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Exploring the internal kinematics of Galactic Globular Cluster cores

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Globular clusters (GCs) are among the longest-studied stellar systems. Despite extensive study, their formation mechanisms, evolutionary history, and interplay with the host galaxy are still unknown. A key to solving these questions lies in the analysis of their internal kinematics, which can provide invaluable insights into their dynamical evolution. However, the study of GC kinematics presents significant challenges due to observational limitations, especially in crowded regions.
In the context of the Multi-Instrument Kinematic Survey (MIKiS), I have investigated the kinematic properties of a sample of massive and dense Galactic GCs, by using large samples of line-of-sight (LOS) velocities of individual stars located over the entire cluster extension. In particular, the talk will focus on the kinematic characterization of the high-density core regions, which are of particular interest because they are most affected by dynamical processes and are notoriously difficult to study due to extreme crowding. Using state-of-the-art integral field spectrographs assisted with adaptive optics (e.g. MUSE) we were able to probe these central regions and extract valuable kinematic information.
We present the derived velocity dispersion profile of each cluster surveyed and the detected rotation signals in most of them. Notably, our analysis excludes the presence of an intermediate-mass black hole in NGC 1904, contrary to previous findings, and reveals an intriguing core rotation in NGC 6440. We then discuss the comprehensive analysis of NGC 1904; for this cluster, we derived the rotation curve both in the LOS direction and in the plane of the sky, and compared our results with those of theoretical models to estimate the dynamical stage of the system. Overall, our results provide strong evidence that GCs are more complex systems than previously thought, and that their kinematic properties are powerful indicators of their dynamical evolution.

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