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Supernova Rate in local universe

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Supernovae are related to many frontiers of astrophysics, i.e., from probes of extreme physics to discovery of accelerating universe. Their distribution and birth rates can help constrain progenitor models and stellar evolution theory. Thanks to the wide-field transient surveys conducted over the past decade, the discovery of nearby supernovae tends to be relatively complete. We compiled a nearby SN sample, including 211 SNe discovered at distances < 40 Mpc over the years from 2016 to 2023, and derived fractions of different types and subtypes, rates and their dependence on environments. The new sample gives a fraction of 30.4% and 69.6% for type Ia and core-collapse SNe, respectively, and the fraction of SNe Ia increased by about 26% relative to previous estimates. In particular, the SN Ia rate shows a prominent increase from redshift $z \sim 0.1$ to $z < 0.01$, revealing a unique double peak distribution in Sc- and E/S0-type galaxies. Such a distinct distribution suggests the presence of a “prompt” channel and the other one with a delayed time up to 12.6 ± 0.4 Gyr, and the latter channel with a fraction of at least one third comes likely from merging explosion of double white dwarfs.

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