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The Ages of the Lowest-Mass Stars and Brown Dwarfs: A Case Study of TRAPPIST-1

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Age-dating ultracool dwarf stars and brown dwarfs is a critical challenge as these sources are increasingly important for searches of habitable exoplanets. Traditional diagnostics of rotation and magnetic activity are stymied by the decoupling of magnetic field lines from neutral photospheres; spectral diagnostics of surface gravity and lithium depletion are limited to young brown dwarfs (ages < 200 Myr); and binary mass measurements are rare and require accurate evolutionary models. In this talk, I discuss the case study of the planet-host ultracool dwarf TRAPPIST-1, which had contradictory ages reported in the literature. By combining statistical constraints from the color-magnitude diagram, average density, lithium, surface gravity, metallicity, kinematics, rotation, and magnetic activity, we infer a concordance age of 7.6+/-2.2 Gyr. Metallicity and radius effects were significant in this determination. I conclude with ideas for developing age-dating techniques for ultracool dwarfs.

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