Star formation history, double degenerates and type Ia supernovae in the thin disc

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We investigate the relation between the star formation history and the evolution of the double-degenerate (DD) population in the thin disc of the Galaxy, which we assume to have formed 10 Gyr before the present. We introduce the use of star-formation contribution functions as a device for evaluating the birth rates, total number and merger rates of DDs. These contribution functions help to demonstrate the relation between star-formation history and the current DD population and, in particular, show how the numbers of different types of DD are sensitive to different epochs of star formation.

We have compared the impact of different star-formation models on the rates and numbers of DDs and on the rates of type Ia (SNIa) and core-collapse supernovae (ccSN). In addition to a quasi-exponential decline model, we considered an instantaneous (or initial starburst) model, a constant-rate model, and an enhanced-rate model. All were normalised to produce the present observed star density in the local thin disc. The evolution of the rates and numbers of both DDs and SNIa are different in all four models, but are most markedly different in the instantaneous star-formation model, which produces a much higher rate than the other three models in the past, primarily as a consequence of the normalisation.

Predictions of the current SNIa rate range from ~2 to 5\times10^{-4} yr^{-1} in the four models, and are slightly below the observed rate because we only consider the DD merger channel. The predicted ccSN rate ranges from 1.5 to 3 century^{-1}, and is consistent with observations.

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