

# *Cosmic Explosions – their importance in the life of the Universe*

**Rupak Roy**  
*Manipal Centre for Natural Sciences,  
Centre of Excellence,  
Manipal Academy of Higher Education*

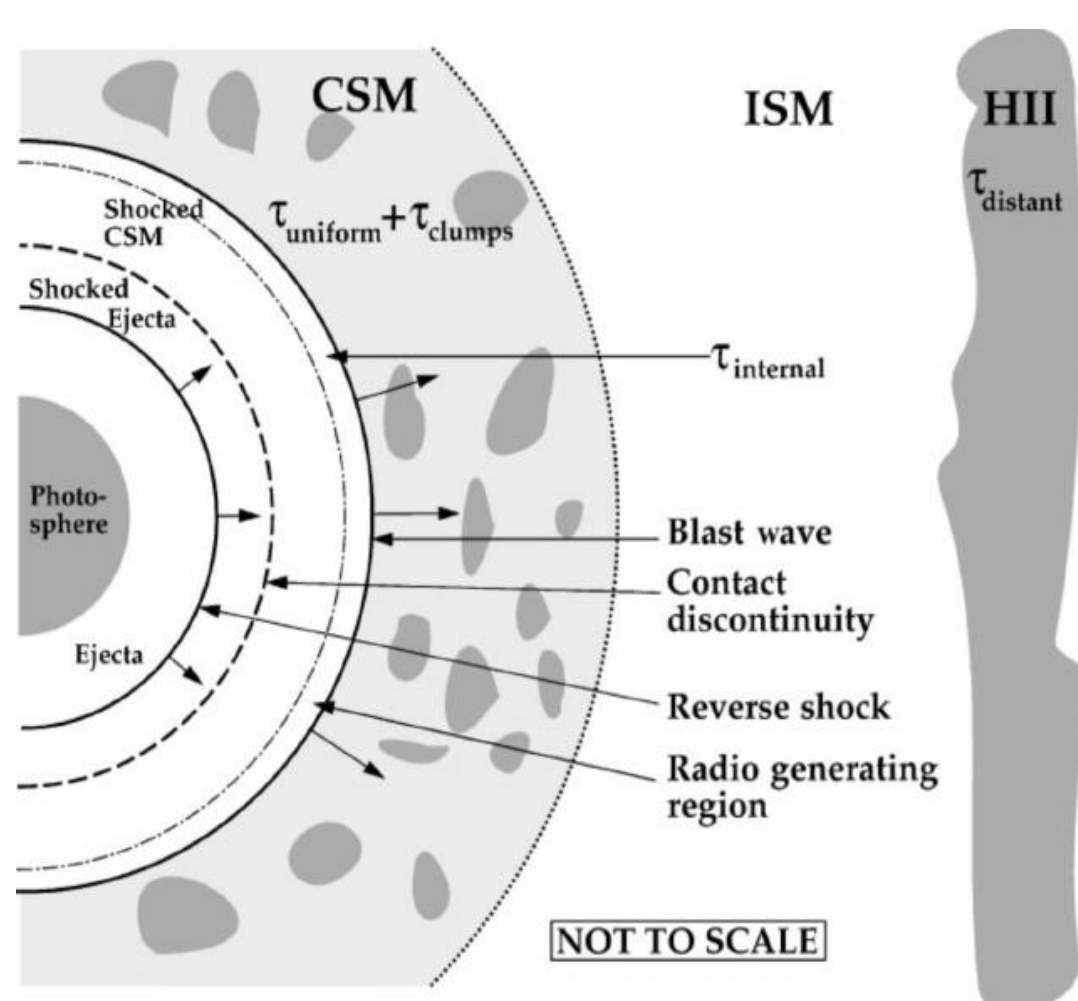
**MRCBAS039**



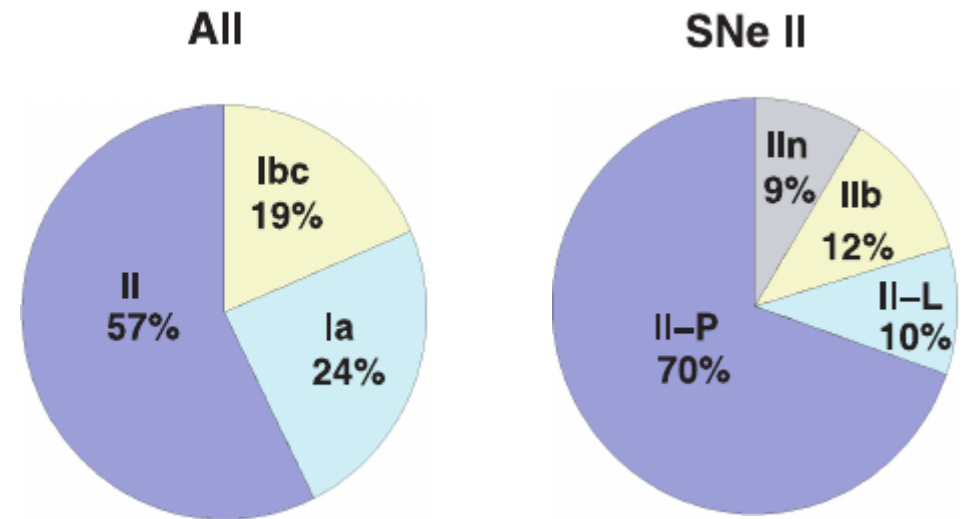
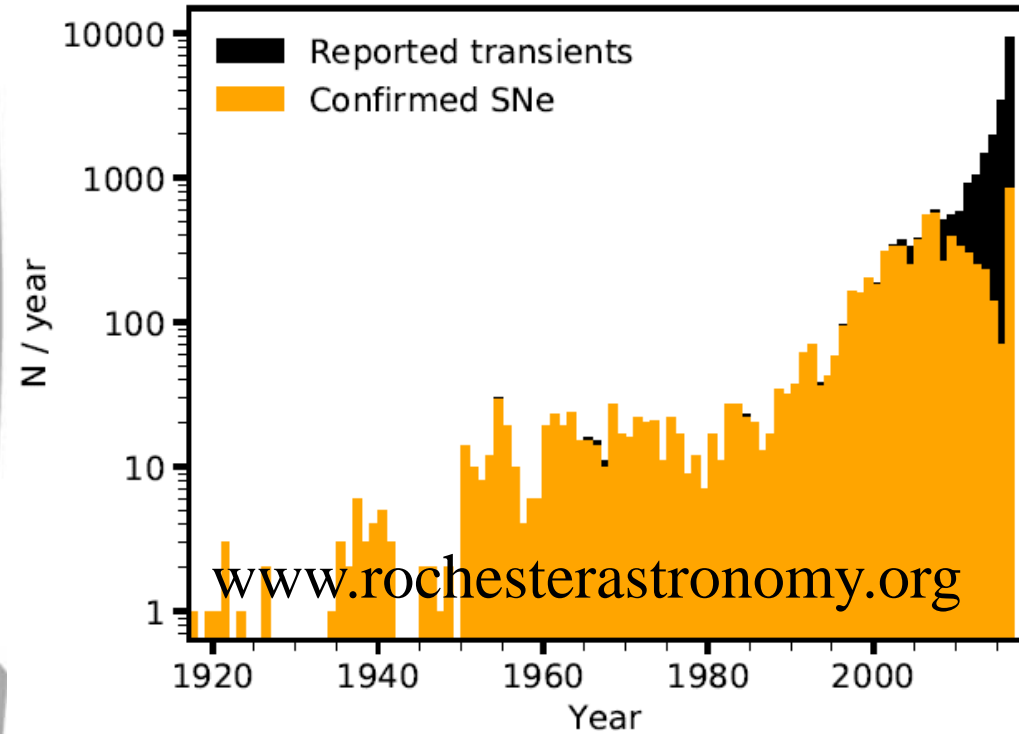
**MANIPAL**  
ACADEMY of HIGHER EDUCATION  
*(Institution of Eminence Deemed to be University)*

