

## Title

# **Unveiling the physics of SAURON - a unique, ring-like radio source with quadrilateral structure discovered with machine learning**

## Abstract

SAURON (a Steep and Uneven Ring of Non-thermal radiation), discovered by [1] using machine learning, is a unique source that so far defies physical explanation. SAURON is a candidate Odd Radio Circle (ORC; [2]) but has a strikingly different morphology and magnetic field structure from other ORCs. This proposal aims to obtain deep, on-axis MeerKAT observations of this source to not only constrain the physics of SAURON, but shed light on the entire class of ORCs. [1] considered several possible models for SAURON, including an end-on radio galaxy, a starburst termination shock and a supermassive black hole (SMBH) merger event. In this proposal, we request on-axis observations of SAURON in L, U and S band. This will allow a detailed study of the morphology of the source, possibly revealing jet structure which would strongly support the SMBH merger hypothesis. We will also determine the full extent of the source and map the spectral index, which was not possible in [1]. This will constrain the energetics required to produce the ring and characterise the shock structure that must be reproduced by the models involving an explosion. The polarization structure of SAURON differs significantly from other ORCs and could be difficult to explain by either the starburst or the end-on models. On-axis polarimetry is required to confirm this structure and to probe the thermal plasma environment. Unravelling the mystery of SAURON could open up a new area of AGN studies. [1] - Lochner et al. (2023), [2] - Norris et al. (2021)