



The total number of supernovae detected within distance D as a fraction of the total number exploded. Within 630 Mpc, Gaia detects ~30% of all type Ia supernovae. Within 355 Mpc, Gaia detects ~20% of all type Ib/c. For type II-L, Gaia detects ~31% within 335 Mpc. Finally, for type II-P supernovae, Gaia detects ~48% within 195 Mpc. Detection is defined as Gaia recording at least one data point on the standard supernova template.

Gaia: Supernovae

Gaia is an ideal instrument to study nearby supernovae (i.e. within a few hundred Mpc). Gaia will provide a huge dataset of high-quality local type-Ia supernovae in which any deviations from ‘standard candles’ can be analysed. As the dataset is so large, there will likely also be a good number of relatively rare phenomena, such as sub-luminous supernovae and type Ib/c supernovae.

Gaia will record data on at least 21,400 supernovae during the five-year mission lifetime. This breaks down into ~14,300 type Ia, ~1400 type Ib/c, and ~5700 type II. These supernovae span a redshift range up to  $z \sim 0.14$ .

In the most favourable case, Gaia will alert on all supernovae detected before maximum. These numbers are ~6300 type Ia, ~500 type Ib/c, and ~1700 type II during the whole mission. In other words, Gaia may issue ~1700 supernovae alerts a year or ~5 alerts a day. Roughly 75% of all alerts will be for type Ia supernovae, while the remainder will be for type Ib/c and II. All these numbers are lower limits since they may be increased by a factor of ~2, depending on the supernova contribution from low-luminosity galaxies.

Supernova rates will be found as a function of galaxy type, as well as extinction and position in the host galaxy. Amongst other applications, there may be about 26 supernovae each year for which detection of gravitational waves is possible and about 180 supernovae each year for which detection of gamma-rays is possible. Gaia’s astrometry will provide the supernova position to better than milli-arcseconds, offering opportunities for the identification of progenitors in nearby galaxies and for studying the spatial distribution of supernovae of different types in galaxies.