The SNEMO and SUGAR Companion Datasets

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The Nearby Supernova Factory

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The Nearby Supernova Factory (SNfactory, Aldering et al. 2002) has made spectrophotometric observations of Type Ia supernovae since 2004. This work presents an interim version of the data produced, including 210 supernovae observed between 2004 and 2013. This data was taken with the SuperNova Integral Field Spectrograph (SNIFS, Lantz et al. 2004), an instrument continuously mounted on the University of Hawaii 2.2 m telescope on Maunakea, which is optimized for automated observation of point sources on a structured background over the full ground-based optical window at moderate spectral resolution. The supernovae have been flux-calibrated as described in Buton et al. (2013) and Pereira et al. (2013), and the host-galaxy has been subtracted as described in Bongard et al. (2011). A publication containing the full description of the data pipeline is in preparation. The supernovae included in this release have been corrected for Milky Way dust extinction (Schlegel et al. 1998, Cardelli et al. 1989) and have been shifted to a common restframe at $z = 0$. The absolute magnitudes were shifted by a random value to preserve blinding for ongoing cosmology analyses.
Two slightly different versions of the SNfactory data are presented here, which we label “NewMexico-Caballo” and “NewYork-Alleg” (short for Allegheny), following a naming convention in which a flux calibration run is given the name of a US state and the corresponding host-subtracted, extracted spectra are given the name of a park in that state. NewMexico-Caballo and NewYork-Alleg are respectively the datasets used in the training and validation of the SUGAR\textsuperscript{1} (Léget et al. 2019) and SNEMO\textsuperscript{2} (Saunders et al. 2018) supernova models. The SNEMO training data is available at cdsarc.u-strasbg.fr/viz-bin/cat/J/ApJ/869/167 and the SUGAR training data is available at cdsarc.u-strasbg.fr/viz-bin/cat/J/A+A/636/A46. These datasets were also used in additional SNfactory science analyses performed during the same time period (Huang et al. 2017, Nordin et al. 2018, Léget et al. 2018, Rigault et al. 2018).

The SNEMO companion dataset, NewYork-Alleg, was produced slightly later than the SUGAR dataset, NewMexico-Caballo, and thus includes more recent supernovae and reflects changes related to the incremental improvements to the data pipeline. The analyses also used different criteria for their data selection with respect to the required phase coverage and inclusion of peculiar Type Ia supernovae, as described in Léget et al. (2019) and Saunders et al. (2018). This results in different sets of supernovae in NewMexico-Caballo and NewYork-Alleg. The number of supernovae and spectra included in each dataset are described in Table 1.

In addition to being blinded with respect to the absolute magnitude, the supernova data productions presented here are not calibrated to a level that would allow them to be used for cosmology. The

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|c|}
\hline
Data properties & SNEMO companion dataset & SUGAR companion dataset & In Common \\
\hline
Total number of SNe Ia & 171 & 172 & 133 \\
Total number of spectra & 2485 & 2187 & 1702 \\
Rest frame wavelength range & 3305.0 Å – 8586.0 Å & 3273.6 Å – 8657.7 Å & \\
\hline
\end{tabular}
\caption{Numbers of supernovae and spectra in the SUGAR and SNEMO companion datasets}
\end{table}

\textsuperscript{1} supernovae.in2p3.fr/sugar
\textsuperscript{2} snfactory.lbl.gov/snemo
variance spectrum included in NewMexico-Caballo and NewYork-Alleg only reports the scatter of the data due to photon and readout noise. The methodology in Léget et al. (2019) and Saunders et al. (2018) appropriately dealt with the total variance affecting their respective models. Additionally, the model construction methods in these analyses are not sensitive to the absolute calibration, since they focus on spectral differences in the supernovae, and are not sensitive to relative differences in the brightness of the supernovae, nor to their absolute magnitudes.

Recent and current work has resulted in a number of significant improvements in the SNfactory data with respect to its ties to the standard star network, calibration on ‘non-photometric’ nights, and other aspects of the data processing. These improvements will enable the dark energy equation of state to be measured; a corresponding reprocessing of the SNfactory data and accompanying publications are in preparation.

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