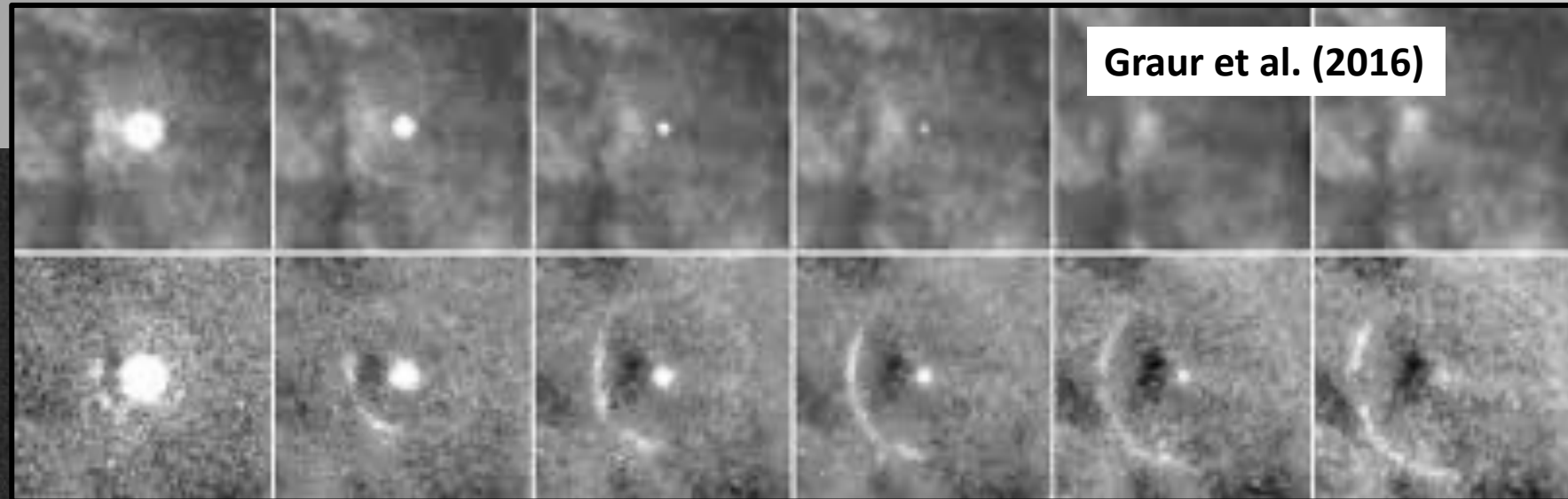
Before

SN2014J

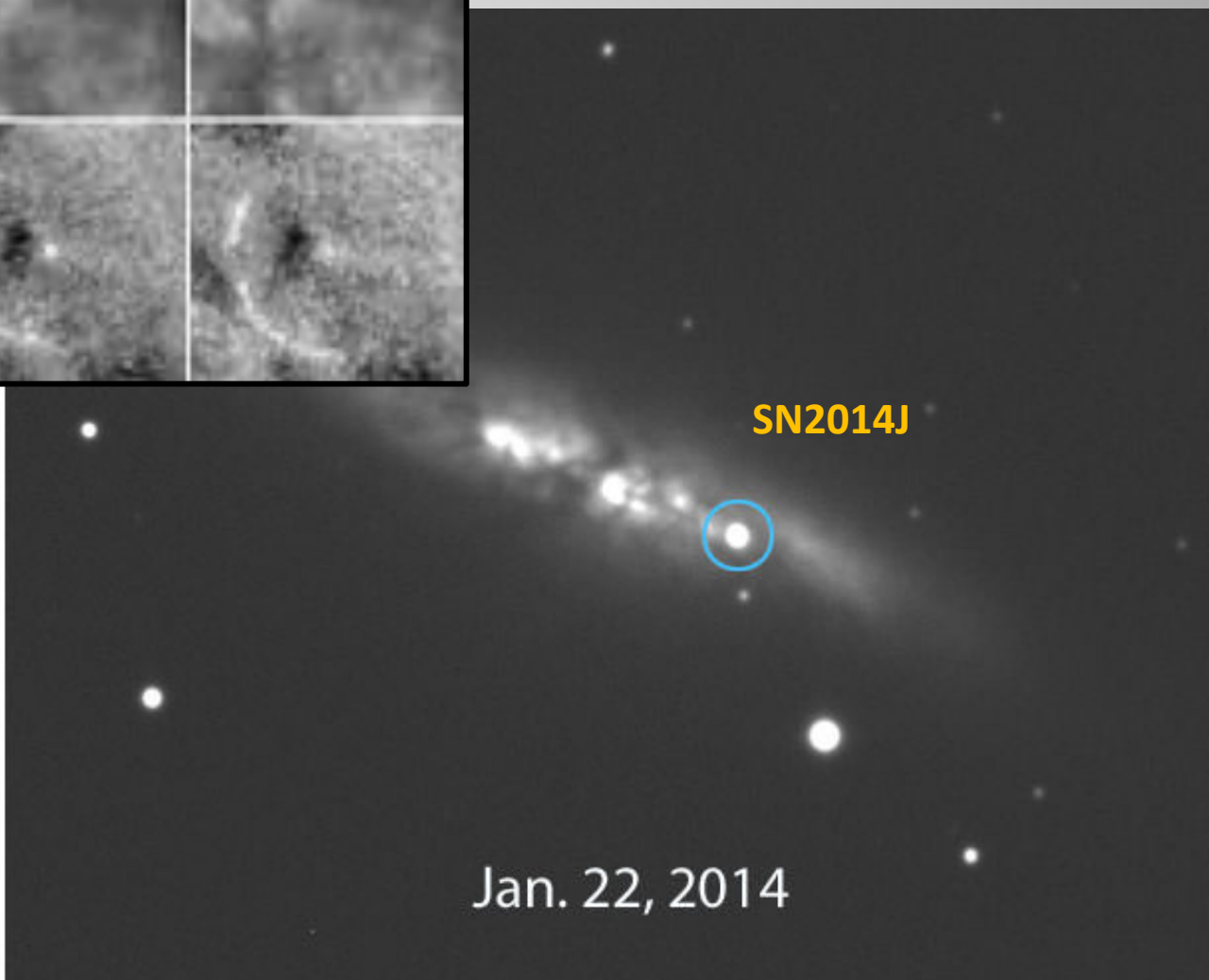
Jan. 22, 2014



Graur et al. (2016)

