

## Abstract

The stars within 25 parsecs (pc) of our Sun constitute the one stellar sample that we aspire to know thoroughly, but we still have not even identified all of the stars within 10 pc. We have still less knowledge of the nearby substellar population, especially the planets. The four studies described herein expand our knowledge of the solar neighborhood.

First, a re-analysis of the Leander McCormick Observatory photographic plates of Barnard's Star failed to detect any planets orbiting it, and this study would have detected planets with 2.2 Jupiter masses or greater. In addition, its parallax, proper motion, and secular acceleration were measured with results comparable with those from more modern equipment.

Second, increased information about nearby planets was sought through time series analyses of astrometric residuals to stars observed by the University of Virginia Southern Parallax Program. Of these, LHS 288 displays an intriguing signal, which might be caused by a very low mass companion. Twelve other stars demonstrate no astrometric perturbations.

While astrometry could reveal the presence of unseen companions, distances from trigonometric parallaxes define the solar neighborhood and identify its inhabitants. Preliminary parallaxes for 43 potential nearby stars being observed by the Cerro Tololo Inter-American Observatory Parallax Investigation (CTIOPI) confirmed 28 stars as being within 25 pc, including three stars—LP 991-84, LHS 6167, and LP 876-10—that

probably lie within 10 pc. Three more stars lie near the 25-pc boundary and their final parallaxes may qualify them as nearby. One recently established neighbor, LP 869-26, is a potential binary. For many stars in this third sample, preliminary photometry ( $V$ ,  $R$ , and  $I$  bands), spectroscopy, and proper motions are also available.

Despite the continuing importance of ground-based parallax measurements, few active programs remain. The final project tested the recently installed infrared camera on the 31-inch (0.8-meter) telescope at Fan Mountain Observatory for astrometric stability. A parallax program would be feasible there and could provide much needed distances for brown dwarfs and very low mass stars.

Through this and similar efforts, we are establishing the foundations for understanding our Milky Way Galaxy, including its component stars and populations.