

Hunting the fastest stars in the Milky Way

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Milky Way high velocity stars are of interest in several astrophysical domains: e.g. probing the interaction between stars and the central Galactic black hole, Sagittarius A*, measuring the Galaxy escape velocity and mass as well as studying the Milky Way assembly and accretion history. Gaia 3rd data release (GDR3) contains 33.8 millions radial velocities down to Grvs magnitude 14. GDR3 radial velocities raw number and full sky coverage represent two strong assets to find new high velocity stars. However, the high velocity tails (here defined as the radial velocities outside [-500, 500] km/s) are so scarcely populated that spurious measures caused by e.g. very low signal to noise ratios or bright neighbours, can significantly contaminate them. As a consequence, in GDR3, the stars with an absolute value of the radial velocity larger than 500 km/s should be considered as candidate High Velocity Stars (HVS) and require confirmation. It is for this purpose that we observed 102 GDR3 HVS candidates with the spectrographs UVES@VLT and Sophie@OHP. Their ground-based radial velocities confirm that 71 of them are genuine HVS, while 20 show low radial velocities typical of the disc and a dozen require further analysis. Most of the confirmed HVS are gravitationally bound to the Milky Way and share a similar location in the energy/angular momentum plane, which suggest an accretion origin for these stars. The newly confirmed and refuted HVS also allow to revisit the signal-to-noise based filter presented in Katz et al., 2022 (arXiv:2206.05902) and meant to mitigate the contamination of GDR3 HVS by spurious measures.