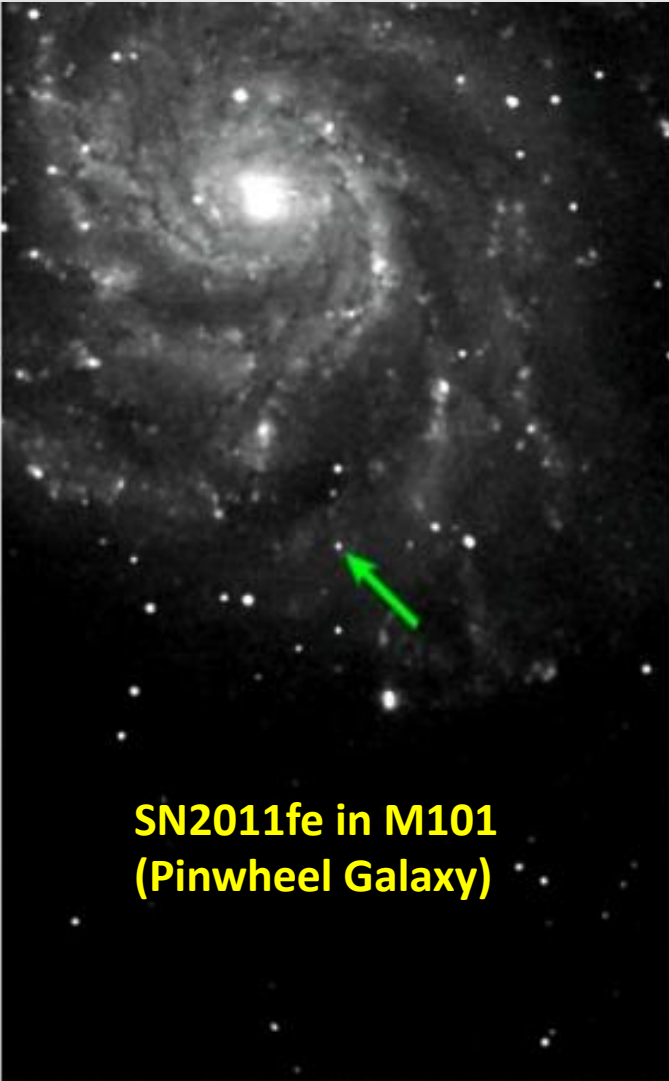
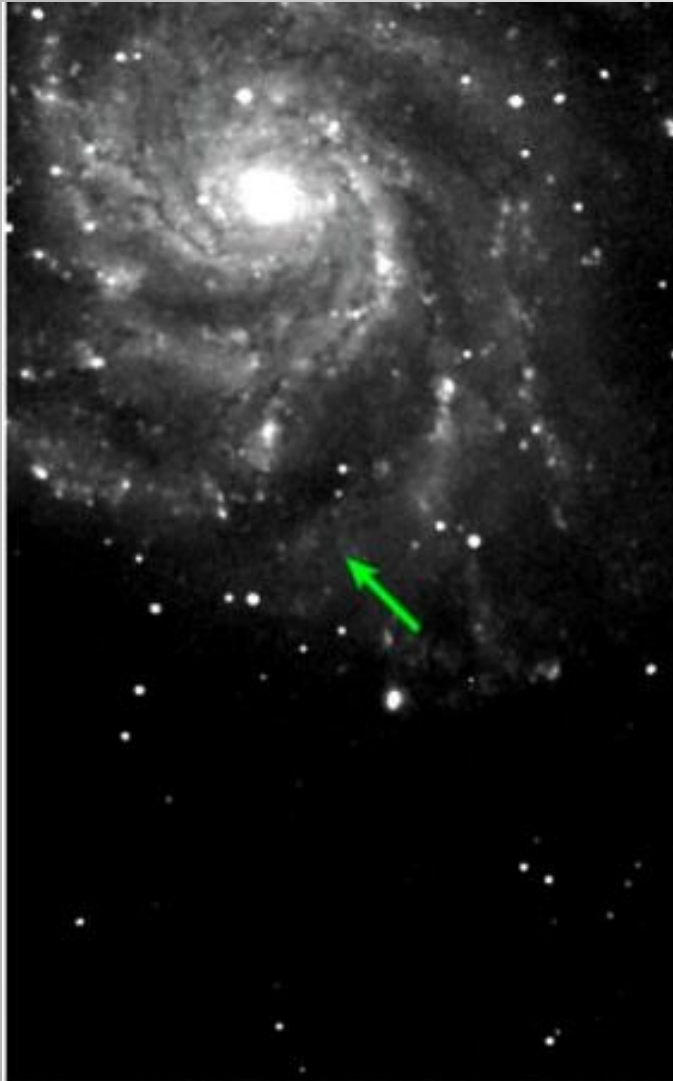


Before

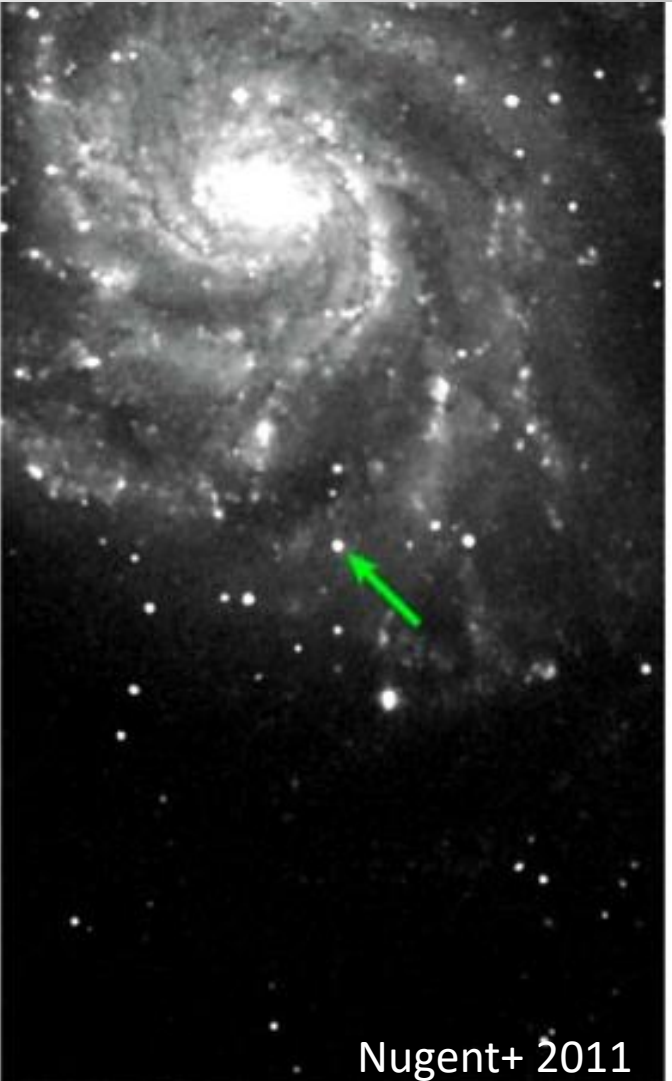


SN2014J

Jan. 22, 2014



**SN2011fe in M101
(Pinwheel Galaxy)**



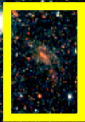
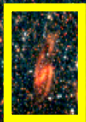
Nugent+ 2011