*MRC- 2023, Manipal Academy of Higher Education, Manipal*

# Introduction



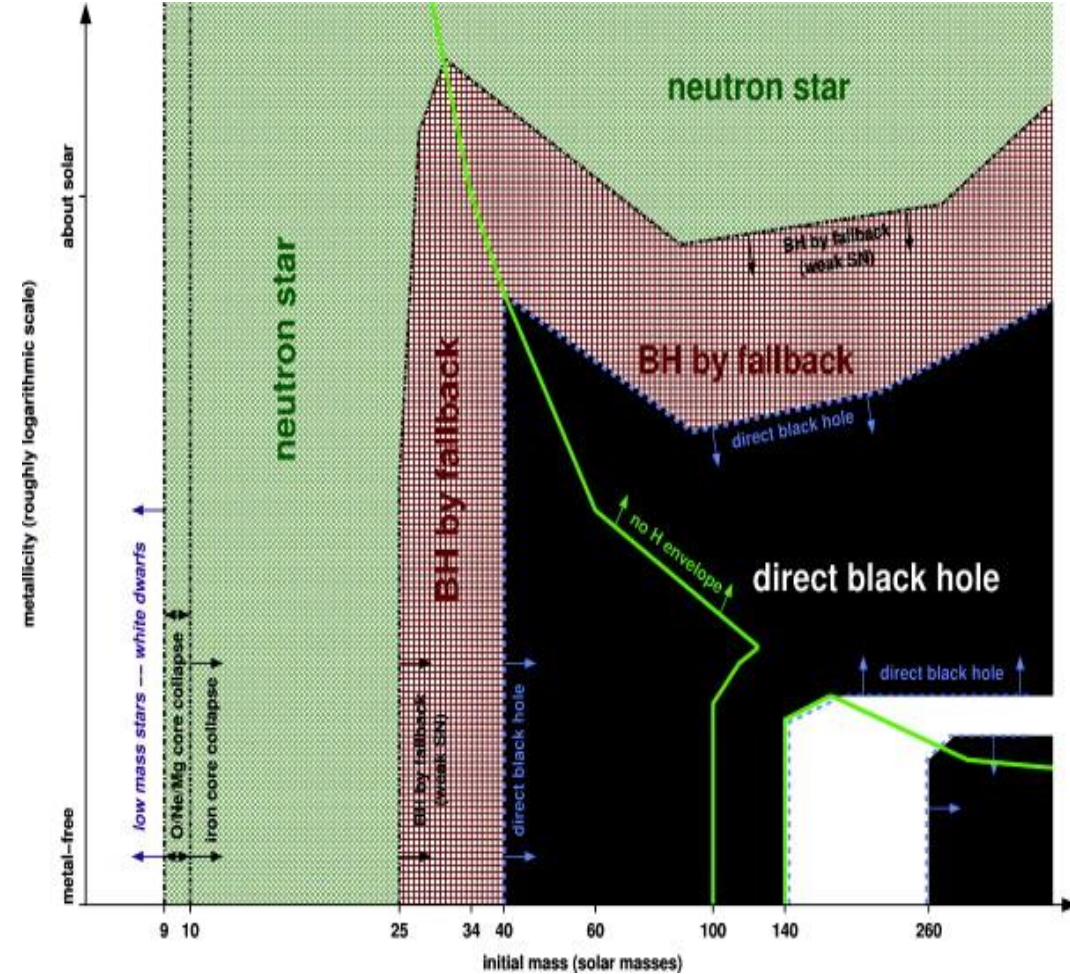
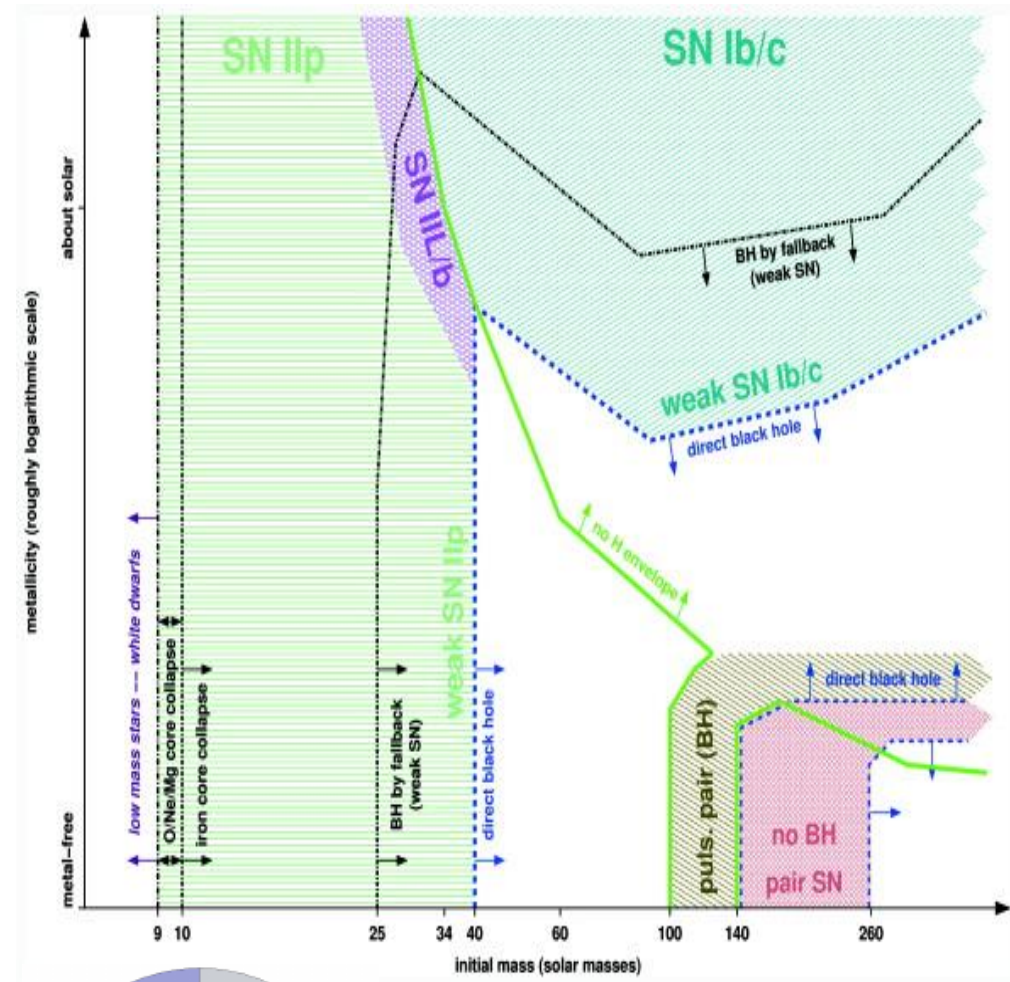
Weiler et al. (2002)



