Radio Astronomy:

Observational Studies and Imaging of Transient Sources using Phased Array Radio Telescopes

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X-ray transients are characterized with highly energetic and short-lived outbursts of X-ray photons with high levels of flux over timescales of hours to weeks. Generally, these transient events are believed to be associated with X-ray binary systems in which a compact object (black hole or neutron star) is gravitationally bound with a companion star. X-ray transients that undergo a change of spectral state are thought to result in discrete ejections via the accretion of matter on to the compact object (Esin, McClintock & Narayan 1997; Hannikainen et al. 2000; Fender 1999; Kuulkers et al. 1999). When the X-ray system makes a transition from a high/soft to a low/hard state (Esin et al. 1998), relativistic jets can form giving rise to radio outbursts. The radio emission is strongly correlated with the X-ray emission (Fender & Kuulkers 2001; Harmon et al. 1995). The underlying physical process behind these transitional events is thought to be the change of accretion rate with which the stellar material is accreted onto the compact object (Esin, McClintock & Narayan 1997).

Under the framework of this project an exploratory transient follow-up program will be carried out possibly using the newly commissioned Radio-Array telescope at NSSTC-UAEU and various other array telescopes such as the ATCA and LBA telescopes in Australia, the EVN in Europe and VLBA in the USA. The strategy would be to carry out rapid radio follow-up observations in response to the detection of such events made by space-borne Gamma-ray and X-ray instruments and ground-based optical telescopes. This study will address the following questions:

- What are underlying lying astrophysical processes that govern jet formation near transient sources?
- Is there any possible connection with the activity in the transient systems and the release of gravitational waves?
- What role do the variations in the accretion rate play in the observed behavior of these systems?

PhD Student Profile:

- Ideally MSc in Astronomy or Astrophysics (or at least MSc Physics with an affinity for Astrophysics).
- Familiarity with a programming language (preferably Python) is desirable.
- Some experience or understanding of data analysis and interpretation would be advantageous.
- Any previous experience (e.g. Masters thesis) in observational astronomy, particularly radio would be a major plus.
- Proficiency in English.