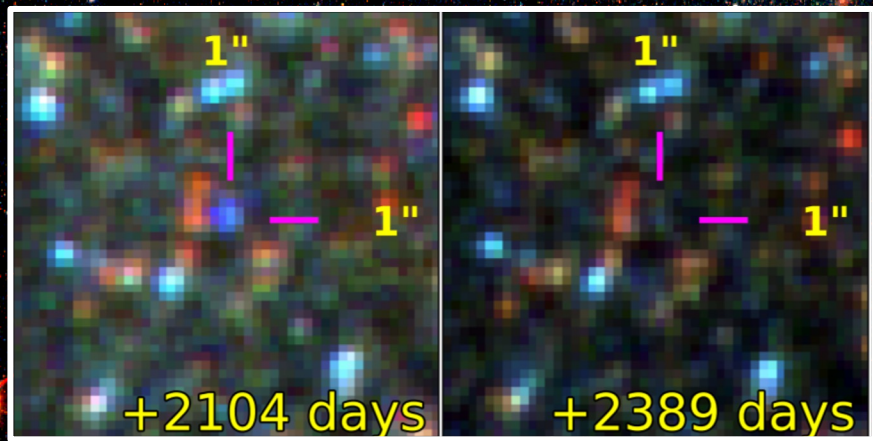
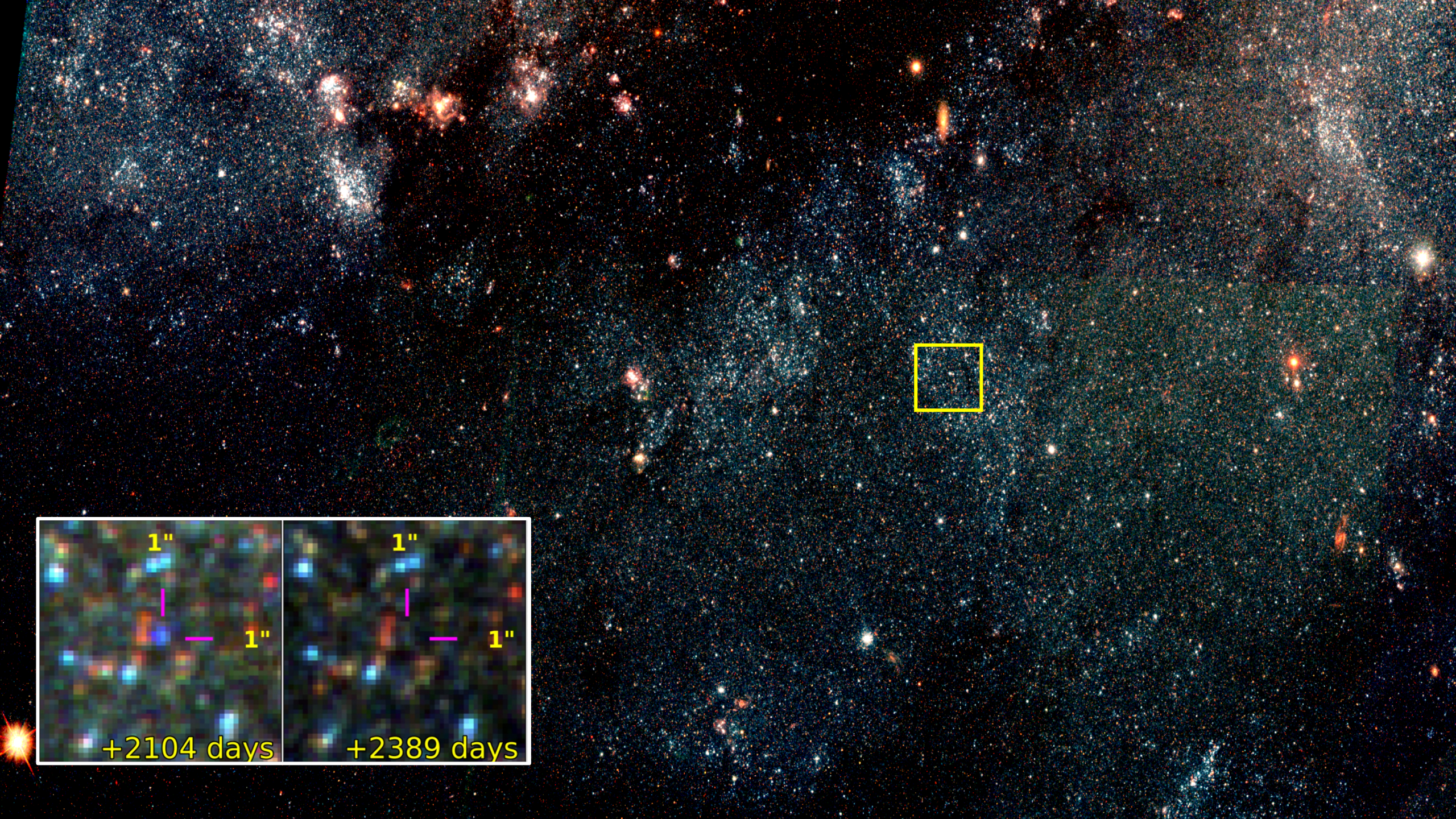