Li et al. (2011)



# Aim / Objectives

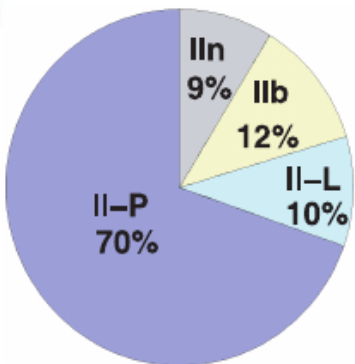


Heger et al. (2003)

*Is there any dependency of Hydrogen rich Supernovae on Metallicity, and vice-versa?*

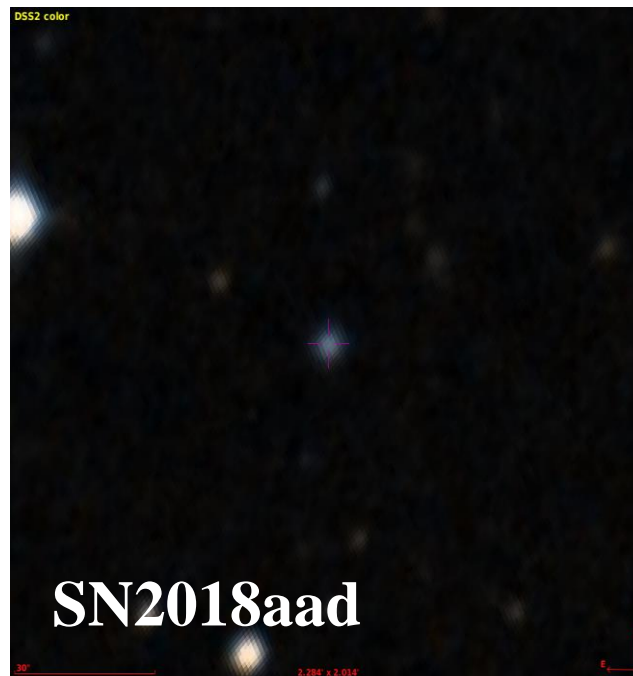
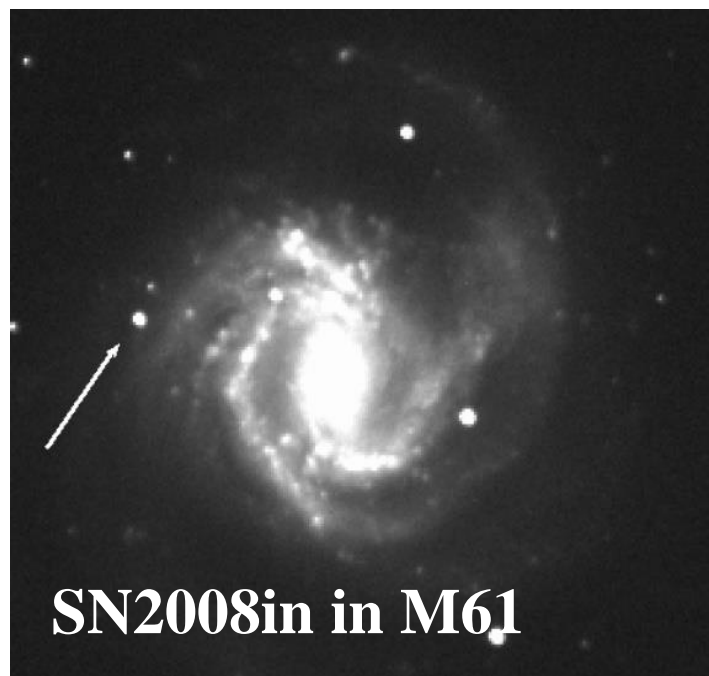
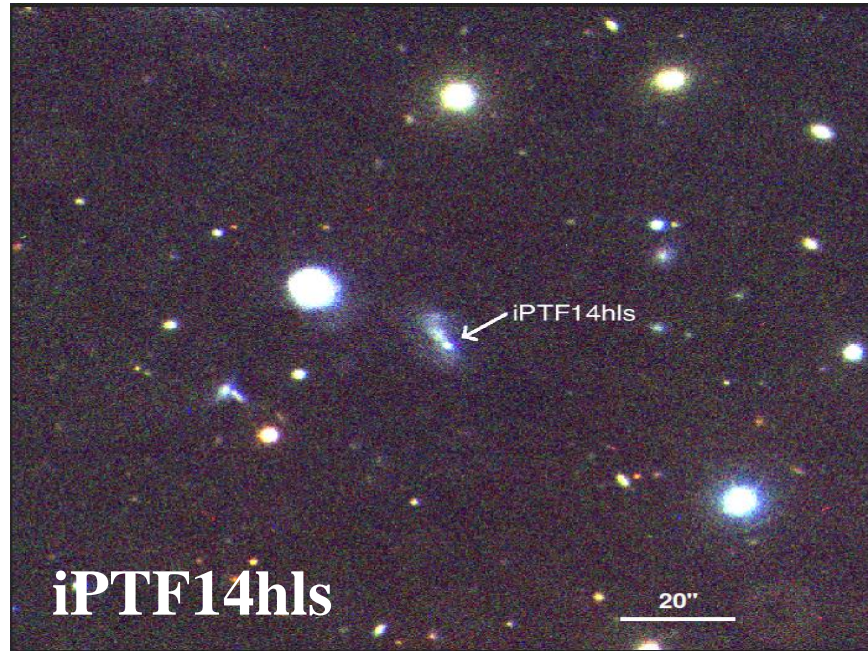
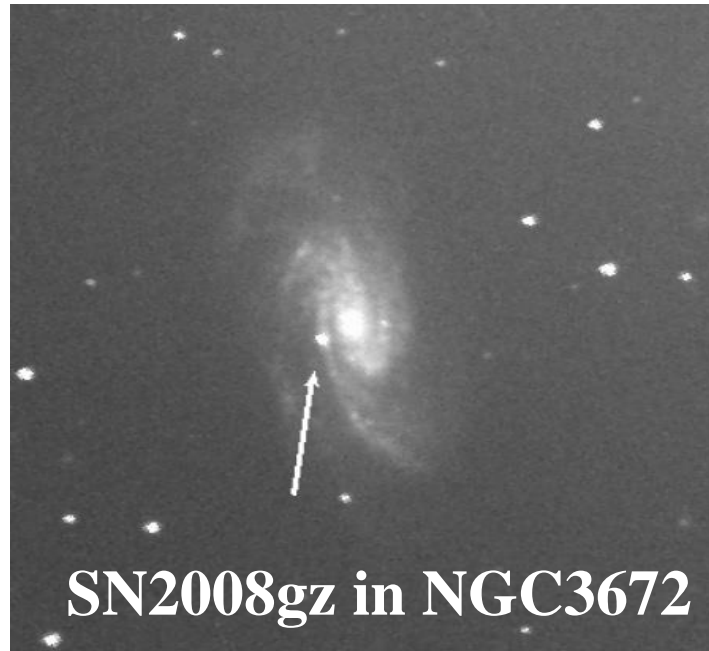
Li et al. (2011)

