SN 2016B: an intermediate type II Supernova

Raya Dastidar[1], Kuntal Misra[1], M Singh[2], D K Sahu[3], A Pastorello[4], A Gangopadhyay[1], L Tomasella[4], S Benetti[4], G Terreran[4], P Sanwal[1], B Kumar[1], A Singh[3], B Kumar[3], G C Anupama[3] and S B Pandey[1]

[1] Aryabhatta Research Institute of observational sciencES (ARIES)
[2] Korea Astronomy and Space Science Institute, 776 Daedeokdae-ro, Yuseong-gu, Daejeon 34055, Republic of Korea
[3] Indian Institute of Astrophysics, Koramangala, Bangalore 560 034, India
[4] INAF-Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, 35122 Padova, Italy

Introduction

❏ The type II Supernovae (SNe) are the hydrogen-rich sub-class of core-collapse SNe.

❏ Two prominent classes based on light curve morphology: Type IIP ('P'lateau) and IIL ('L'inear)

❏ 'Intermediate' refers to the events exhibiting characteristics of both Type IIP and IIL

❏ 'Intermediate events' challenges the classification scheme and stresses the importance of constraining the progenitor properties.

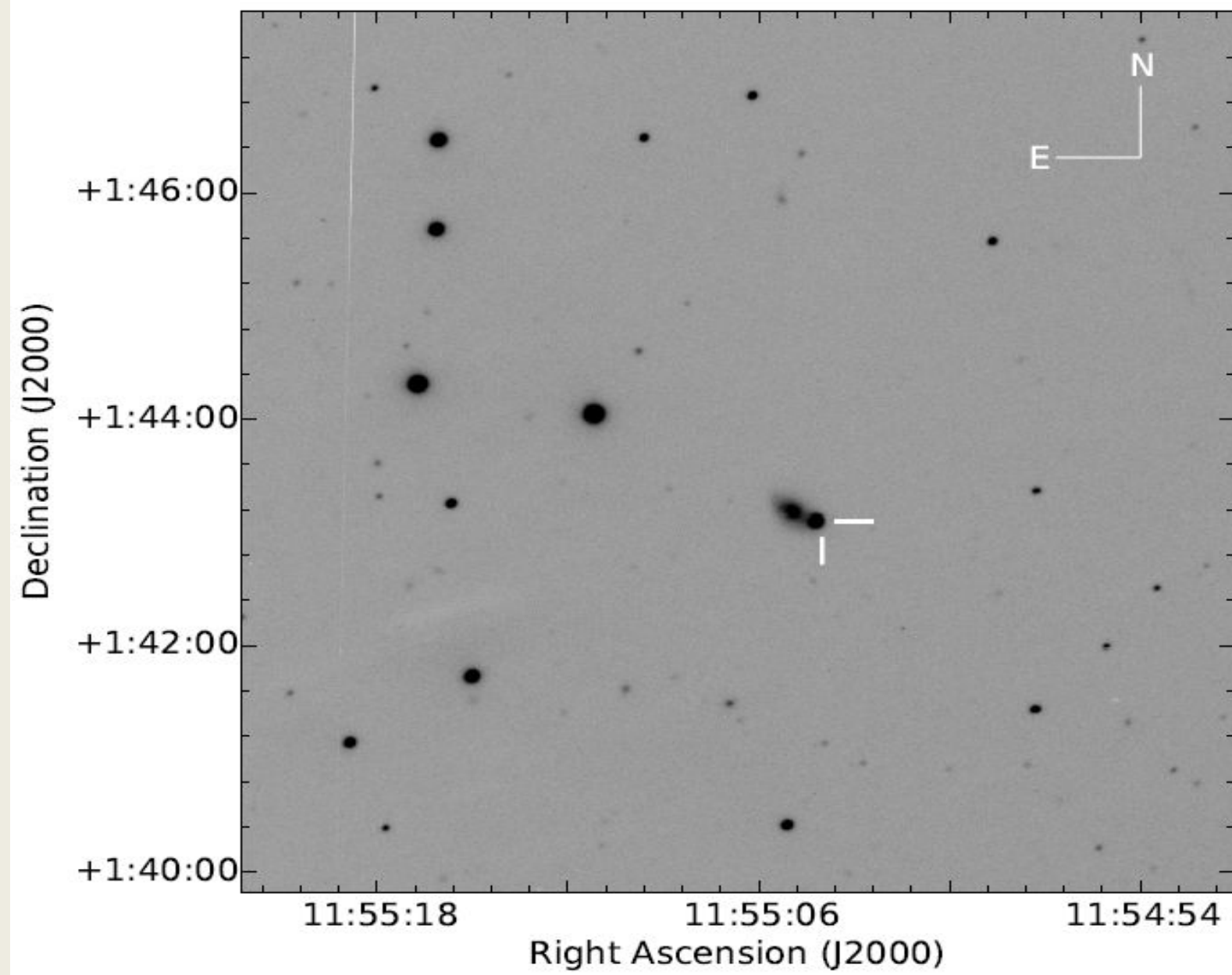## SN 2016B, a.k.a. ASASSN-16ab in PGC 037392

