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Central kinematics of globular clusters: evidence for a massive black hole?

A number of different hypotheses about the origin of Supermassive black holes (SMBHs) in the galactic centres was proposed. One formation channel that we investigate in our project is the gravitational runaway scenario, that suggests an SMBH seed to form by runaway collisions in dense star systems like globular clusters (GCs). We focused on two promising candidates that can host such a massive black hole: the second-brightest GC in the Milky Way 47 Tuc and NGC 1916 observed in the Large Magellanic Cloud (LMC). The central part of 47 Tuc was recently investigated in the ultra-deep radio survey, and a central point source that consistent with the location and emission strength expected from an ~1000 Msun black hole was detected. NGC 1916 was proposed to be a Nuclear Star Cluster (NSC) of the LMC, that makes it a great spot to search for a massive BH. In this work, we analyse the kinematics of 47 Tuc with a combined MUSE Radial Velocities (RVs) and HST Proper Motions (PMs) sample that contains ~21 thousand stars with PMs and more than 7 thousand stars with RVs within the central 1 arcmin. The available three-dimensional velocity information makes it possible to identify high velocity stars in the cluster, that could be potential escapers, binary interaction products, or companions to an intermediate-mass black hole. We also compare our results with a Monte Carlo model that has a prediction about the black holes' population, and perform Jeans dynamical modelling to study the kinematics of the cluster to reveal its rotation or unseen mass distribution. For NGC 1916 we have the HST photometric data and MUSE RVs and metallicities for more than a thousand stars, that allows us to perform a chemical and kinematic analysis for the central part of the cluster.

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