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Galactic habitable zones with chemical evolution models

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The Galactic habitable zone is defined as the region with a metallicity that is high enough to form planetary systems in which Earth-like planets could be born and might be capable of sustaining life. Life in this zone needs to survive the destructive effects of nearby supernova explosion events. Our aim is to find the Galactic habitable zone using chemical evolution models for the Milky Way disk, adopting the most recent prescriptions for the evolution of dust and for the probability of finding planetary systems around M and FGK stars. Moreover, for the first time, we express these probabilities in terms of the dust-to-gas ratio of the interstellar medium in the solar neighborhood as computed by detailed chemical evolution models. At a fixed Galactic time and Galactocentric distance, we determined the number of M and FGK stars that host earths (but no gas giant planets)
that survived supernova explosions. The probabilities of finding terrestrial planets but not gas giant planets around M stars deviate substantially from the probabilities around FGK stars for supersolar values of [Fe/H]. For both FGK and M stars, the maximum number of stars hosting habitable planets is at 8 kpc from the Galactic Center when destructive effects by supernova explosions are taken into account. Currently, M stars with habitable planets are roughly10 times more frequent than FGK stars. Moreover, we provide a fit for the relation found with chemical evolution models in the solar neighborhood between the [Fe/H] abundances and the dust-to-gas ratio.

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