

The Hyperactive L Dwarf 2MASS J13153094-2649513: Continued Emission and a Brown Dwarf Companion

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We report new observations of the unusually active, high proper motion L5e dwarf 2MASS J13153094-2649513. Optical spectroscopy with Magellan/MagE reveals persistent nonthermal emission, with narrow H I Balmer, Na I and K I lines all observed in emission. Low-resolution near-infrared spectroscopy with IRTF/SpeX indicates the presence of a low-temperature companion, which is resolved through multi-epoch laser guide star adaptive optics imaging at Keck. The comoving companion is separated by 338 ± 4 mas, and its relative brightness ($\Delta K_s = 5.09 \pm 0.10$) makes this system the second most extreme flux ratio very low-mass binary identified to date. Resolved near-infrared spectroscopy with Keck/OSIRIS identifies this companion as a T7 dwarf. The absence of Li I absorption in combined-light optical spectroscopy constrains the system age to $> \sim 0.8$ –1.0 Gyr, while the system's kinematics and unusually low mass ratio ($M_2/M_1 = 0.3$ –0.6) suggests that it is even older. A coevality test of the components also indicates an older age, but reveals discrepancies between evolutionary and atmosphere model fits of the secondary which are likely attributable to poor reproduction of its near-infrared spectrum. With a projected separation of 6.6 ± 0.9 AU, the 2MASS J13153094-2649513 system is too widely separated for mass exchange or magnetospheric interactions to be powering its persistent nonthermal emission. Rather, the emission is probably chromospheric in nature, signaling an inversion in the age-activity relation in which strong magnetic fields are maintained by relatively old and massive ultracool dwarfs.

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