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A Southern Radio Survey of the Fast Blue Optical Transients

Abstract

We propose to perform a high sensitivity L-band survey of fast blue optical transients (FBOTs) in order to reveal the radio properties of this new and unusual class of stellar explosion. FBOTs are characterised by their rapid optical rise time and high peak luminosities, which together prove challenging to explain with traditional supernova models. Radio observations are key to distinguishing between FBOT progenitor scenarios as they are sensitive to the fastest outflows these systems produce, and the mechanism driving said outflows. To date only the brightest (L_opt > 1e43erg s−1) optical FBOTs have been observed extensively at radio frequencies, with fainter sources only having late time, unconstraining limits placed on their radio luminosity. The three FBOTs with radio detections have shown diverse and unusual properties, with outflow velocities ranging from non-relativistic, in the case of AT2018cow, to mildly-relativistic, in the case of CSS161010. The energies associated with the outflowing material produced in these explosive events bridge the poorly-understood gap between non-relativistic SNe and the sub-energetic gamma-ray bursts. With this proposal we seek to study the radio properties of FBOTs as a general population, not only the most optically bright members of the class, in order to reveal the true range of outflow properties and driving mechanisms associated with these transients. The MeerKAT telescope, with its high snapshot sensitivity, is uniquely suited to carrying out such a survey, and promises to significantly increase the number of FBOTs with constraining early time radio observations.