*MRC- 2023, Manipal Academy of Higher Education, Manipal*

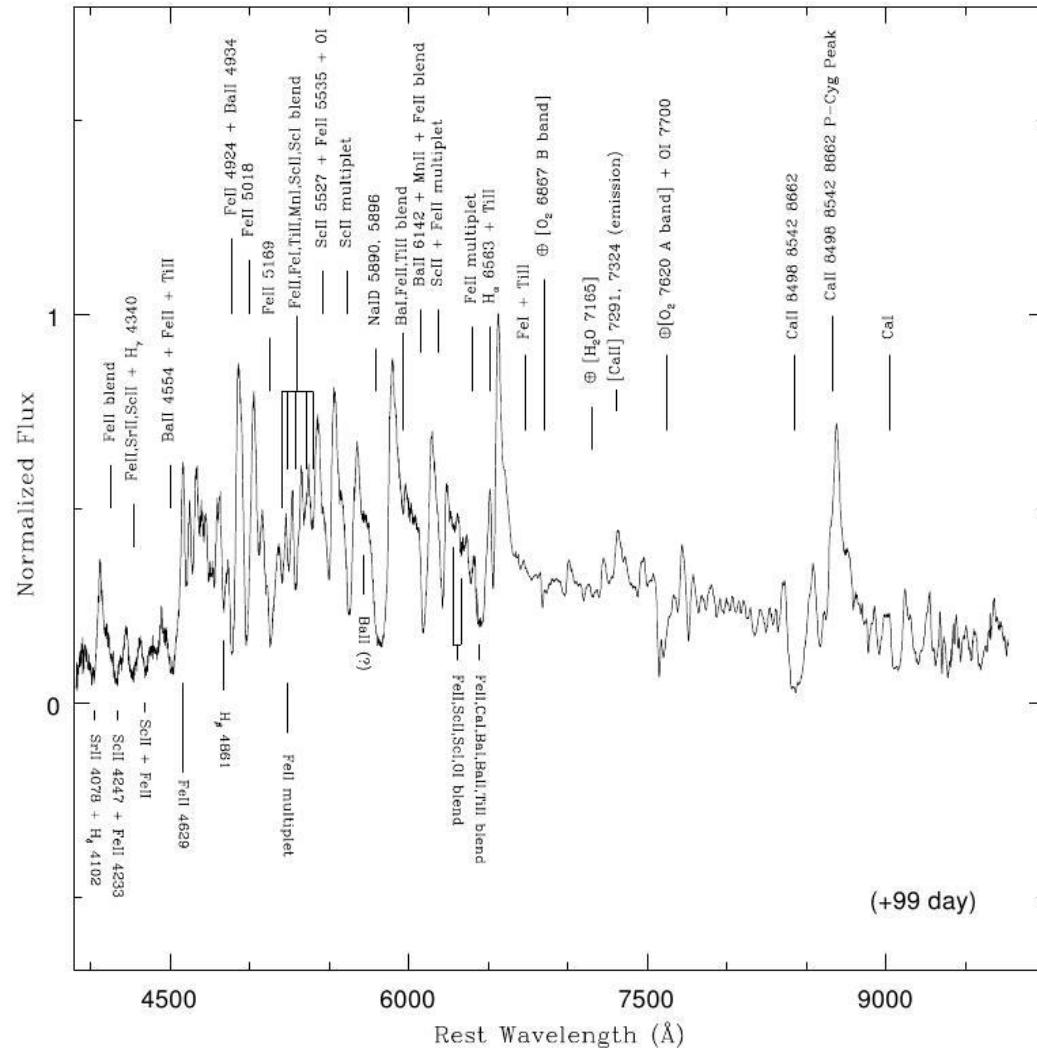




# Methods

