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Erratum: Low luminosity Type II supernovae – III. SN 2018hwm, a faint event with an unusually long plateau

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The paper 'Low luminosity Type II supernovae – III. SN 2018hwm, a faint event with an unusually long plateau' was published in MNRAS, 501, 1059–1071 (2021). After the publication of the paper, we realised that there was an error in the bolometric light curve of SN 2018hwm reported in fig. 7 (top panel), which was one order of magnitude fainter than the luminosity reported correctly in fig. 6 (bottom panel). As a consequence, the average luminosity of the plateau, as shown in fig. 7, is $\sim 3 \times 10^{40}$ erg s^{-1} instead of $\sim 3 \times 10^{41}$ erg s^{-1}. The input bolometric light curve used for the modelling was hence 10 times fainter that the correct luminosity, and the SN parameters inferred from the modelling need to be revised.

We re-run the hydrodynamical modelling code over the correct bolometric data adopting the same assumptions on the explosion epoch, distance modulus and reddening (MJD = 58425.0 ± 1.5, DM = 33.58 ± 0.19 mag, $A_V = 0.071$ mag, respectively). The best match between the hydrodinamical model and the observed data is shown in Fig. 1. This new figure is intended to replace fig. 7 of Reguitti et al. (2021). The new progenitor parameters we infer are: initial radius $R_0 = 5.9 \times 10^{13}$ cm (845 $R_\odot$), kinetic plus thermal energy $E = 0.075 \times 10^{51}$ erg, ejected mass $M_{ej} = 8.0\,\mathrm{M}_\odot$ and Nickel mass M(^{56}Ni) = 0.0085 M$_\odot$. These values replace those originally reported in Reguitti et al. (2021): $R_0 = 1.5 \times 10^{13}$ cm (215 R$_\odot$), $E = 0.055 \times 10^{51}$ erg, $M_{ej} = 8.0\,\mathrm{M}_\odot$ and M(^{56}Ni) = 0.002 M$_\odot$. In particular, with the correct bolometric light curve, we infer R_0 and M(^{56}Ni) values which are a factor of about four larger than estimated before. Although the above mentioned error required a revision of the previous SN parameters, the new estimates do not significantly affect the main conclusions of Reguitti et al. (2021).

The larger progenitor radius and the slightly higher ^{56}Ni mass makes SN 2018hwm similar to other low-luminosity SNe IIP studied in the past (e.g. Pastorello et al. 2004; Spiro et al. 2014). In particular, the more expanded progenitor for SN 2018hwm resembles the observed red supergiant (RSG) progenitors of SNe 2005cs (Maund, Smartt & Danziger 2005) and 2008bk (Mattila et al. 2008; Van Dyk et al. 2012; Maund et al. 2014b; O'Neill et al. 2021). Kozyreva et al. (2021) also pointed out that SN 2018hwm is probably a Fe-CC SN from a relatively low-mass RSG. However, on the basis of the new aforementioned parameters, the electron-capture (EC) SN explosion of a super-asymptotic giant branch star cannot be definitely ruled out.

The expansion velocities of SN 2018hwm during the photospheric phase are comparable to those of SN 2005cs (Pastorello et al. 2009) and the samples of faint SNe IIP (Pastorello et al. 2004; Spiro et al. 2014). For the energy versus ejected mass ratio, we now revise the value to $E/M_{ej} = 0.0094$ foe/M$_\odot$ (where 1 foe = 1×10^{51} erg), which is among the lowest calculated for a Type IIP SN (Pumo et al. 2017; Lisakov et al. 2018 and references therein), and is nearly half of what is derived for other low luminosity SNe IIP for which a 8–10 M$_\odot$ RSG progenitor was directly observed in pre-explosion archive images.

How the revised parameters impact the progenitor and explosion scenarios will be presented in a forthcoming paper (Valerin et al. 2021, in preparation).

In conclusion, with the new parameters, both the ECSN and the Fe-CCSN scenarios are still plausible scenarios for SN 2018hwm.

We apologize for the inconvenience.

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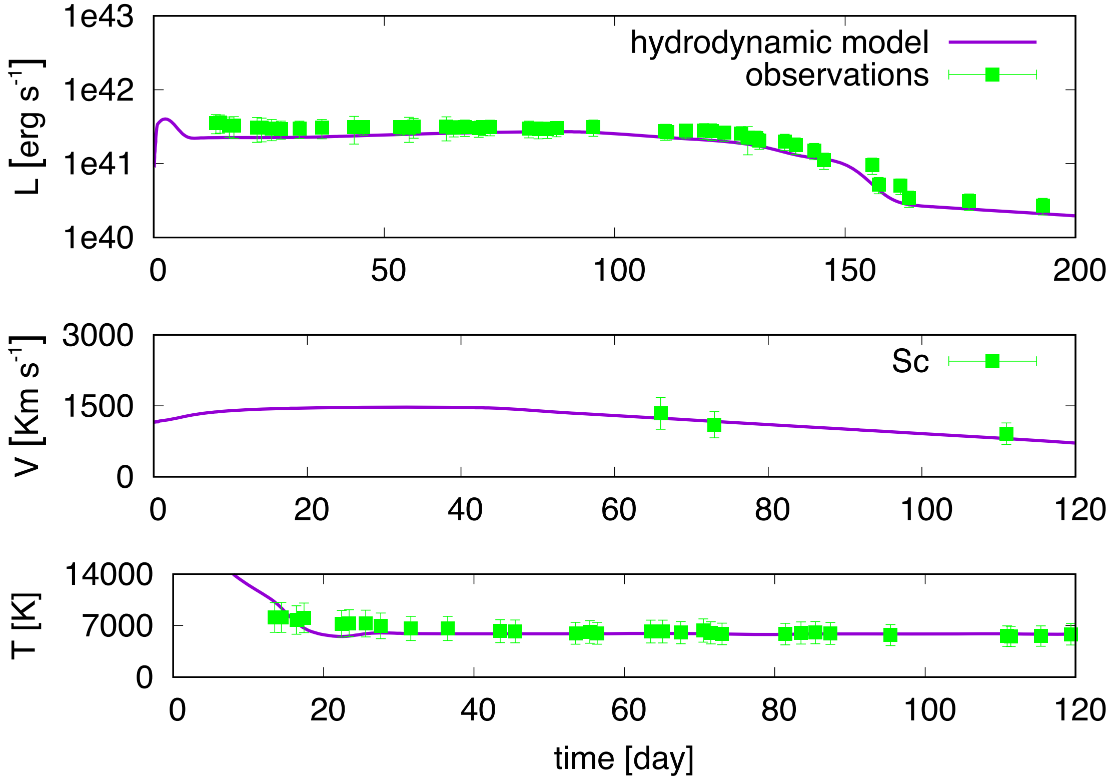

Figure 1. Comparison of the evolution of the main observables of SN 2018hwm with the best-fit model computed with the general-relativistic, radiation-hydrodynamics code on the correct data. The new best-fit model parameters are: total energy 0.075×10^{51} erg, radius at explosion 5.9×10^{13} cm, M(^{56}Ni) = 0.0085 $M_{\odot}$ and ejected mass 8.0 $M_{\odot}$. Top, middle, and bottom panels show the bolometric light curve, the photospheric velocity, and the black-body photospheric temperature as a function of time, respectively.

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