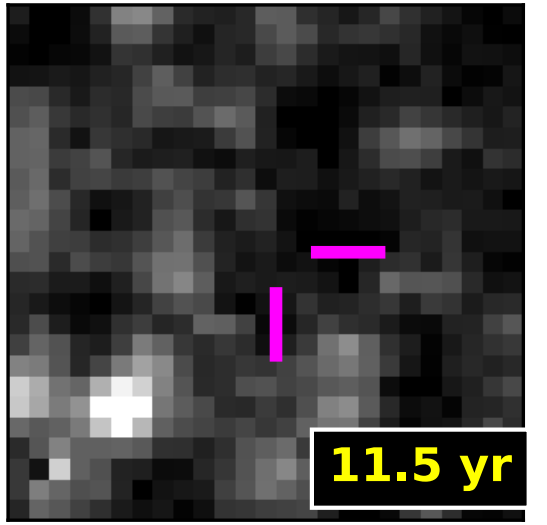
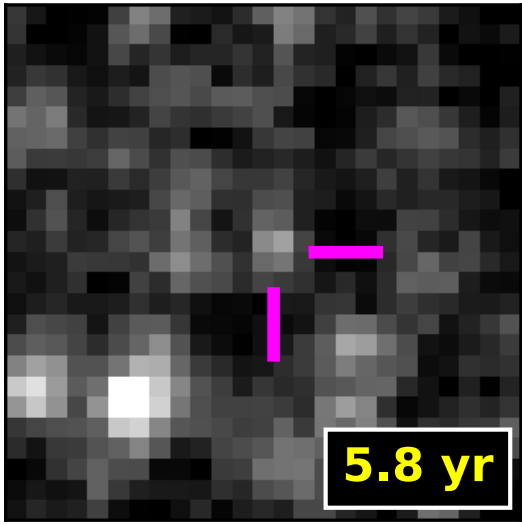
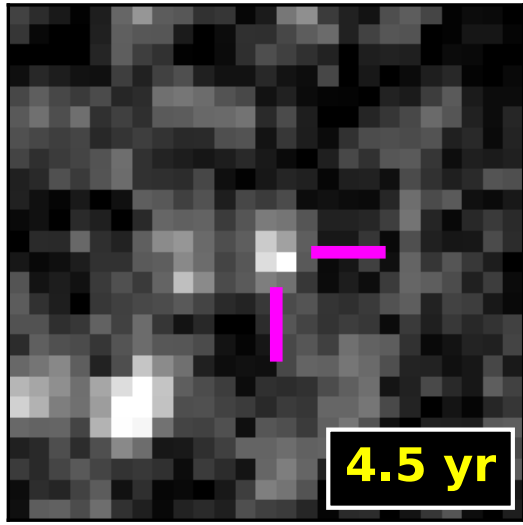
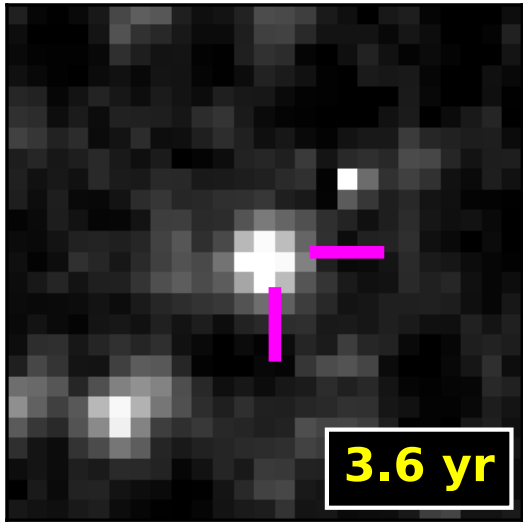
SN 2011fe

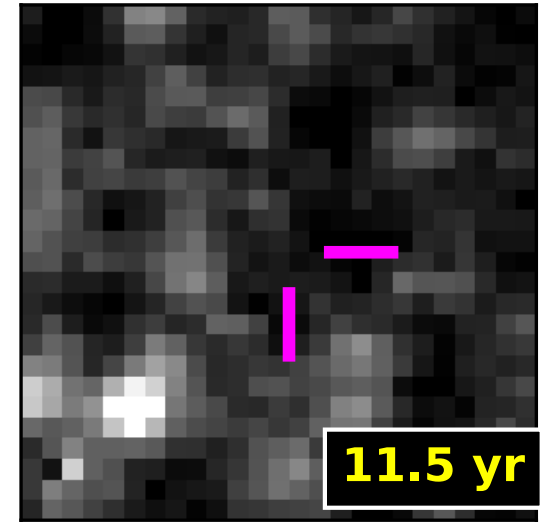
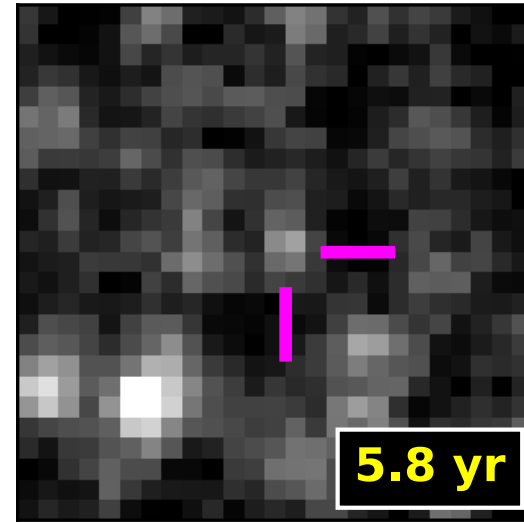
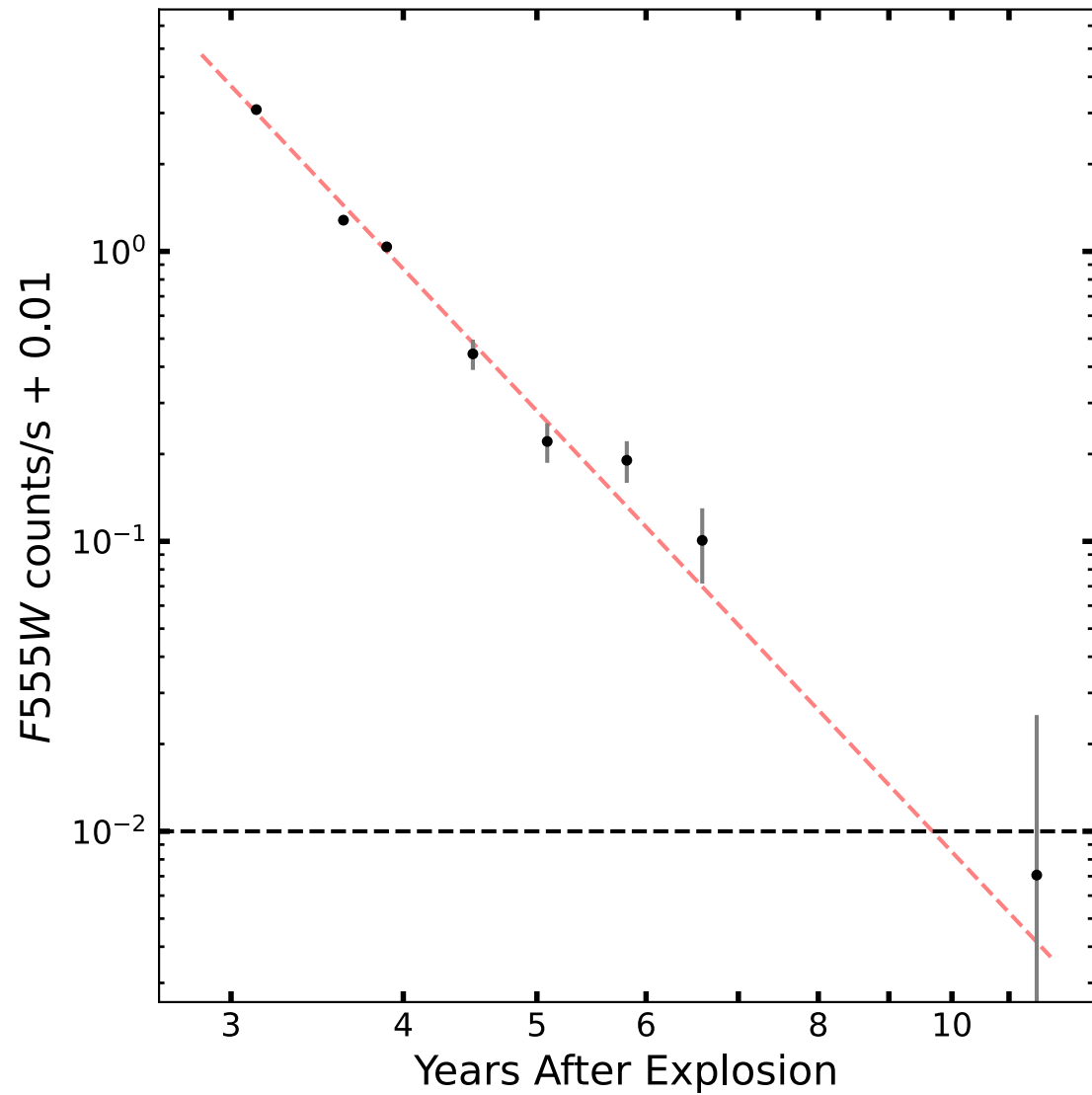
Credit: BJ Fulton/LCO