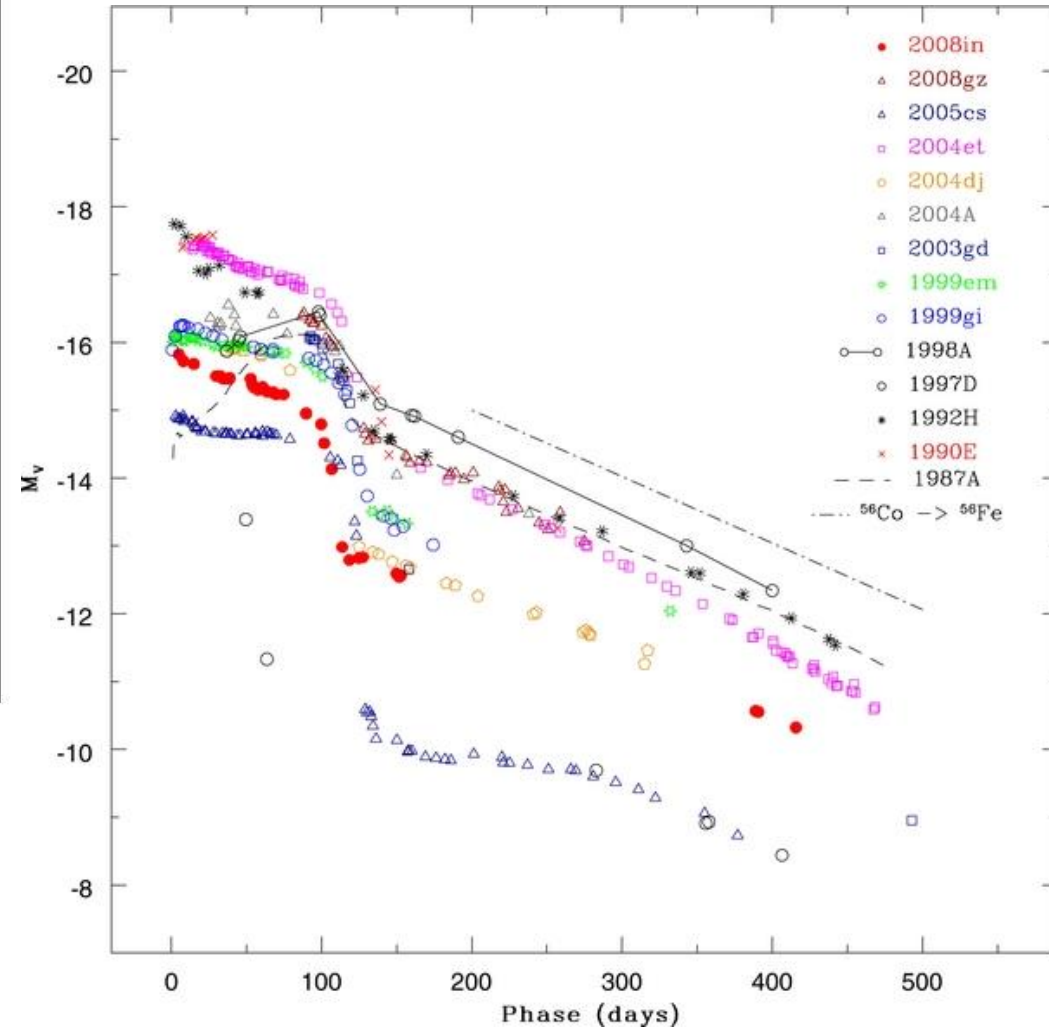


# Results



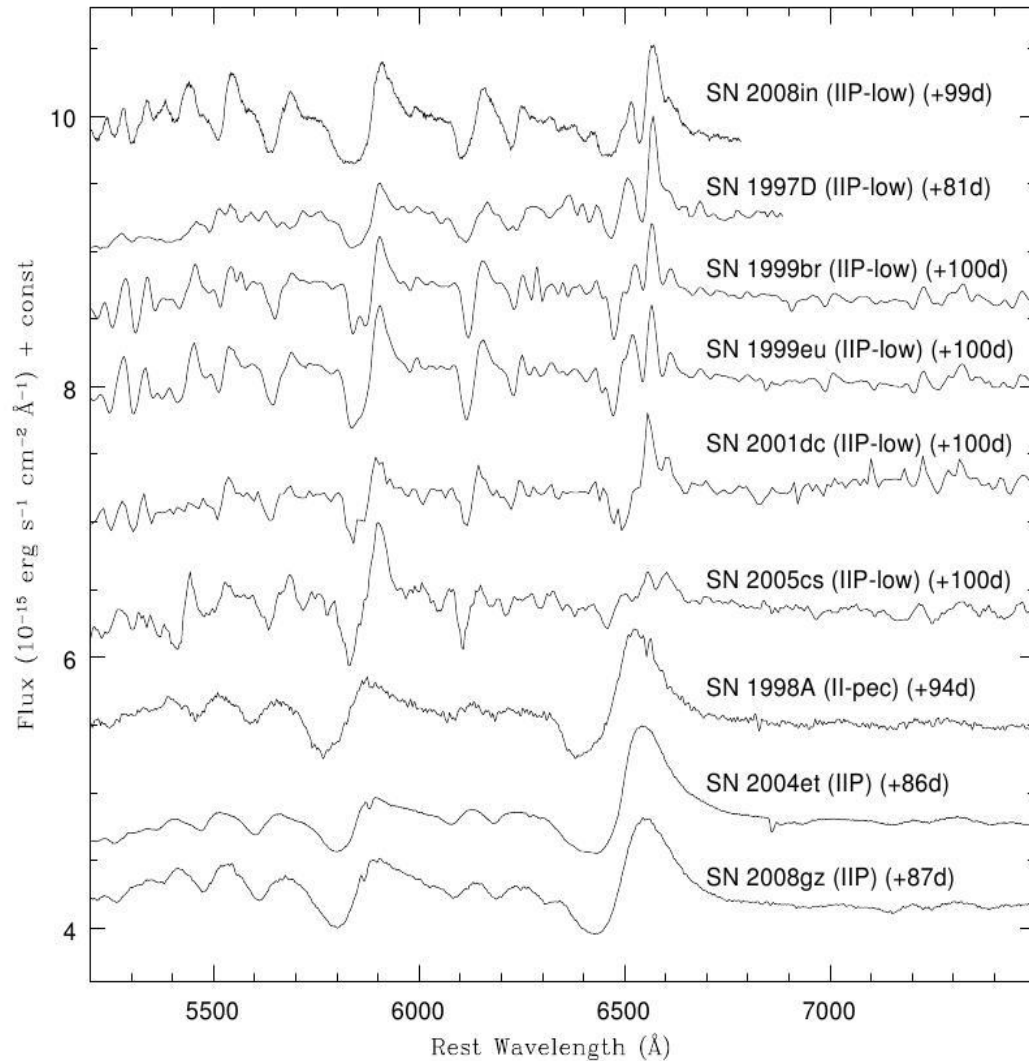
Roy et al. (2011)

Roy (2013)



