M Dwarf Multiplicity in the Solar Neighborhood

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Stellar multiplicity provides fundamental clues about the nature of star formation, the evolution of stellar systems over time, and the distribution of baryonic mass in the Universe. How stars are parceled into singles, doubles, and higher order multiples also provides clues about the angular momentum distribution in stellar systems and constraints on whether or not planets may be found. Because of their large numbers, arguably the best sample that can be studied to understand stellar multiplicity are the nearby M dwarfs.

Previous companion searches for M dwarfs have had sample sizes on the order of 100 stars, resulting in a weak statistical understanding of the distribution of companions. We have systematically surveyed ∼1250 red dwarfs that have trigonometric parallaxes placing them within 25 pc of the Sun for stellar companions at separations of $1''$ to $10'$. Because the systems all have accurate parallaxes, biases inherent to photometrically-selected samples are eliminated. We obtained I-band images using the CTIO/SMARTS 0.9m in the south and the Lowell 42in in the north, probing the environs of these systems for companions at separations of $1''$ to $3'$. A complementary reconnaissance of wider companions out to $10'$ was also done via blinking of SuperCOSMOS archival BRI images. In addition, we have have long-term astrometric information on hundreds of the stars that can be used to estimate the number of companions closer than $1''$, and we have incorporated results from radial velocity work as well.

The results allow statistical analyses of the nearby M dwarf population, refinement of the solar neighborhood membership roster, and improvement of the mass function for these objects at the end of the main sequence. This is the largest, most comprehensive study ever done of the multiplicity of the most common stars in the Galaxy.

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