❏ Discovery: All Sky Automated Survey for SuperNovae (ASAS-SN) programme.

❏ Observations spanned from 13 to 188 days.

❏ **Observations with 2.0m HCT:**
  ❏ 9 photometric data points in BVRI bands
  ❏ 14 spectra with HFOSC (Gr 7 and 8)

Fig 1: V-band image of SN 2016B with the 2.0m HCT taken on Jan 07, 2016
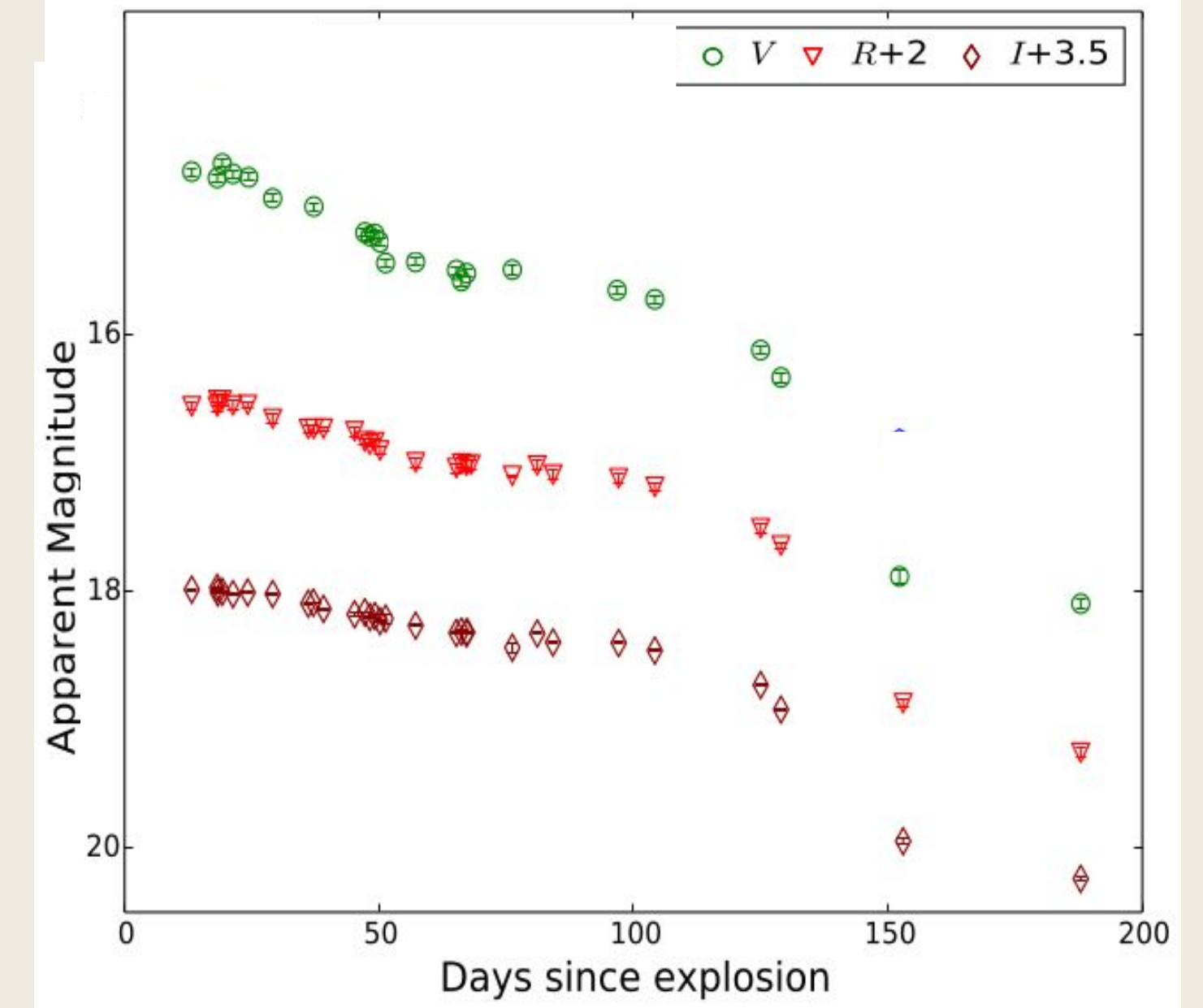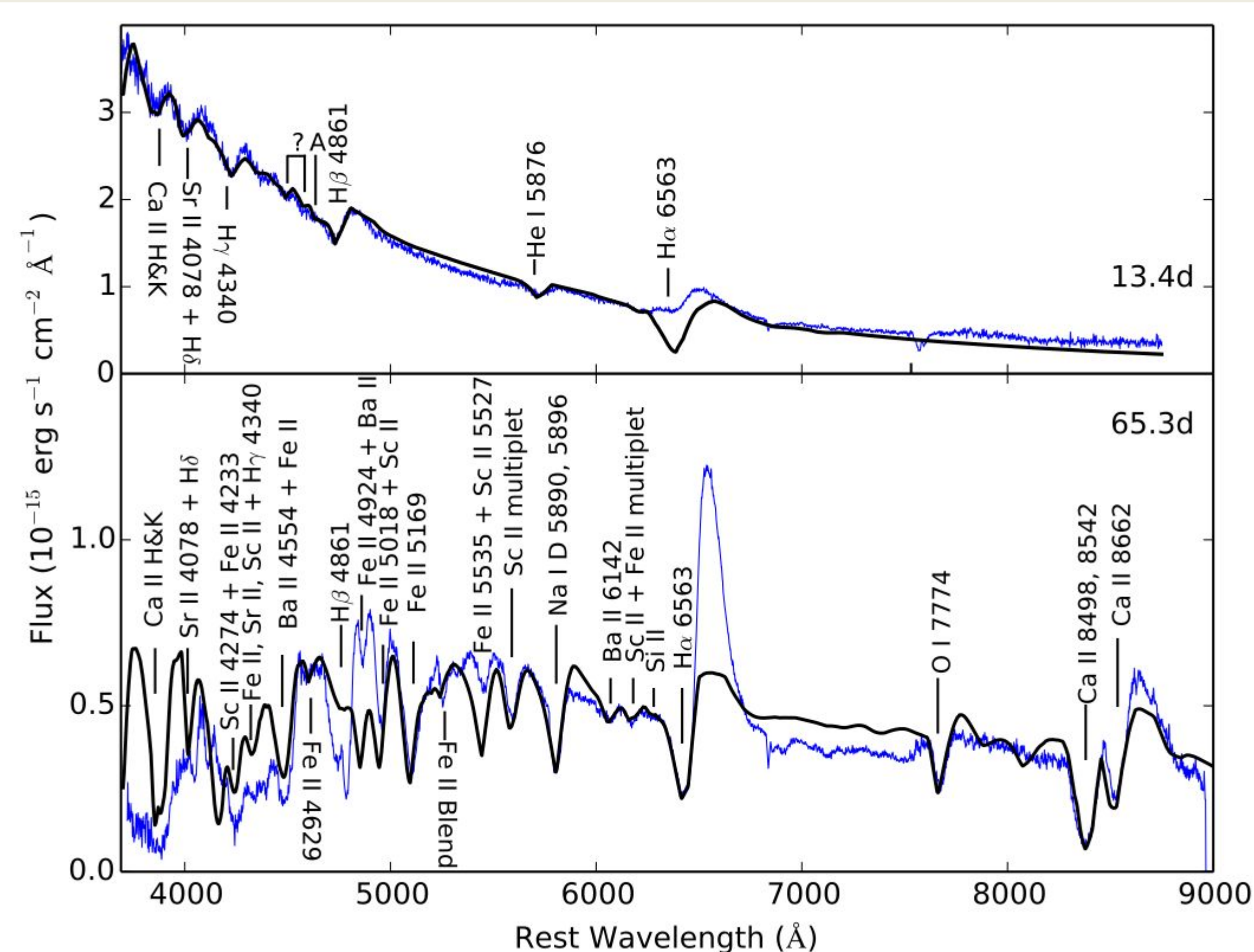
Fig 2: VRI band light curves of SN 2016B

SYN++ fits

Fig 3: SYN ++ modelling of the early (13.4 d) and plateau phase (65.3 d) spectra of SN 2016B marked with the lines identified from the modelling.

