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Unveiling the Heart of Darkness: Modeling the Central Kinematics of Omega Centauri and Its Elusive Black Hole

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Dense stellar systems, such as globular clusters and nuclear star clusters, represent natural laboratories for exploring the intricate interplay between gravitational interactions, stellar dynamics, and the formation of exotic objects like intermediate-mass black holes (IMBHs). Recent discoveries of massive black holes above 10^7 Msol in stripped nuclei within the Virgo and Fornax clusters have prompted a quest to understand the distribution of IMBHs in various galactic environments. But so far the expected population of black holes have not been found in the more abundant stripped nuclei expected at lower masses. The dense stellar systems within the Local Group's most massive clusters are the perfect place to hunt for the IMBHs, presenting significant implications for our understanding of globular cluster formation theories and the broader mechanisms governing black hole formation and growth in the early universe.
Omega Centauri (NGC 5139) stands out among globular clusters in the Milky Way for its massive size, complex stellar population, and the long-suspected presence of a central black hole. Likely the remnant nuclear star cluster of a galaxy accreted by the Milky Way, Omega Centauri's central kinematics present a complex puzzle. Our latest observations from MUSE obtained the highest-resolution spectroscopic data yet in the narrow field and the wide field modes. Our observations reveal a counter-rotating central kinematic structure within 20" relative to the bulk rotation of Omega Centauri. Furthermore, I will present the latest results of our Jeans'dynamical models, which aim to unravel the complexities of the central kinematics in this massive cluster. By integrating these observations and models, we aim to shed light on the elusive presence of an intermediate-mass black hole and its implications for our understanding of galactic nuclei dynamics and black hole demographics.

Affliation

Liverpool John Moores University

Current Position

Postdoc

Primary author: PECHETTI, Renuka (Liverpool John Moores University)

Co-authors: Dr SETH, Anil (University of Utah); Dr KRAJNOVIC, Davor (Leibnitz Institute fur Astrophysik); Ms WRAGG, Florence; Dr VAN DE VEN, Glenn (University of Vienna); Dr NEUMAYER, Nadine (Max Planck Institute for Astronomy); Dr WEILBACHER, Peter; Dr KAMANN, Sebastian (Liverpool John Moores University); Dr DREIZLER, Stefan; Dr MARTENS, Sven

Presenter: PECHETTI, Renuka (Liverpool John Moores University)

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