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Time-resolved UV Circular Polarimetry of Massive Star Magnetospheres

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Massive stars are characterized by their intense luminosities and powerful, radiatively driven stellar winds. About 7% of massive stars also host strong (~1 kG), global magnetic fields, with stable, nearly dipolar magnetic topologies. These fields channel the stellar wind into a complex magnetosphere which has a significant impact on the star's evolution. It is therefore critical to measure these fields in order to determine how magnetic massive stars live, die, and influence their environment. This is typically accomplished with optical spectropolarimetry, by measuring the circular polarization caused by Zeeman splitting in optical photospheric lines. Additionally, the amplitude of the circular polarization (Stokes V) signatures is modulated with the stellar rotation period, as the observer's view of the magnetosphere changes. We explore here the possibility of detecting Stokes V signatures in the wind-sensitive UV resonance lines formed in magnetically confined winds. High-resolution UV spectropolarimetry can provide a technique for direct measurement of the field in the magnetosphere, which to date has only been estimated from theoretical calculations. We use the "UV-ADM code"to calculate synthetic Stokes V signatures at multiple viewing angles of the magnetosphere, to trace the rotational modulation and estimate the field strength. Our parameter study provides important observational constraints for the next generation of high-sensitivity, spaceborne UV spectropolarimeters, such as the Polstar mission.

Primary author: ERBA, Christi (East Tennessee State University)

Presenter: ERBA, Christi (East Tennessee State University)

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