Mass loss of the Milky Way globular clusters on cosmological timescale: interaction with the Galactic center

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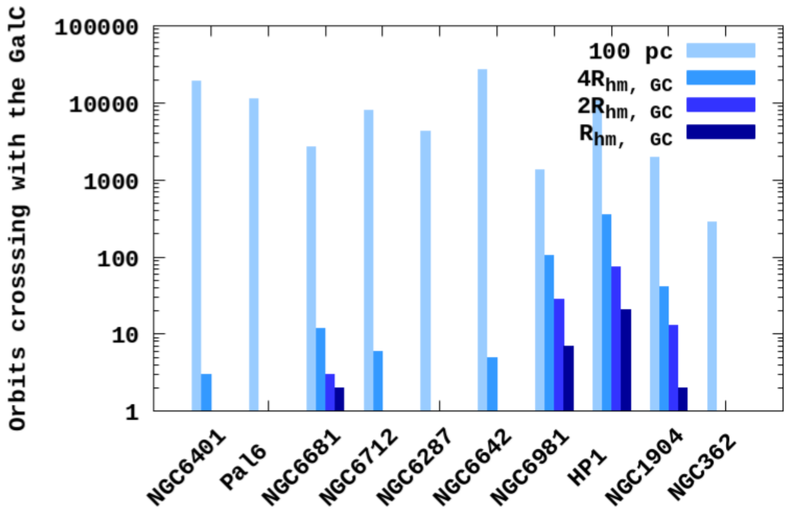
Milky Way globular clusters on cosmological timescales – Paper 1 and Paper 2, see QR- code:

Idea. Based on the Gaia DR3, **we reconstructed the orbital evolution** of the known Milky Way globular clusters and found six objects — **NGC 6681, NGC 6981, Palomar 6, NGC 6642, HP 1, and NGC 1904** — with a high probability of close interaction with the nuclear star cluster.

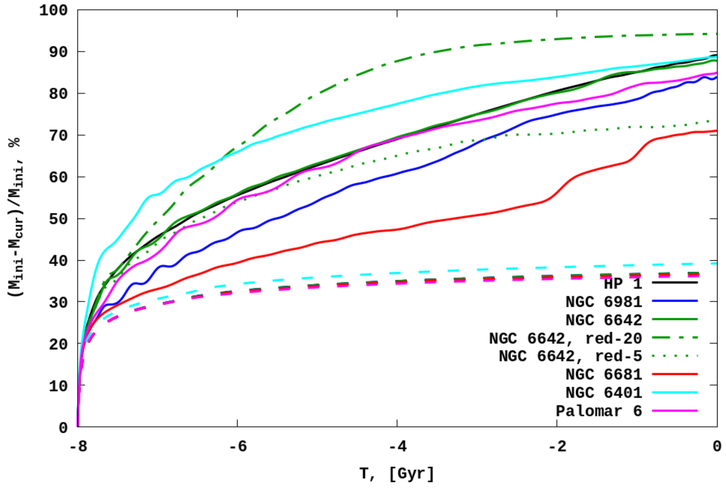


Amount of orbits crossings with the Galactic Centre for Globular Clusters in 411321 TNG-TVP external potential. Dark-blue corresponds to the r_{hm} distance from Galactic Centre, light-blue – 100 pc distance.

Methods. For the dynamical modeling of the clusters, we used the **parallel N-body code ϕ-GPU, which allows star-by-star simulations of the systems.** Our current code also enables us to follow the stellar evolution of individual particles, including the formation of high-mass remnants. Modelling was carried out in a **Milky Way-like, time-variable potential** (with dynamically changing mass and scale-length), obtained **from the IllustrisTNG-100** database, with a full integration time of **8 Gyr years**.

Results. Based on extensive numerical modelling and analysis, **we estimate a mass loss and the global and inner structures** of the selected six clusters. Over 8 Gyr years of evolution, the **clusters lost almost 80%** of their initial mass. For NGC 6681, NGC 6642, HP 1, and NGC 1904.

We analysed as a main scenario of the star accretion into to the forming nuclear star cluster the stellar capture from the individual GC core or tail structures.



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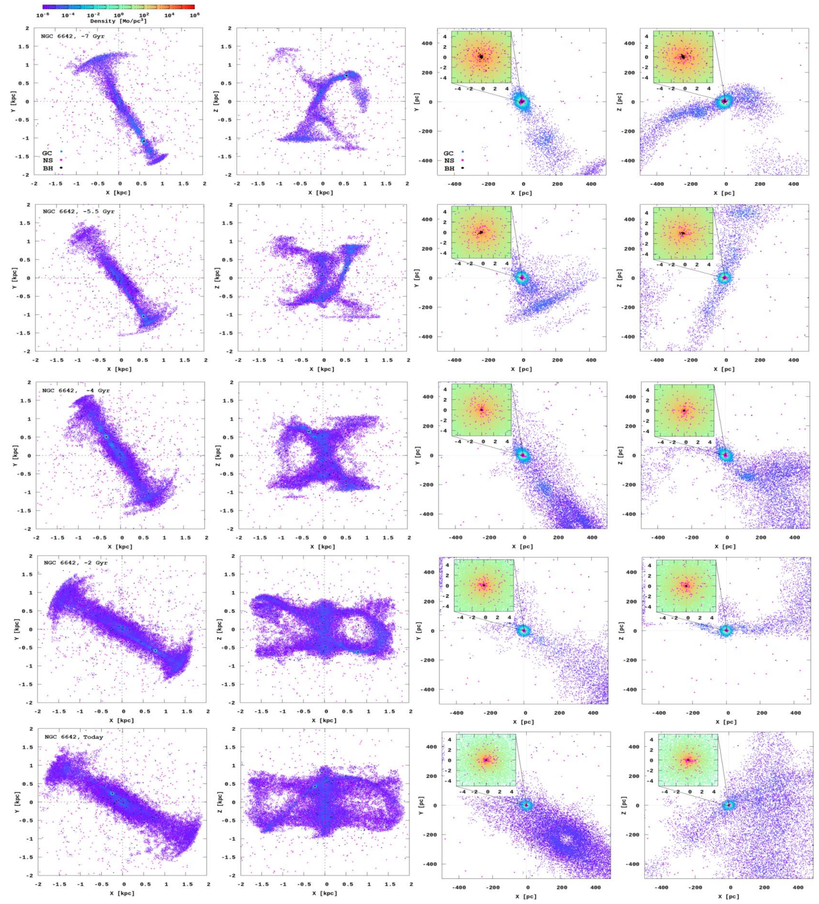
Based on our numerical modelling of the pre-selected real GC systems dynamics in the time variable Galactic potential on a cosmological time scale, **we can conclude that only NGC 6642 of four of such systems potentially can be a significant source of the stars for the formation of Galactic nuclear star cluster.**



NGC 6642 density distributions in **411321 TNG-TVP external potential**. The orbital global evolution is present in two projections (X,Y) - (X,Z). GC central part in the cluster local frame with the Black Holes (black dots), Neutron Stars (magenta dots) and with detail zoom of the central area (with box size 10 pc) we present in included graph.