Contributed Talk

Splinter Populations

Hypervelocity stars

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Hypervelocity (HVS)stars travel so fast, that they overcome the Galaxy's gravitational attraction. Such stars were predicted in 1988 to exist if a supermassive black hole acts as a slingshot by disrupting a binary via its tidal interaction and releasing one stellar component at a velocity well above 1000 km/s (the socalled Hills mechanism). Only by 2005 three stars were discovered serendipitously as B- and O/type star far out in the halo (to as much as 60kpc) from radial velocity surveys to exceed the local excape velocity. Because such stars would be important tracer of Galactic dark matter halo as well as for the stellar popuation near the Galactic centre, a systematic survey was carried out, whcih increased the number of known HVS to two dozen today.

Recently it has become obvious that ejection mechanisms other than the Hills mechanism are required to eject stars at sufficiently high velocities. These mechanisms include binary supernova ejection, dynamical ejection from stellar clusters and from disrupted satellite galaxies. The fastest HVS, US 708, is the only known highly evolved low mass star (a hot subdwarf star), for which the Hills mechanism can be excluded because proper motion measurements both from ground as well as form HST rule out an origin in the Galactic centre. The star can be explained as the surviving remnant of a SN Ia explosion. This implies that the progenitor sytem was a close binary consisting of a helium star (hot subdwarf) and a massive white dwarf. When Roche Lobe Overflow started, helium was transfered to the white dwarf until it led to a helium detonation. This inn turn triggered the explosion of the C/O core of the white dwarf as a SN Ia. The subdwarf was released at about its orbital speed. Recently, a few subdwarfs similar to US 708 have been found, for which this scenario is attractive.

Besides a Galactic origin of the HVS stars, HVS of spectral-type B have been suggested to actually come from the LMC, which could explain a striking

puzzle, their apparent clumping on the sky in the constellation of Leo.

However, our present knowledge of HVS stars is limited by the absence of accurate proper motion measurements for most HVSs, i.e. their kinematical analyses are based on the RV measurements alone. This will, of course, be remedied by Gaia soon. Gaia will also provide an all sky survey and, therefore, will provide samples of proper motion selected high-velocity stars, that will complement the radial velocity selected HVS samples. We shall summarize our present understanding of HVSs and discuss the impact of Gaia for the research field.