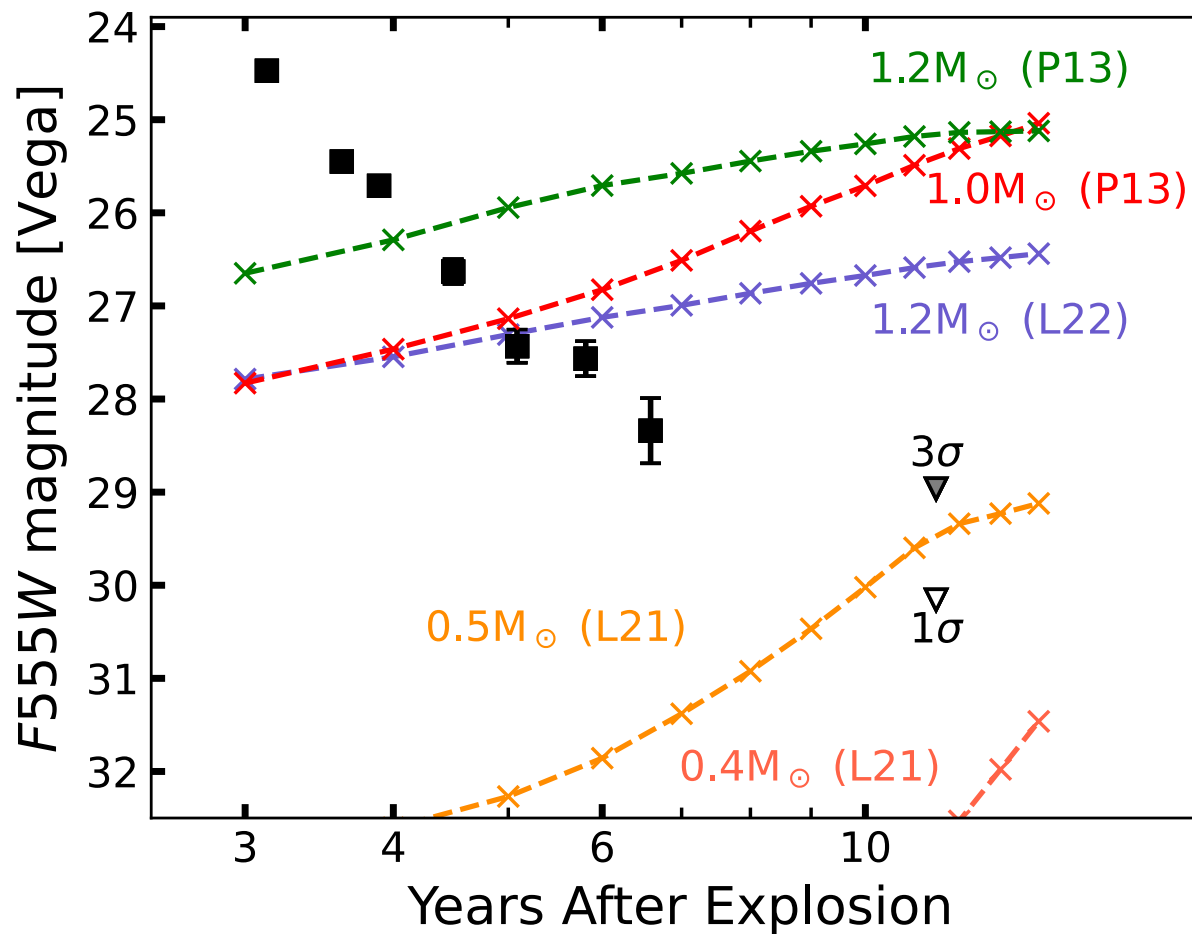




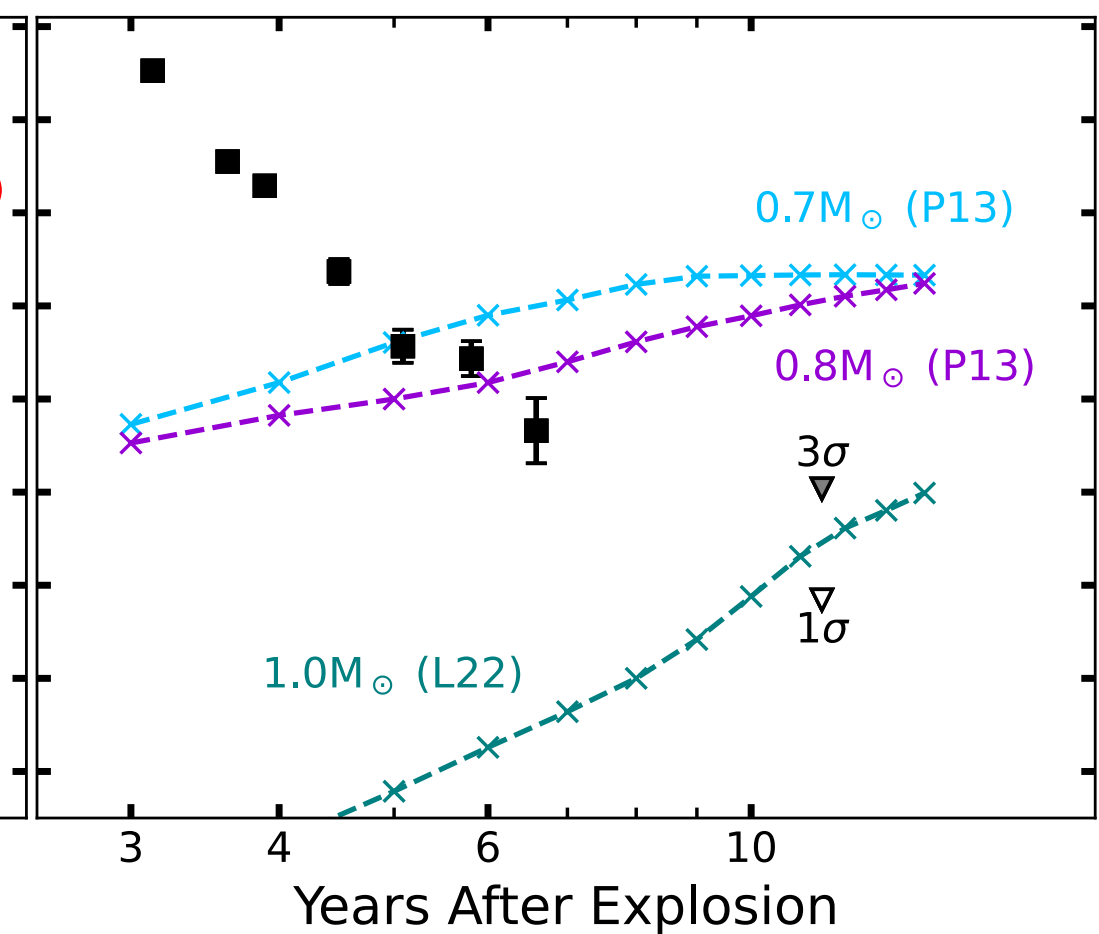


SN2011fe is now undetectable with HST after ~10 years

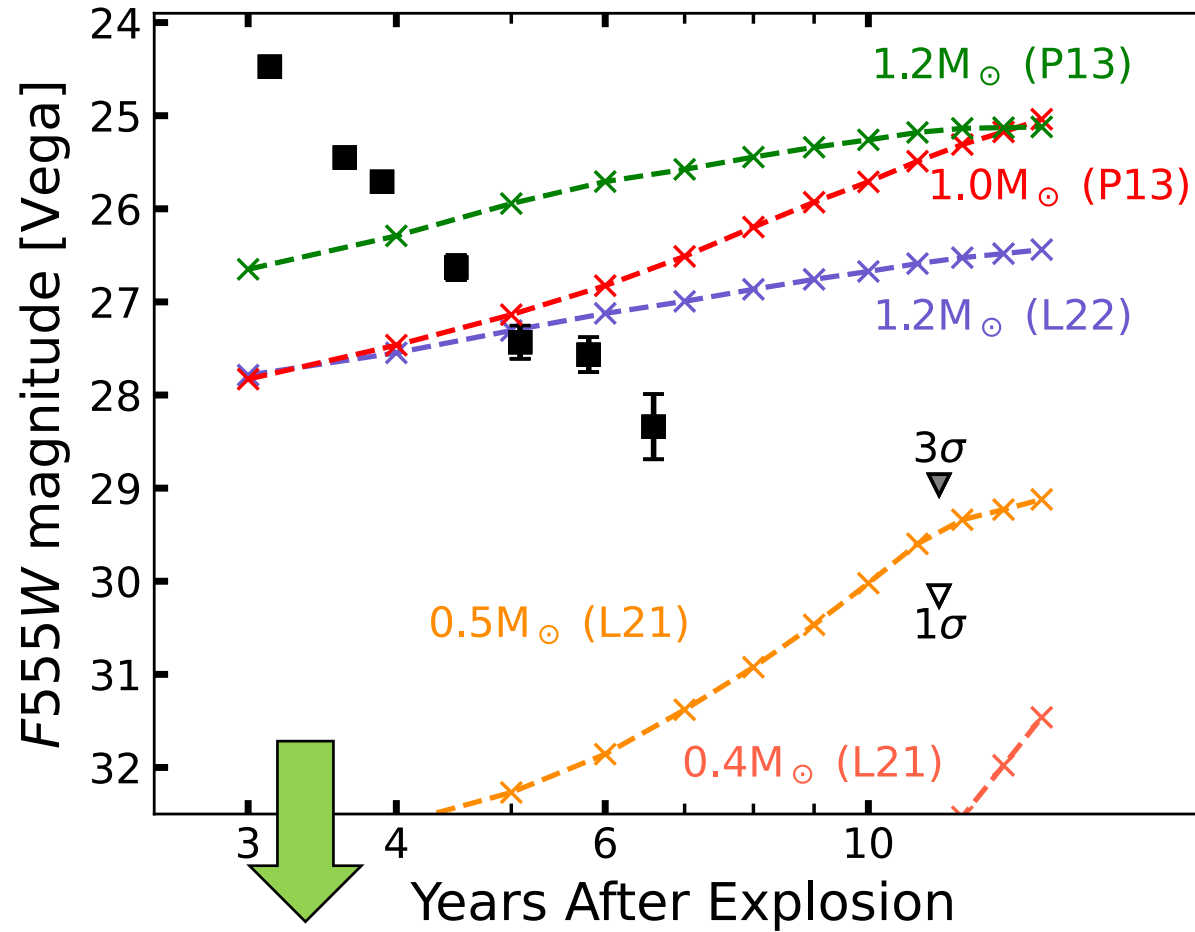
Main-sequence He donors