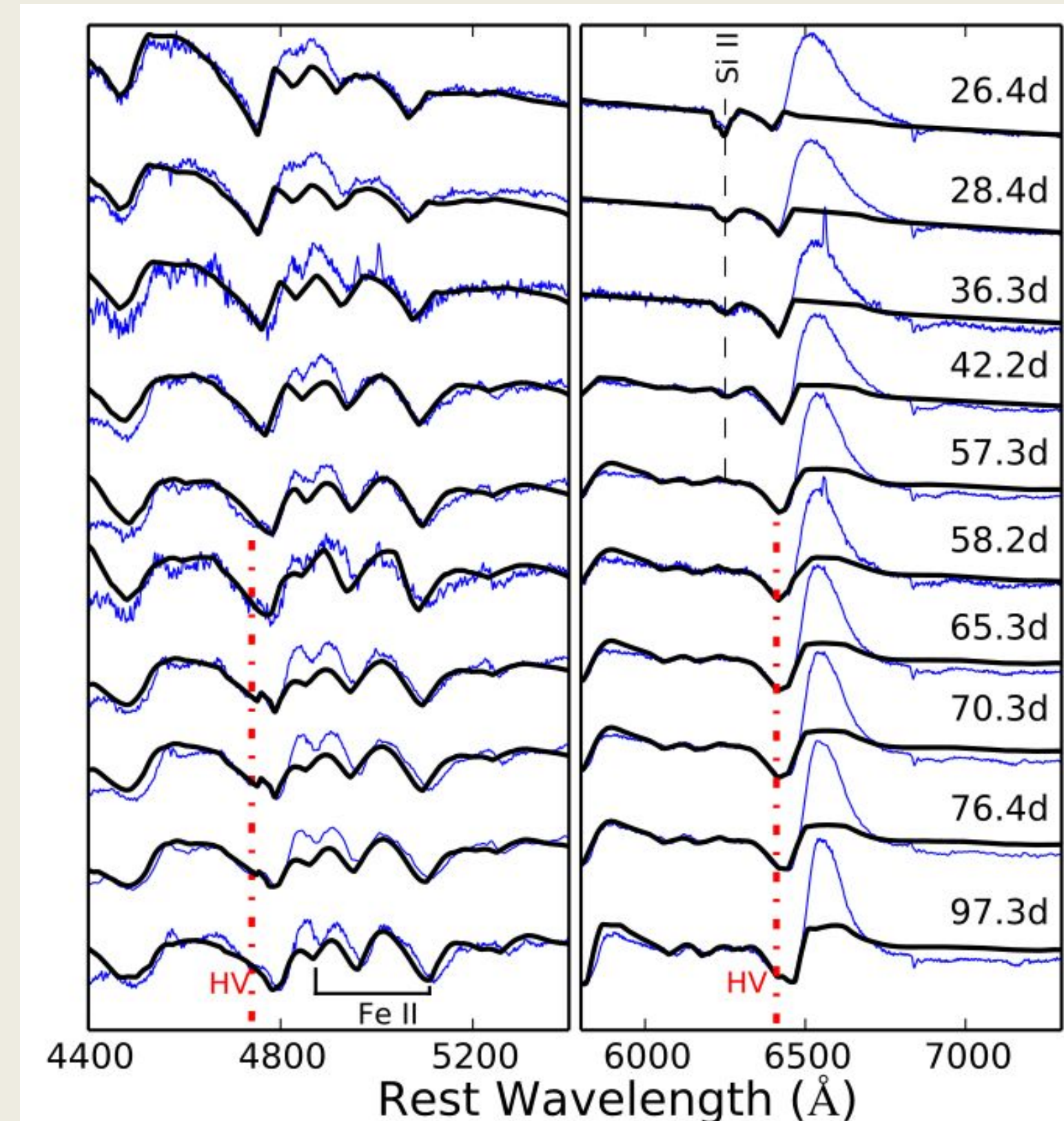## Signature of ejecta-circumstellar interaction

