THE 2ND PIETRO BARACCHI CONFERENCE

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Rapid-response radio follow-up of high-energy astrophysical events

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Only recently have radio telescopes been capable of automatically responding to transient alerts and multi-messenger events through the use of a rapid-response observing system. Such systems enable telescope to automatically repoint and begin observing an event within seconds to minutes of its discovery, responding to transient alerts broadcast by dedicated telescopes or multi-messenger facilities. Many transients and multi-messenger events are known or predicted to produce early-time radio emission. One of the main targets are gamma-ray bursts (GRBs) detected by dedicated telescopes such as Swift and Fermi. Of particular interest are short GRBs, which have been shown to be linked with merging neutron stars detected by gravitational wave detectors. GRBs are predicted to produce prompt, fast-radio burst (FRB) like signals and longer-lived synchrotron afterglow emission. Nearby rapidly rotating magnetised stars, such as M dwarfts, also produce X-ray/gamma-ray superflares that are detected by Swift and MAXI, which simultaneously emit giant, gyrosynchrotron radio flares. The detection of radio emission from such high-energy transients are crucial for localising events, studying the surrounding environment, probing magnetic fields, studying unusual coherent emission mechanisms, and determining the nature of the remnants from merger and cataclysmic events. Using GRBs and flare stars as an example, I will discuss Australia's effects towards the roboticisation and automation of Australian radio telescopes for transient studies through the use of rapid-response observing systems. These telescopes include the Murchison Widefield Array (MWA) and the Australia Telescope Compact Array (ATCA).

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