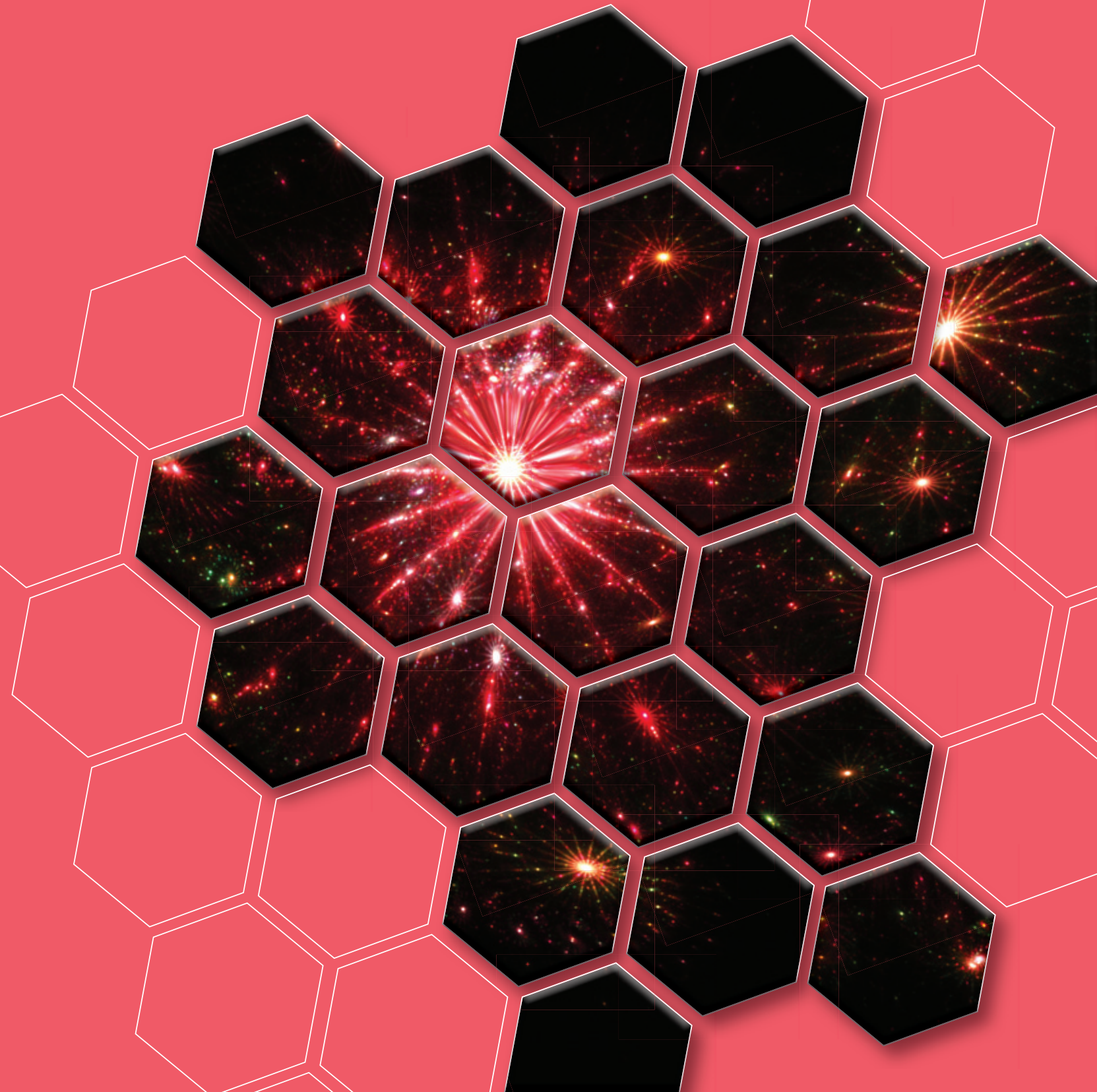


ASTRONOMY



Nceba Mhlahlo

Hartebeesthoek Radio Astronomy Observatory

Mentor: M Bietenholtz

Broad research area: The study of transient radio sources

Specific research field: Transient radio sources and their observational possibilities with the HartRAO 26m antenna, KAT7 and MeerKAT

Purpose of study:

Explosive events in astrophysical situations create shocks, which accelerate particles to very high energies ($<10^{19}$ eV). They also compress ambient magnetic fields. This combination can lead to short-scale, 'transient' emission over a wide range of wavelengths. The most commonly discussed transient radio sources have been supernovae, also observed optically, and Pulsars. Pulsars are sources of pulsed radio emission which are thought to be related to the supernova remnants (SNR) and to represent a 'final' rotating stellar remnant of compressed neutron material some 15 km or so in diameter. However, there are a variety of other transient radio sources, which include jets in white dwarf accretion systems. Magnetic Cataclysmic Variable stars (mCVs) may belong to this category. Recently, a number of radio observations of mCVs, a sub-class of Cataclysmic Variable stars (CVs), have been made to constrain models of radio emission. Most of the observations have been made at frequencies ranging from 1-23 GHz using

existing arrays such as Very Large Array (VLA), MERLIN and Australian Telescope Compact Array (ACTA), with typical resolution of 0.05-arcsecond. The results have shown radio detections of a few mCVs (the polars and the intermediate polars, or IPs). These systems have shown flux densities at levels between 0 and 15 mJy, and short radio flare events at flux densities ranging from 1-35 mJy. Even so, AE Aqr, a disc-less IP with a fast-rotating white dwarf, remains the only confirmed persistent radio IP. The lack of radio emission from nonmagnetic CVs (outside of outburst) and from isolated magnetic white dwarfs has also been reported. This, together with the fact that AE Aqr is the only disc-less IP showing persistent radio emission, has led to a hypothesis that accretion discs prohibit radio emission in CVs. And for those mCVs that produce radio emission, different emission mechanisms have been suggested. These include gyrosynchronism and magnetic reconnection near the red dwarf or white dwarf, and the debate continues. Also radio jets, which occur in nearly all accreting objects, have not been observed in CVs until recently. Is this due to observational difficulties? The purpose of my project is to study variable sources at radio wavelengths, with the main focus on supernovae remnants and the mCV AE Aqr, to detect jets from mCVs and to constrain radio emission in these systems.

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