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Milliseconds, Minutes, and Mysteries: The New Era of Radio Transients

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The quest for radio transients has evolved into a thriving field, driven by the rise of wide field-of-view telescopes. In recent years, two remarkable classes of extreme coherent radio transients have emerged: long-period transients, with pulse durations from minutes to hours, and fast radio bursts, with pulse durations from microseconds to tens of milliseconds. Intriguingly, the long-period transients are lighting up from the compact object "graveyard," where traditional models predict they should no longer be detectable in the radio. Zombie stars, anyone? Emerging theories, coupled with observational data, reveal striking similarities in the spectral, temporal, and polarimetric properties of long-period transients and fast radio bursts. While the exact origins of FRBs remain unclear, the 2020 detection of a fast radio bursts-like pulse from the Galactic magnetar SGR 1935+2154 confirmed that magnetars can produce such bursts, at least in some cases. But many questions remain: Are all fast radio bursts from magnetars? What powers their extreme emission? And could long-period transients be their evolutionary cousins?

In this talk, I will highlight recent discoveries from the ASKAP and MeerKAT telescopes that are reshaping our understanding of fast radio bursts and long-period transients. Early JWST follow-up has begun to uncover fast radio bursts in distant, high-redshift environments, offering new clues about their origins and strengthening their potential as cosmological probes. I will also discuss how next-generation facilities like the SKA will revolutionise the field through population studies and new tests of fundamental physics.

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