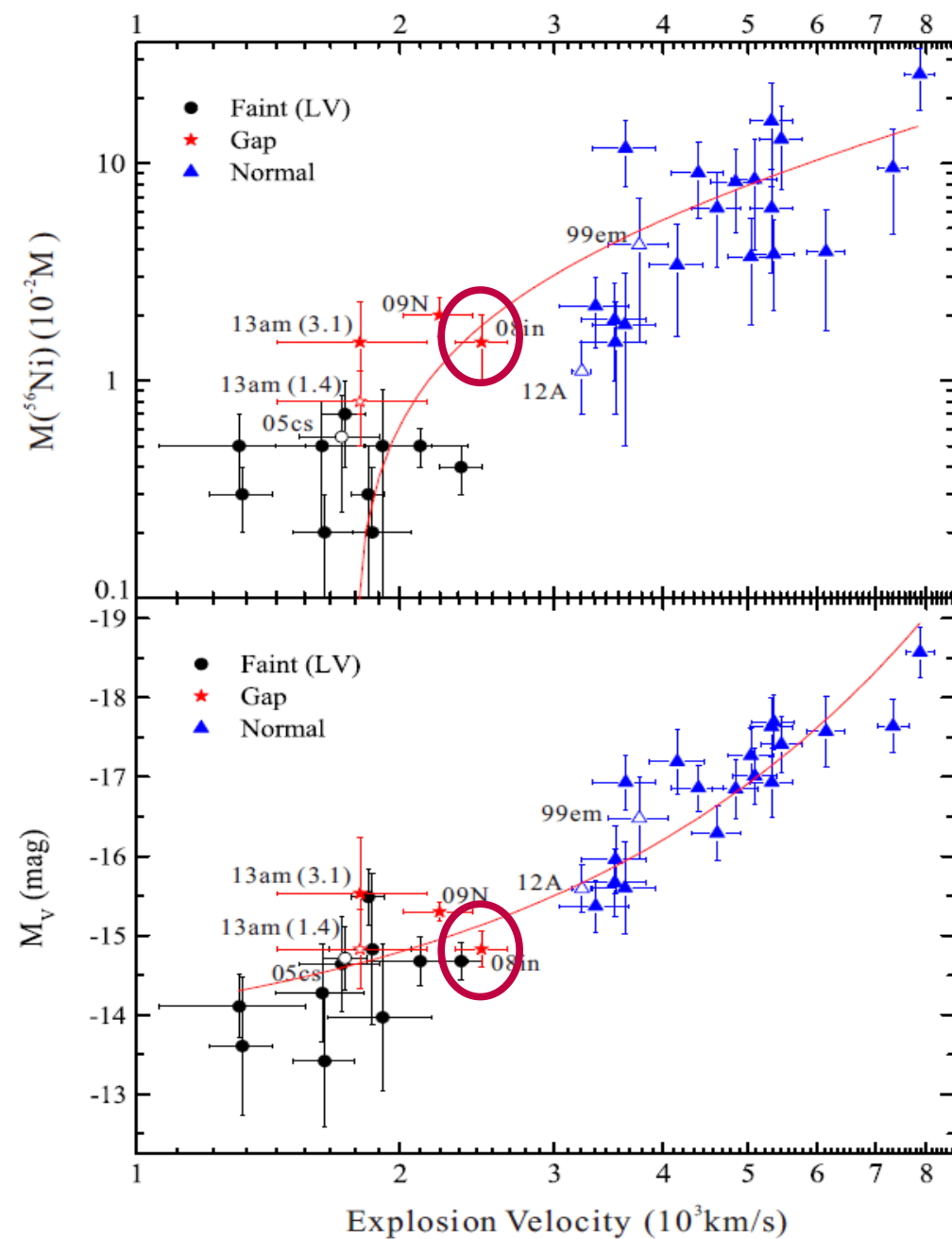


# Results

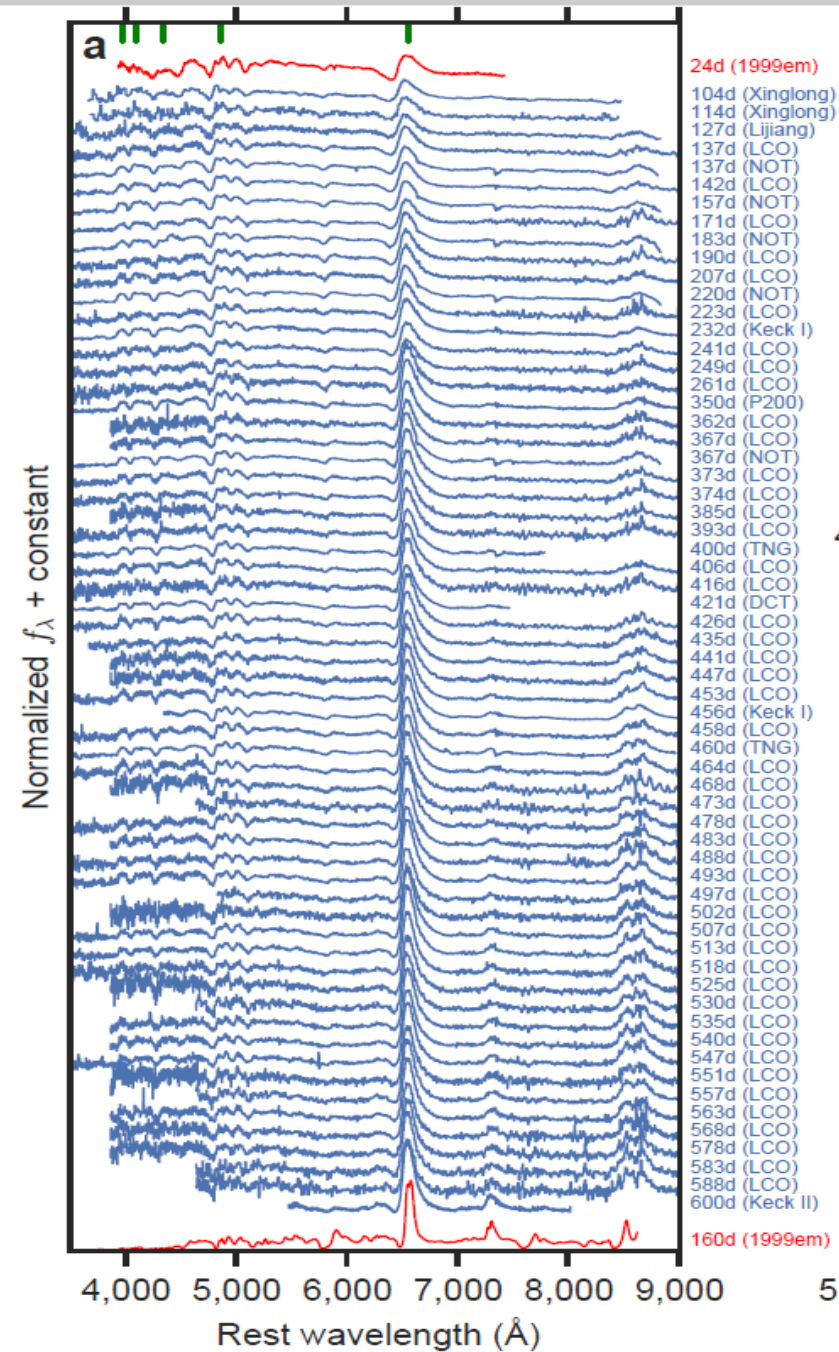
