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Extrasolar Space Weather Monitoring with the OVRO-LWA

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1 Extended Abstract

Recent results from our own solar system demonstrate the importance of not only stellar magnetic activity, but also the critical importance of planetary magnetic field strength, in determining the conditions for planetary habitability [1]. Expanding the study of stellar and planetary radio emissions to objects beyond the solar system will provide unique insight into trends in stellar magnetic activity and the non-thermal radio emissions they power, as well as direct measurements of exoplanet properties (e.g. magnetic field strength) and constraints on planetary magnetic dynamo models. In addition, by measuring planetary and stellar magnetic activity for nearby stellar systems over a range of mass and age, we can begin to form a more complete picture of the relationship between planetary magnetospheres and stellar activity, and the impact of both on habitability.

Despite all magnetized planets in the solar system being known radio emitters, previous searches for exoplanetary radio emission have all resulted in non-detections (e.g. [2, 3]). However, these surveys were limited by a number of factors, including observations in the non-optimal frequency range above 100 MHz, and targeting small numbers of objects over short periods of time. Thus, wide-field, long-duration surveys at low frequencies (< 100 MHz) with the capability of monitoring thousands of objects simultaneously are needed to detect exoplanetary radio emission.

We are conducting the largest survey for exoplanetary radio emission and stellar magnetic activity to date with the Owens Valley Radio Observatory Long Wavelength Array (OVRO-LWA). The OVRO-LWA is a 288-element dipole array operating between 24 and 82 MHz in Owens Valley, California, unique in its ability to image the entire viewable sky at high cadence with 10-arcminute resolution. I will discuss initial results from our first 100-hour survey monitoring nearly 4000 stellar and substellar objects out to 25 pc in both Stokes I and V for transient emission associated with extrasolar space weather events such as stellar CMEs and exoplanetary aurorae.

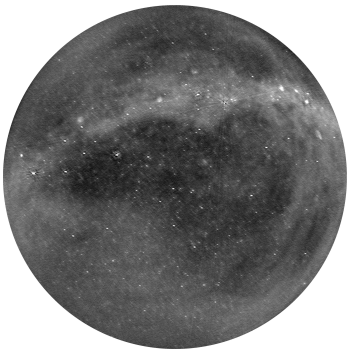

Figure 1. Example of an all-sky image with the OVRO-LWA. This 13-second integration, covering 58 MHz of bandwidth, of the entire viewable sky ($> 20,000$ sq. deg.) above the array, has a sensitivity of $\sim$few Jy.

References

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[2] Lazio, T. J. W., & Farrell, W. M., "Magnetospheric Emissions from the Planet Orbiting τ Bootis: A Multi-epoch Search," *The Astrophysical Journal*, **668**, 1182, October 2007, doi:10.1086/519730.

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