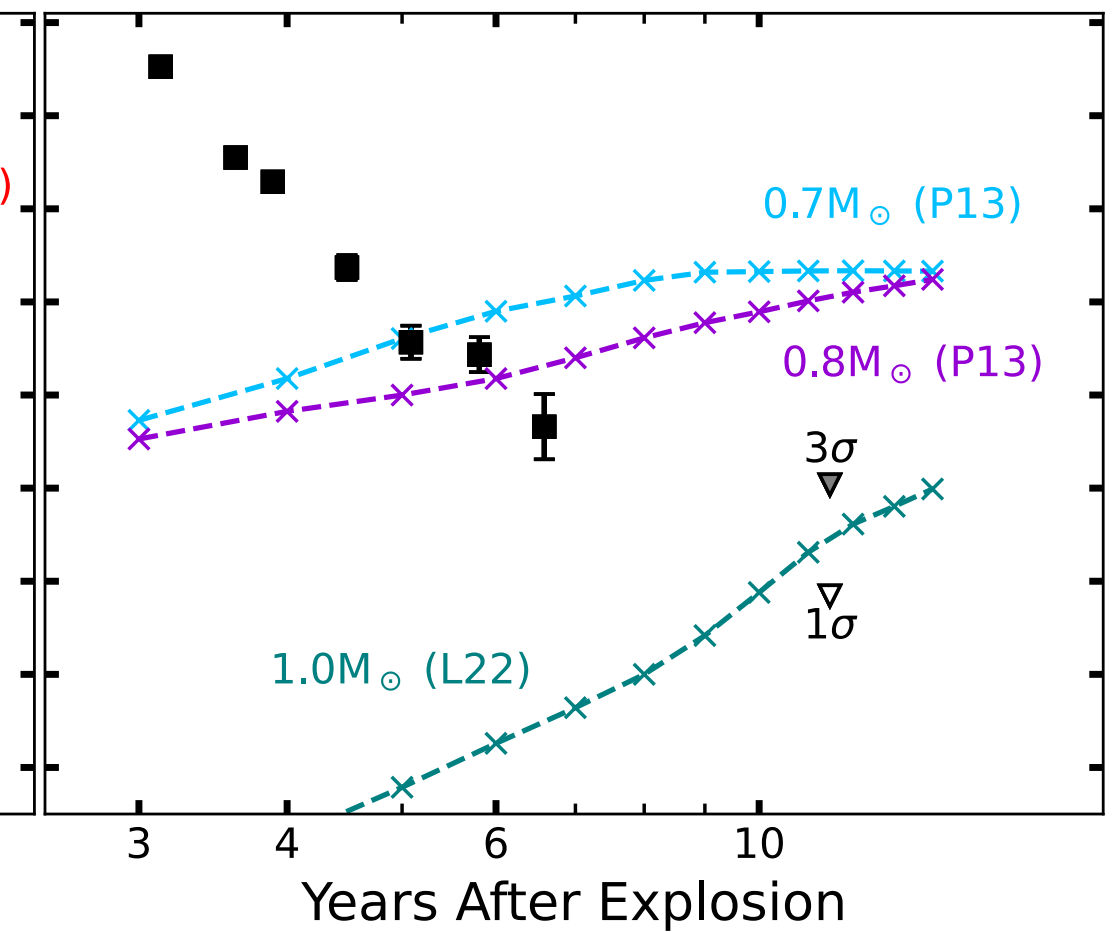
Subgiant He donors



Main-sequence He donors

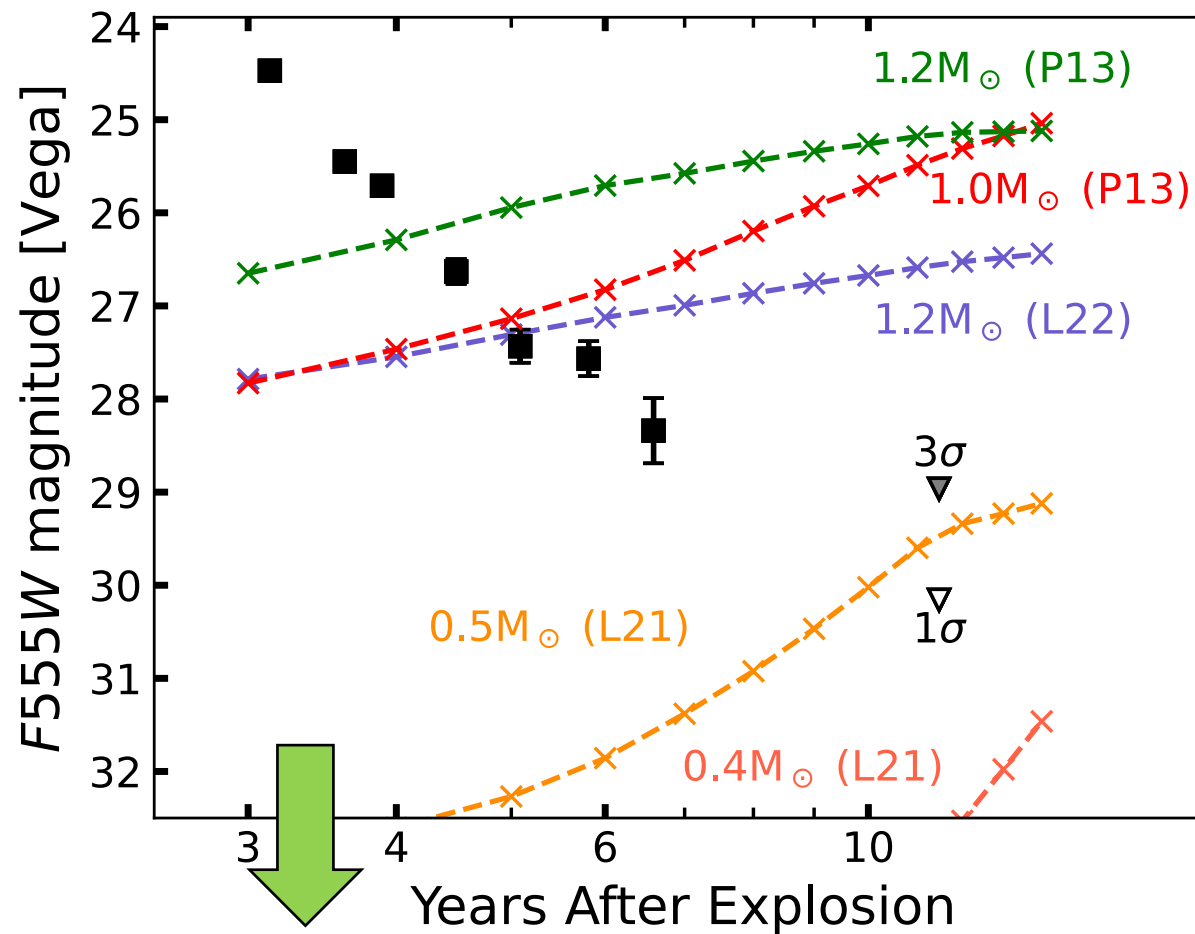


Subgiant He donors



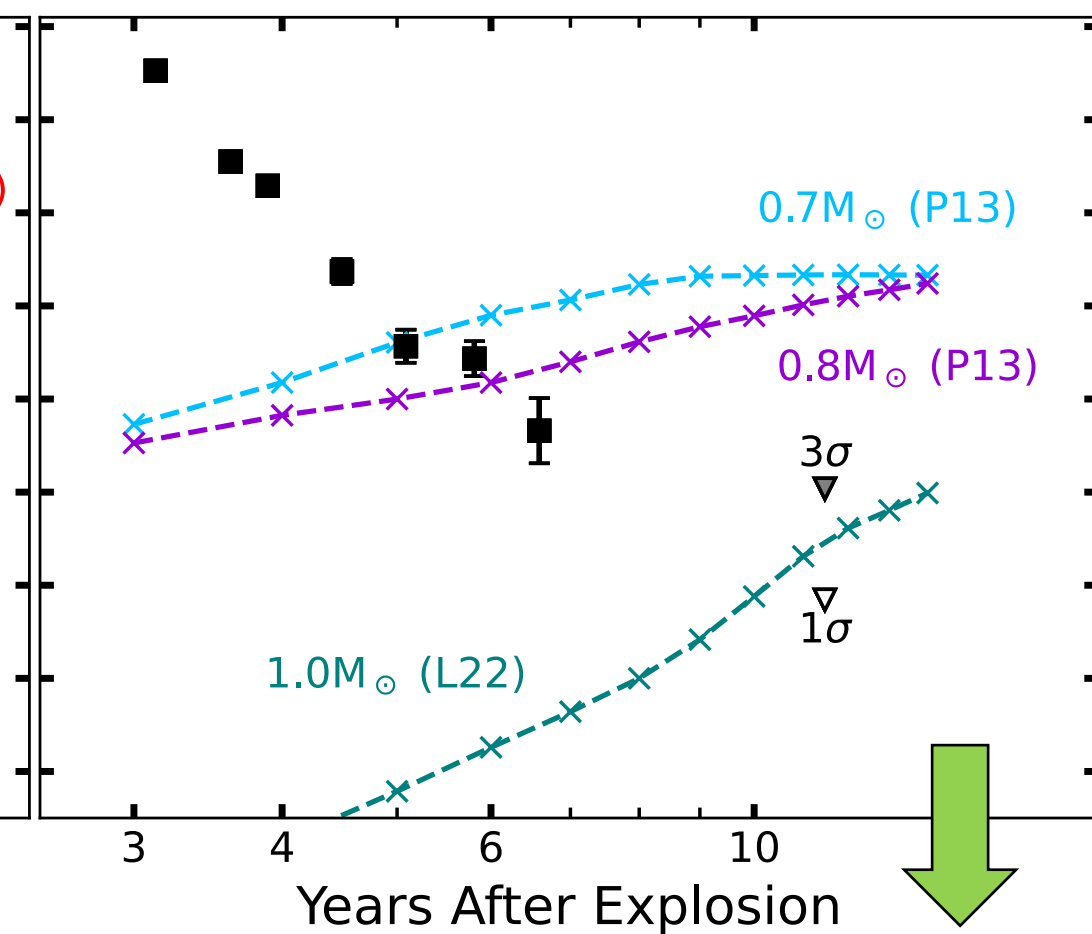