Fig 4: SYN ++ modelling of the H Balmer, Fe II , and Si II lines in the spectra of SN 2016B shown at the photospheric phases. The broad, extended absorption feature of H I from the 57.3 d spectrum is reproduced using a normal velocity and a high-velocity component.
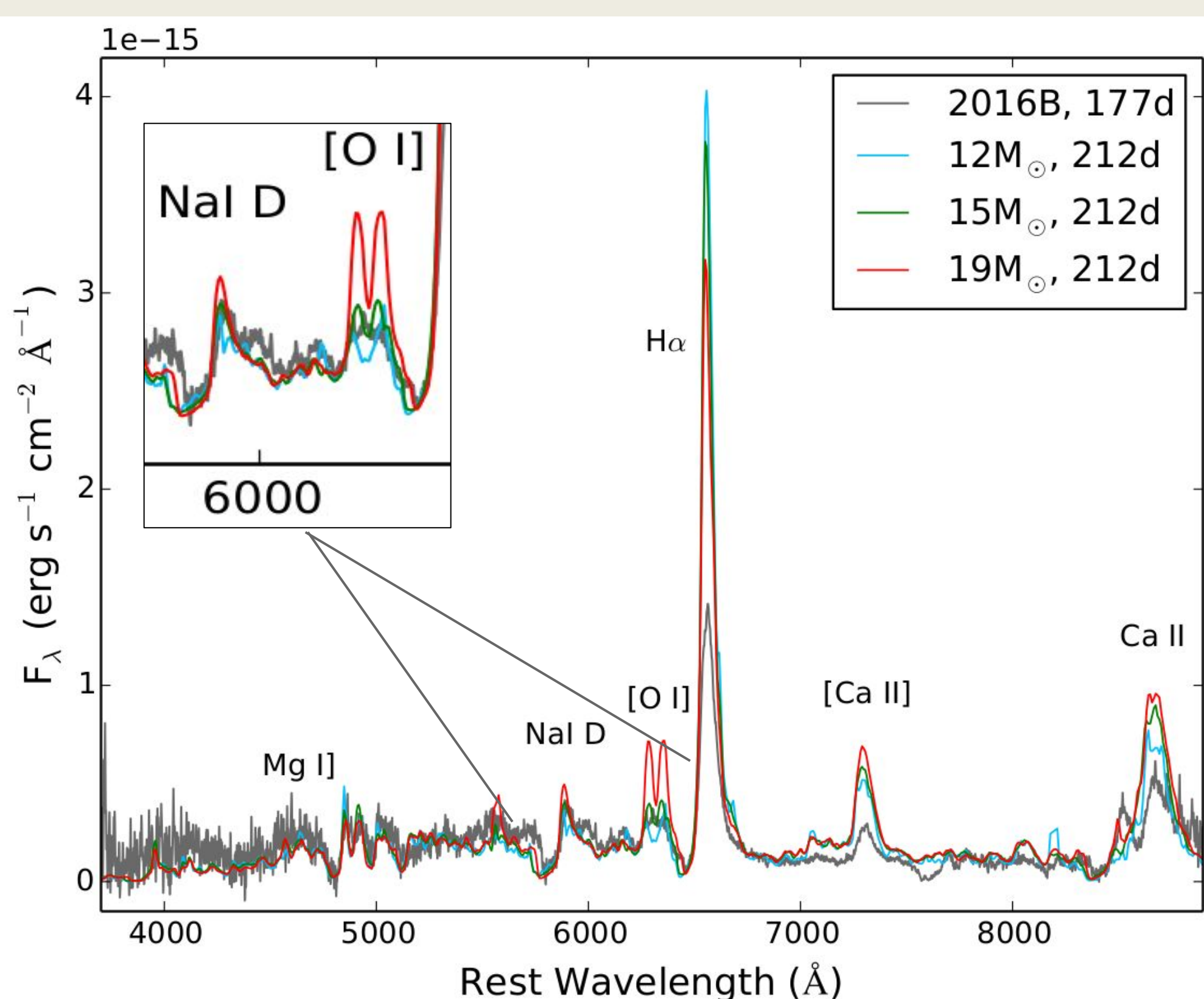
Progenitor mass range estimation

Fig 5: Comparison of the 177 d spectrum of SN 2016B with that of the scaled model spectra from Jerkstrand et al. (2014). The model spectra flux has been scaled for Ni-56 mass, distance, and time.

Estimated progenitor mass range: 12-17 $M_\odot$

Summary and role of 2.0m HCT

● SN 2016B exhibits properties intermediate to those of IIP and IIL
  ○ The long optically thick phase is typical of Type IIP
  ○ Ejecta - Circumstellar material interaction commonly expected in Type IIL
● Progenitor: Red supergiant star in the mass range 12 - 17 $M_\odot$

● Role of 2.0m HCT:
  ○ Late time photometric observations.
  ○ Nebular phase spectroscopy

References:
• Dastidar R., Misra K., Singh M., et al., 2019, MNRAS, 486, 2850
• Jerkstrand A., Smartt S. J., Fraser M., et al., 2014, MNRAS, 439, 3694