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Antarctic Infrared Binocular Telescope: Observations in the 1.4 μm water-vapor-absorption band

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Spectra of ultracool stars exhibit strong absorption features by water-vapor in their atmospheres. Normally, ground-based observations in 1.4 μm are limited by strong absorption of telluric water-vapor. However, Dome A, Antarctica has exceptionally dry conditions that offer a unique opportunity for observations in this band. We designed a new filter covering 1.34–1.48 μm, namely W', and installed it on the Antarctic Infrared Binocular Telescope (AIRBT) at Dome A in 2025. AIRBT comprises two identical 15 cm optical tube assemblies and two InGaAs cameras equipped with J and W' filters, respectively. The scientific goal with W' band is to search for and study cool stars by detecting their water-vapor-absorption features.
We first selected 3 nights from observations in 2025 as an Early Data Release (EDR), which covers ˜20 square degrees in the Galactic plane. The $J - W'$ vs $J - H$ color-color diagram distinguishes ultracool candidates with water-vapor-absorption features from reddened early-type stars. Furthermore, later-type stars tend to exhibit stronger water-vapor-absorptions. Some sources show larger $\Delta W'$ than ΔJ across the three nights, which we attribute to variations of their absorption depth. We conclude that it will be efficient to search for ultracool stars and estimate their spectral subtypes using W' band imaging at Dome A.
This talk will present the instrument design, observational strategy, and preliminary results of observations with W' band.

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