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Chemical evolution of the Universe and the properties of merging double compact objects

Gravitational wave observations begin to probe the properties of the populations of merging double compact objects, providing constraints that can be confronted with theoretical models and help to validate the assumptions about the evolution of their progenitor systems.

The formation and characteristics of various transients of stellar origin, in particular double BH mergers, are highly sensitive to metallicity. Furthermore, compact binaries that merge within the local Universe originate from progenitor systems formed at different redshifts and in different environments (i.e. metallicities). Hence, to correctly compare the observations with theoretical results one needs to know the amount of star formation occurring at different metallicities and redshifts and understand the associated uncertainties.

Different approaches have been taken in the literature to learn about the distribution of the cosmic star formation rate over metallicities and redshifts (SFRD(Z,z)), leading to different results. We investigate the effect of the assumed distribution on the properties of merging double compact objects, in particular on their merger rate densities. We use the observational properties of star forming galaxies to find the observation-based SFRD(Z,z) and constrain its uncertainty due to currently unresolved questions in the determination of various characteristics of galaxies.

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