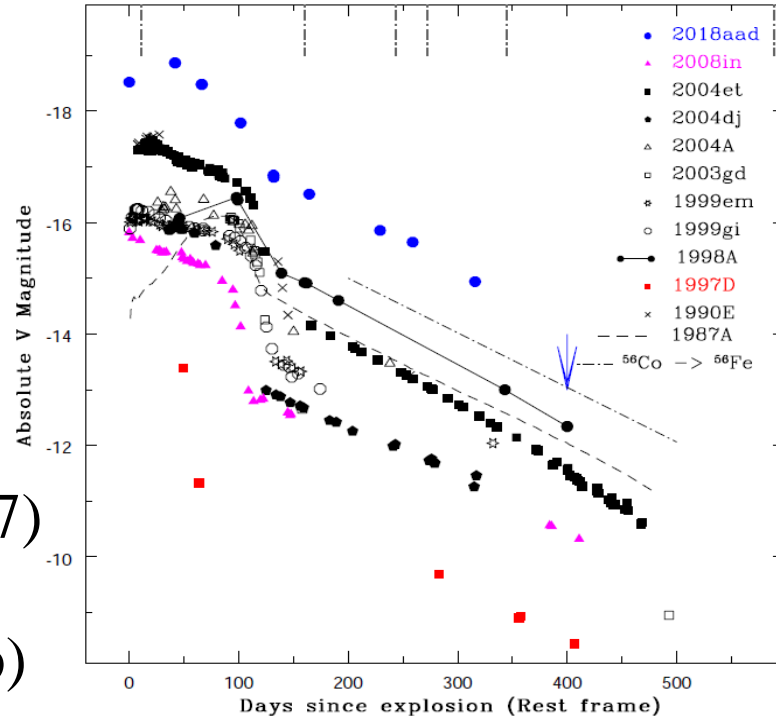
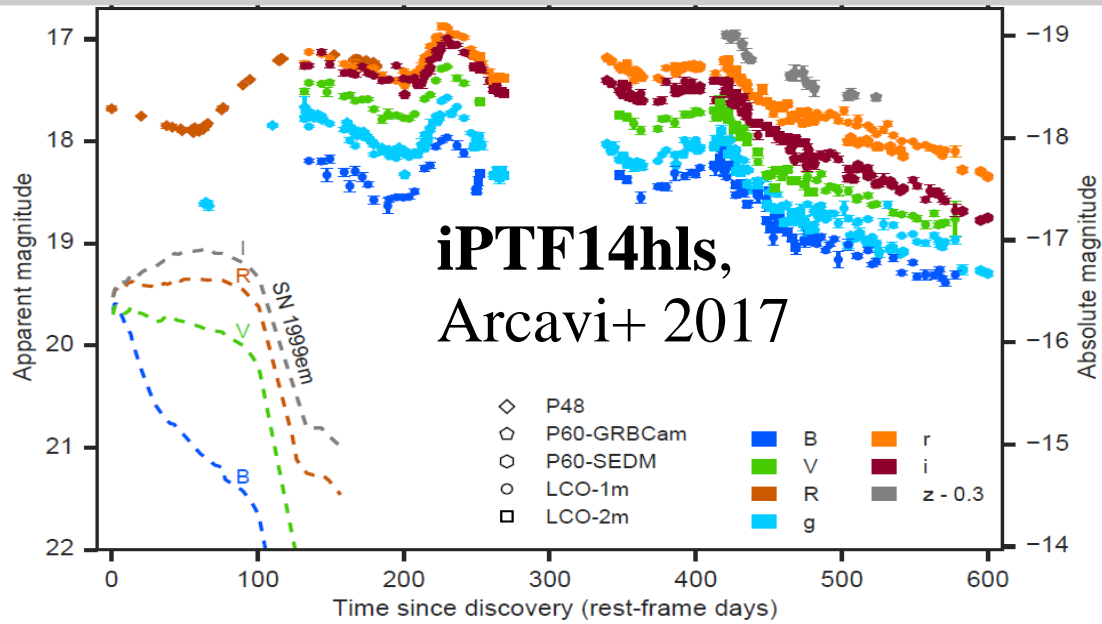


Roy et al. (2011a, 2011b)

Gandhi et al. (2013)



