

# Testing the Collisional Formation of Dark Matter Free Galaxies

## Abstract

Two ultra-diffuse galaxies in the NGC1052 group, DF2 and DF4, share several remarkable properties - large sizes, extremely luminous globular cluster populations, and a near complete lack of dark matter. A recently proposed explanation is that DF2 and DF4, along with ~10 other galaxies that are on an apparent line between them, formed in a high speed 'bullet dwarf' collision. Such an event would provide insight into the nature of dark matter, as it can rule out alternative gravity theories, ultimately providing a constraint on the cross-section for dark matter self-interactions. Under this scenario, while some collisionally-separated gas collapsed to form the trail of galaxies including DF2 and DF4, most should remain unbound in a diffuse stream coincident with the trail. Here we propose a 32.5 hr observation with MeerKAT to look for this predicted HI emission, covering the trail of galaxies over 2 pointings. The program is expected to yield a robust 5 sigma detection if the stream exists, and a meaningful upper limit if no emission is found. While the field was previously observed with the VLA in the 1980s, MeerKAT's short baselines and large field of view make it the only feasible instrument to detect this diffuse stream. Observation of such a stream would be 'smoking gun' evidence of this scenario and provide insights into the collision itself, potentially including the identification of the remains of the two progenitor galaxies.