Probing Dark Matter in 2HDM+S with MeerKAT

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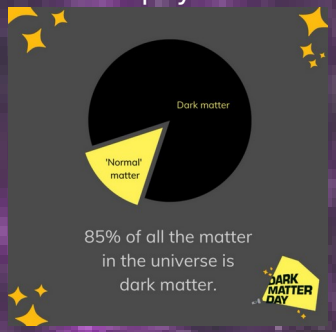
NRF National Research Foundation | SARAO South African Radio Astronomy Observatory

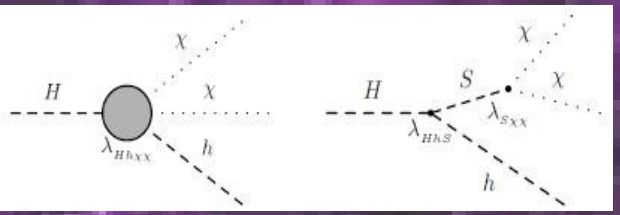
Significance

Dark matter forms a significant part of the mass budget in the universe. Its particle composition remains unknown. As evidence for physics beyond the Standard Model mounts this work combines aspects of particle collider and astrophysics.

2HDM+S

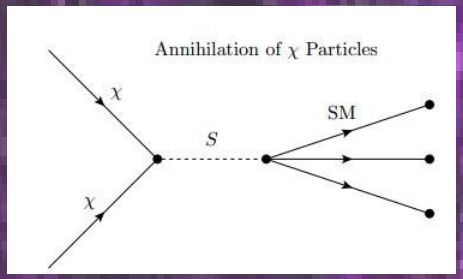


Introduced in order to explain Multi-lepton anomalies observed at the LHC this particle physics model contains A heavy Higgs' and scalar boson. Via the decay chain H -> Sh, SS the model implies the production of leptons. Multiple studies have reported statistically significant excesses of opposite sign, same sign and three leptons. The significances reported have reached levels of 10 sigma.The hidden particle sector of this model provides a DM candidate for investigation. Kinematic considerations place the mass range of this candidate ~ 65-100 GeV. This overlaps with DM models aimed at explaining anti-particle and gamma-ray excesses in the Galactic centre as seen by HESS and Fermi-LAT.

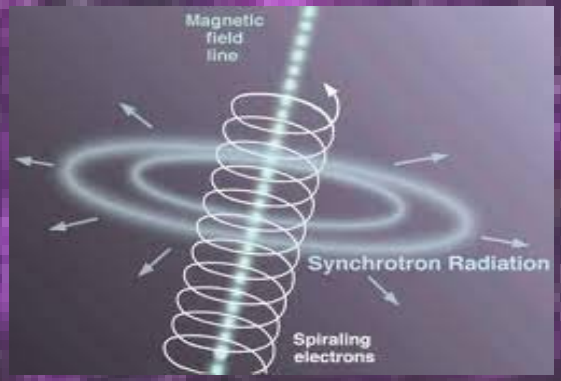


MeerKAT and radio data

Under the assumption that the 2HDM+S DM candidate annihilates through the scalar boson to SM particles, we can use MeerKAT to look for annihilation products.



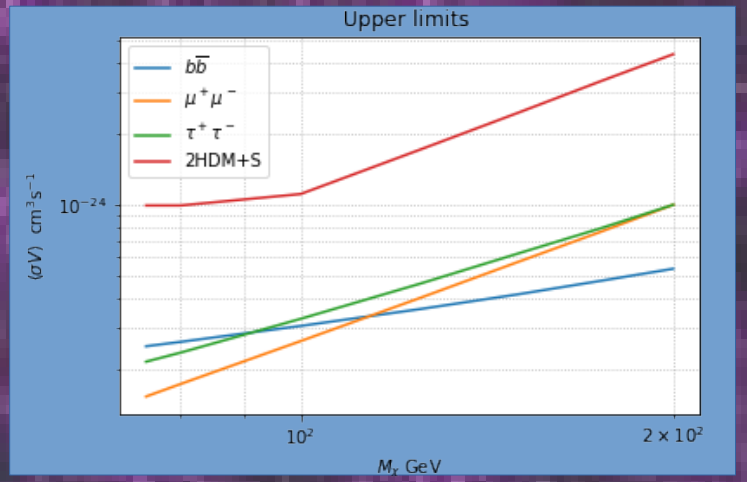
In this work we look for diffuse radio emission produced through the interaction of secondary electrons with the magnetic fields of clusters.



By comparing the measured diffuse emissions to predictions made with Dr. Becks' tool we can probe the constraints of the DM sector while keeping the other parameters fixed in accordance with the particle physics model.
MeerKAT boosts a higher sensitivity than previously expected, allowing us to probe fainter diffuse emissions.

Results

The annihilation cross section limits for the generic WIMP channels and the 2HDM+S channel produced for 12 clusters. The best results are from Abell 370.



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