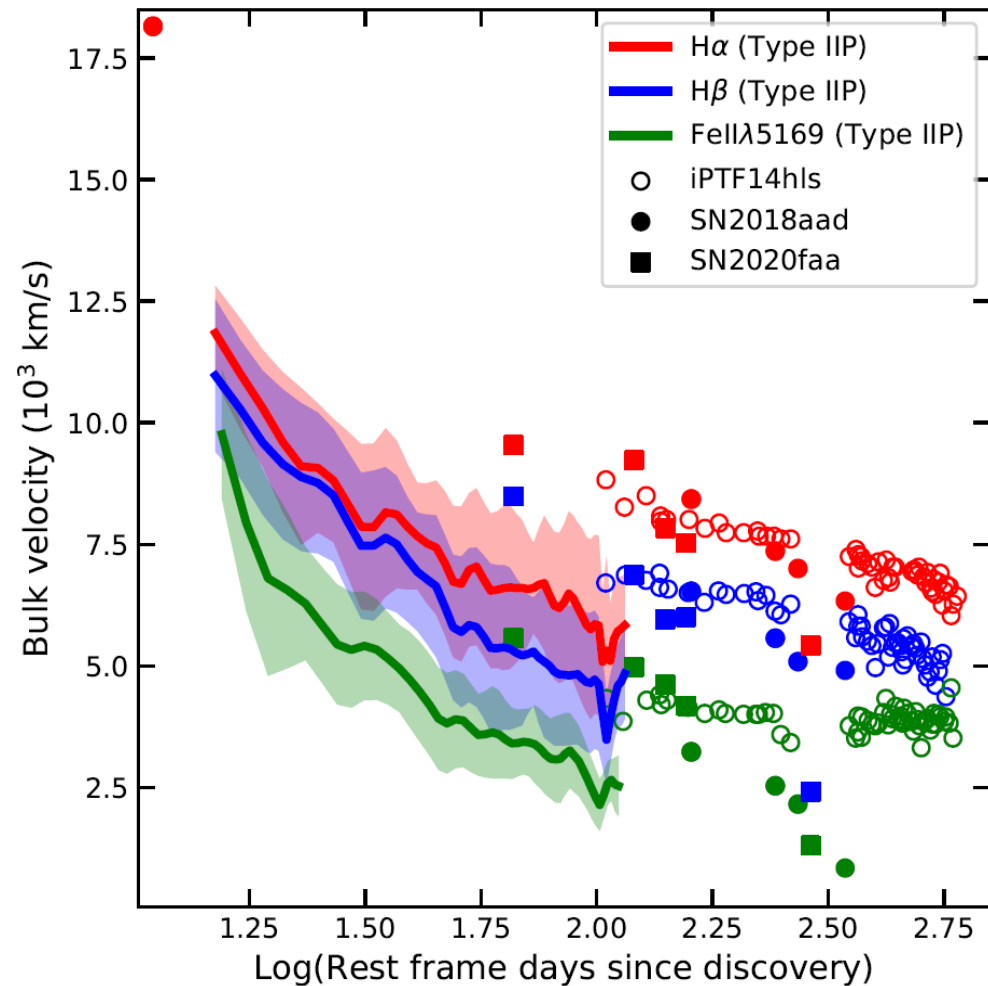
# Results



Arcavi et al. (2017)

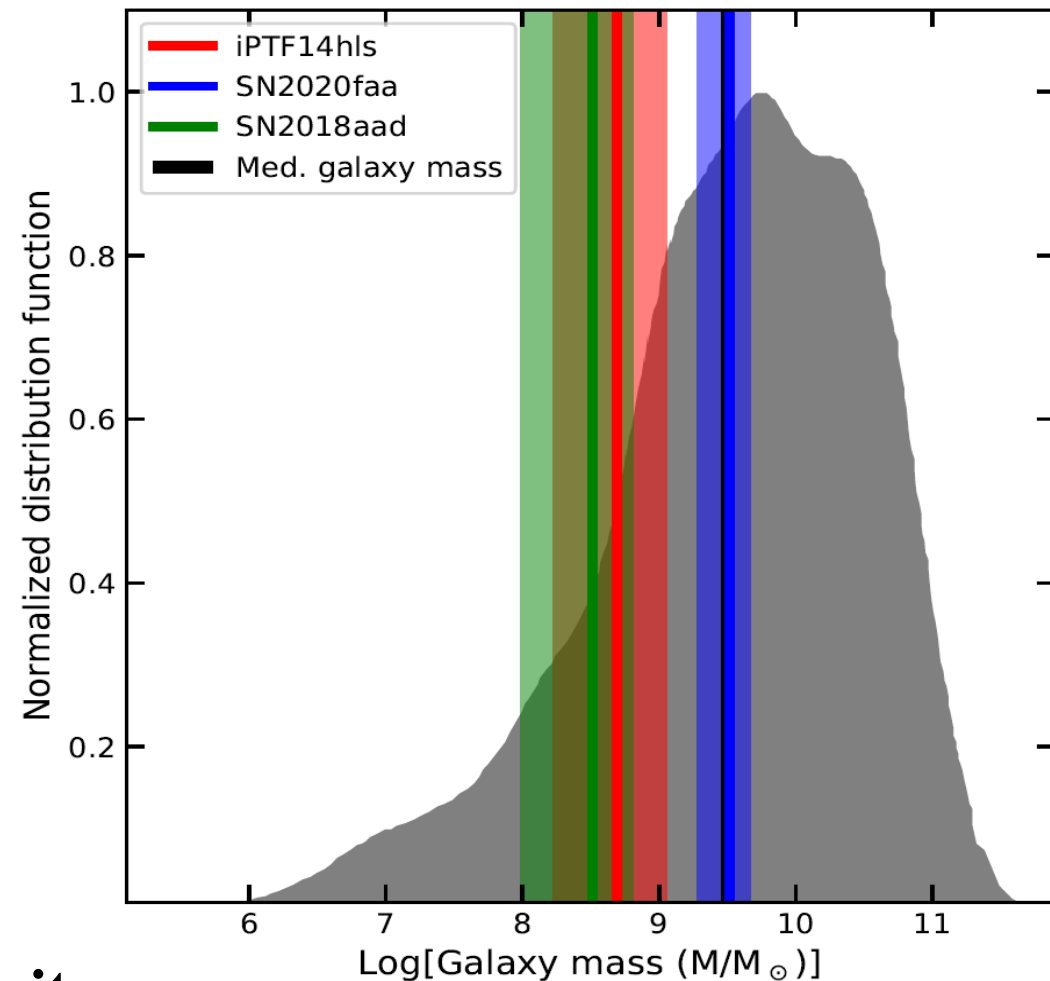
Roy et al. (in prep)

# Results



*So far, only  $\sim 4$  extremely luminous Type IIP SNe have been discovered*

Roy et al. (in prep)



**Lower galaxy mass  $\Rightarrow$  Lower metallicity**



# Conclusion

**Supernovae are one of the prime astrophysical processes that produce Metals and dust in the distant Universe.**

**There is a possible dependency of the occurrence rate of Hydrogen-rich Supernovae on the metallicity of the host galaxy. However, this correlation may not be very strong, as extremely luminous Hydrogen rich supernovae have also been discovered in relatively massive Galaxies.**

**So far very few extremely luminous Hydrogen rich supernovae have been discovered. These extremely luminous supernovae may also be powered by Magnetar. Compact remnants produced at centers of such progenitors provide excess energy to the ejecta while spinning down to a lower energy state after the explosion. Other possibility is the interaction of the SN-shock with the structured circumstellar material (CSM). More observations and theoretical modeling are necessary to understand the natures of the progenitors of such cosmic catastrophes.**

# References

**Arcavi I., Howell D. A., Kasen D. et al. Nature, 551, 210 (2017)**

**Gandhi P., Yamanaka M., Tanaka M. et al. ApJ, 767, 166 (2013)**

**Heger A., Fryer C. L., Woosley S. E. et al. ApJ, 591, 288 (2003)**

**Li W., Leaman J., Chornock R. et al. MNRAS, 412, 1441 (2011)**

**Roy R., Kumar B., Benetti S. et al. ApJ, 736, 76, (2011a)**

**Roy R., Kumar B., Moskvitin A. S. et al. MNRAS, 414, 167 (2011b)**

**Roy R. PhD Thesis (2013)**

**Weiler K. W., Panagia N., Montes M. J. et al. ARA&A, 40, 387 (2002)**

*Thanks .....*