Too rare to match observed SN Ia rate

Main-sequence He donors

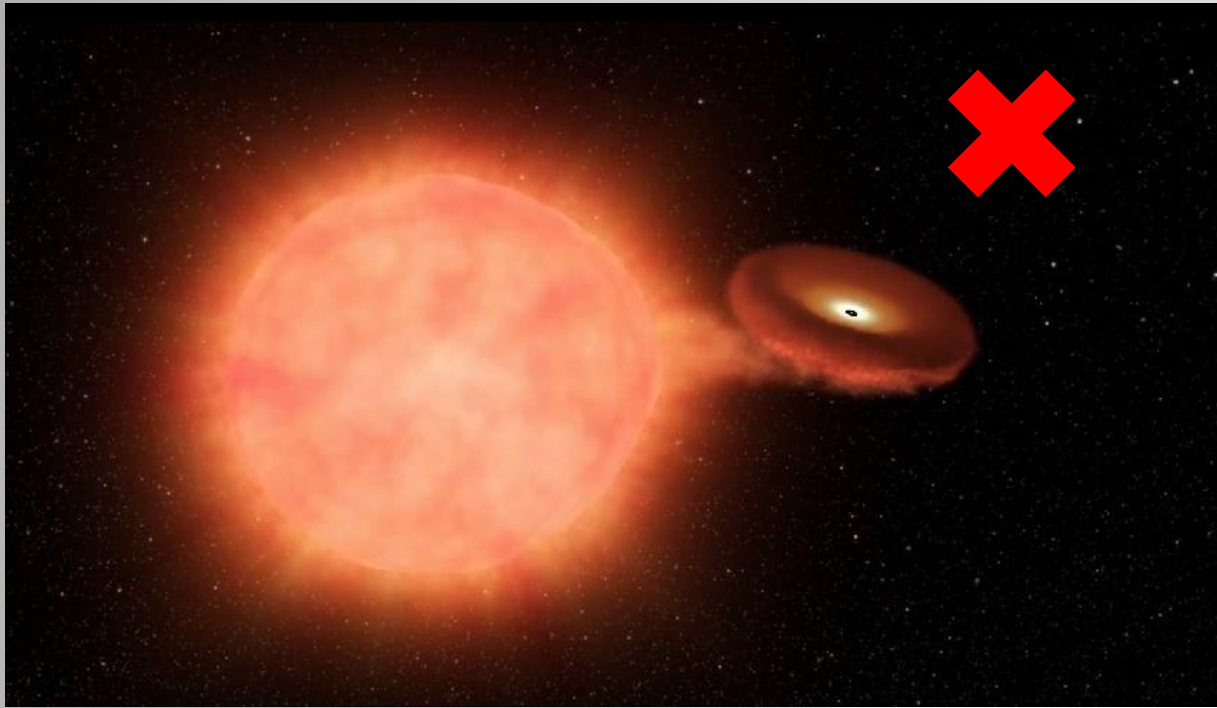


Too rare to match observed SN Ia rate

Subgiant He donors



Excluded by pre-explosion imaging



404

~~**FILE NOT FOUND**~~

Donor

A white rectangular box containing a sad face emoji with 'X' eyes, the number '404', the text 'FILE NOT FOUND' with a red horizontal line through it, and the word 'Donor' in red.

