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Surveying the Dynamic Radio Sky with the Long Wavelength Demonstrator Array

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This paper presents a search for radio transients at a frequency of 73.8 MHz (4 m wavelength) using the all-sky imaging capabilities of the Long Wavelength Demonstrator Array (LWDA). The LWDA was a 16-dipole phased array telescope, located on the site of the Very Large Array in New Mexico. The field of view of the individual dipoles was essentially the entire sky, and the number of dipoles was sufficiently small that a simple software correlator could be used to make all-sky images. From 2006 October to 2007 February, we conducted an all-sky transient search program, acquiring a total of 106 hr of data; the time sampling varied, being 5 minutes at the start of the program and improving to 2 minutes by the end of the program. We were able to detect solar flares, and in a special-purpose mode, radio reflections from ionized meteor trails during the 2006 Leonid meteor shower. We detected no transients originating outside of the solar system above a flux density limit of 500 Jy, equivalent to a limit of no more than about 10^{-2} events/yr/deg^2, having a pulse energy density >~ 1.5 x 10^{-20} J/m^2/Hz at 73.8 MHz for pulse widths of about 300 s. This event rate is comparable to that determined from previous all-sky transient searches, but at a lower frequency than most previous all-sky searches. We believe that the LWDA illustrates how an all-sky imaging mode could be a useful operational model for low-frequency instruments such as the Low Frequency Array, the Long Wavelength Array station, the low-frequency component of the Square Kilometre Array, and potentially the Lunar Radio Array.

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