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Nuclear cluster, dark matter or both? Constraints on distributed matter in the innermost galactic centre from stellar orbits

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In the centre of most galaxies there reside(s) (a) massive black hole(s). The one in our own galaxy, Sgr A, *weights roughly four million solar masses. How black holes can become so massive is an open question. Certain theories predict that black holes can grow continuously by accreting dark matter. A star orbiting a black hole through such a distribution would feel a continuously changing gravitational pull, altering its trajectory. Naturally also ordinary matter, such as other members of the nuclear cluster, can have almost the same effect if it is distributed. Small differences arise due the different matter types relaxing in distinct profiles. Inverting the problem we can infer the underlying distribution from precise measurements of stellar orbits. Future infrared observations of the Galactic Centre will thus help not only to further constrain the amount of distributed matter around Sgr A*, but may also allow to infer the nature of that matter. In my talk I will summarise my work with collaborators on this front:

• A theoretical study of the impact of dark matter onto the orbit of S2, focusing on the guiding of observational campaigns w. r. t. key orbital sections, and estimates on future constraints. https://doi.org/10.1051/0004-6361/202142114

• The latest observational constraints on dark matter around Sgr A* of the GRAVITY collaboration. https://doi.org/10.1051/0004-6361/202142465

• A novel shell model for dark matter, and its potential utility for both theoretical investigations and future observational constraints due to its ability to assume a wide range of shapes. https://www.esa.int/gsp/ACT/projects/dark_matter/

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