

The origin of ORCs: a new class of astronomical objects?

Abstract

Several unexpected diffuse rings of radio emission (ORCs = Odd Radio Circles) have been found in the ASKAP-EMU pilot survey. These objects have not been seen before in radio observations, are not artefacts, and despite brainstorming and follow-up observations by a large group of astronomers, the physical mechanism behind them is still unknown. MeerKAT DDT observations of the first ORC resulted in a stunning image, which shows that the ORC consists of two, not one, circles, with additional structure within the ORC. Many questions still remain: are the ORCs an unusual manifestation of a familiar type of object (e.g. a double-lobed edge-brightened radio galaxy seen end-on) or a completely new class of object (e.g. a spherical shock from an explosive event)? Are they one class of object, or are we finding different types of object which happen to show the same morphology (arcmin-sized circular rings with no optical/IR counterpart)? Having demonstrated the power of MeerKAT to detect and resolve much more detail than can be seen with ASKAP or ATCA, we now wish to observe a sample of eight "ORC analogues" that show the characteristic circular features of ORCs without any corresponding optical or infrared emission. Each of the objects to be studied in this proposal is puzzling in its own right, and the mechanism that produces the observed structure is unknown. By broadening our studies of ORCs to this extended sample of ORC analogues, we hope to find the mechanism(s) that can generate circular rings of radio emission.