



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

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Project Title Photometric Detection of an Extra-Solar Planetary Transit across the Sun-Like Star HD 209548

<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I report photometric measurements of HD 209458, an extra-solar planetary system known to have an orbiting planetoid of Jupiter mass by radial velocity measurements. The star has been observed with a 10" Meade Schmidt-Newtonian LXD 55 telescope and imaged by a thermo-electrically cooled Nikon Coolpix 995 CCD digital camera. I detect two full transits at projected transit times defined by radial velocity measurements (Mazeh et al.). An accuracy of +/- 0.01 stellar magnitudes has been achieved using the equipment described. The photometric dimming observed, attributed to the transit of a planet across the stellar disk, is consistent with past photometric measurements made by considerably large observatories (Hubble, Keck I) and provides one of the first small aperture extra-solar planetary detections to date. The primary data analysis procedure used in the determination of stellar magnitude is differential aperture photometry. Also presented are derived values for the diameter of the extra-solar planetary disk.</p> <p>Methods/Materials Procedures - 1. Position telescope to track star HD 209458 solar system. 2. With CCD camera, take picture of three stars next to HD 209458 solar system and HD 209458 system, itself, every 2 minutes. 3. Apply differential photometric analysis of star field, so that any changes in luminosity of the HD 209458 system will be genuine and not artifacts of atmosphere (where other stars in the pictures will be used to show HD 209458's luminosity fluctuation is unique among all other stars apparent in picture.) 4. Using light curve measurements, determine planet's properties. 5. Monitor light curve to check for abnormalities unique to extra-solar planets.</p> <p>Conclusions/Discussion The hypothesis was supported by detailed differential aperture photometric analysis of HD 209458. An accuracy of +/- 0.01 stellar magnitudes was achieved, and was sufficient enough to discern the light curve of the extra-solar planetary system. Based upon light curve measurements, I report the radius of the planetoid orbiting HD 209458 to be 1.3 Jup. , a .2 difference from radius derived by radial velocity measurements by Keck I (Marzeh et al 2000). This proves consistent with past photometric measurements by Charbonneau et al. 2000. Consequently, these photoelectric measurements confirm a planetoid of 1.3 Jup. , orbiting around HD 209458.</p>

Summary Statement Detecting and estimating the size of a planet orbiting a sun-like star outside our solar system.
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Help Received Equipment and software donated by USC under supervision of Dr. Hans Bozler. Mother helped procure telescope. Father helped on Observation trips.
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