are distorted due to the gravitational bending of light, and at at limiting surface brightness of 29-30 mag arcsec^{-2} there are over 100 background galaxies per arcmin^2. High redshift background galaxies can be selected for this purpose by selecting on color and surface brightness.

Using deep 2048^2 images we have measured the distortion of over ten thousand background galaxies to trace the mass distribution of the large cluster Abell 1689 to beyond 800 h^{-1} kpc. Multiple realistic simulations allowed us to correct for systematics arising from measurement error and finite image resolution. We were able to calibrate the total mass in the cluster by using the presence of two large arcs located at the Einstein radius.

In our poster we will report on the shape of the mass distribution and compare it to some recent N-body/SPH simulations of X-ray clusters. Outside the core region the mass is not symmetrically distributed around the core. We will compare this with the light distribution in the cluster. We will also show comparisons among the density profiles of the total mass, the hot gas, and the galaxies. Finally we will present comparisons between this gravitational lensing result and both X-ray (ROSAT) and kinematic measurements (optical spectroscopy) in order to quantify systematic differences among these approaches.

23.04

Spectroscopic Results of Gravitational Microlenses: Are These Dark Objects or Faint Stars?

C.L. Joseph, J. Gallagher (U. Wisconsin), M. Phillips (CTIO)

We report on the spectroscopic results obtained in October 1994 with the 4-meter telescope on Cerro Tololo Interamerican Observatory (CTIO). Spectra of 2 recent microlens candidates toward the Galactic bulge reported by the Optical Gravitational Lens Experiment (OGLE) as well as one caught in the early phases of brightening toward the LMC reported by the MAssive Compact Halo Object (MACHO) Project have been obtained. The spectral coverage is from 6500 to 9800 Angstroms at a resolution of 6 Angstroms.

The long-term goal of this spectroscopic study is to obtain sensored statistical evidence on the luminosity of the microlenses, constraining the nature of these lenses. Several models of composite spectra of a bulge or LMC star plus a cool lensing star of different spectral types are presented to demonstrate the ranges in the product of luminosity times distance that the faint star could be detected in a composite spectrum.

23.05

A Survey of Dark Matter in Clusters: Calibration of Weak Gravitational Lens Tomographic Mapping

Tony Tyson & Philippe Fischer (AT&T Bell Labs)

Preliminary results for the total mass and light distribution in a survey of 28 clusters of galaxies will be given. The mass is derived from hundreds of weak lensing arclets — gravitational lens distorted background faint blue galaxies — found in deep CCD shift-and-stare exposures to uniform faint surface brightness (29 mag arcsec^2) in two colors. Gravitational lens distortion tomography (arclet inversion) is a direct measure of the projected total mass distribution in the lens. In this poster we focus on the mass calibration of this cluster survey.

Realistic Monte Carlo simulations of the entire source-lens-atmosphere-detector process were performed, including multiple background galaxy redshift shells, masses for individual cluster galaxies, clumped dark matter, atmospheric seeing, and pixel sampling and sky shot noise. These allow us to verify analytic corrections for systematics in the mass profiles at large radius from the cluster center arising from the image ellipticity measurement, arclet inversion, and finite image resolution. "Blank" field HST WFC-2 Medium Deep Survey data, together with seeing deconvolved ground-based data, are used to derive the source galaxy angular scales. Given accurate seeing and source galaxy angular scales, we find that the mass scale may be calibrated from these weak lensing data alone. Strong lensing (long arcs at the Einstein critical radius) then forms an independent check on this weak lensing mass scale calibration.

We will show a color video of Monte Carlo simulations of lensing in the rich cluster Abell 1689 in which 5 background color-encoded redshift shells of source galaxies are scanned past the cluster. The rate of formation of strong lensing artifacts such as radial spikes and rings can be a useful test of the underlying mass profile.

23.06

First Results from the CLASS Gravitational Lens Survey: Two New Compact Radio Lenses with Arc-Second Separations

S.T. Myers, C.D. Fassnacht, S.G. Djorgovski, G. Neugebauer, T.J. Pearson, A.C. Readhead (Caltech), I.W.A. Browne, P.N. Wilkinson, S. Nair (NRAL Jodrell Bank), N. Jackson, I. Snellen, G. Miley (Leiden University), G. de Bruyn, R. Schilizzi (NFRA Dwingeloo)

The first phase of a large gravitational lens survey using the Very Large Array at a wavelength of 3.6 cm has been completed, yielding images for 3271 radio sources. The Cosmic Lens All-Sky Survey, or CLASS, is designed to locate gravitational lens systems consisting of multiply-imaged compact components with separations of 0.2 – 10 arc-seconds. Previous surveys indicate lensing-rates for samples of flat-spectrum radio sources of around 0.2%, therefore this phase of our survey is expected to yield 6 lenses. Lenses selected in this manner are likely to be suitable for time-delay measurements that can be used to measure the Hubble constant H_0, and over a large enough redshift range, q_0. So far, the survey has produced two unambiguous lenses: a quadruple-imaged object with maximum separation of 2.1 arcsec, and a doubly-imaged quasar with separation of 1.4 arcsec. Over a dozen candidates with simple double structure have also been extracted from the survey, and many more with complicated structure have been tagged for follow-up.

Optical images and spectra confirming the indentification of these candidates have been obtained. The lensed object in the double system has been identified as a quasar at redshift $z=1.6$. For the quad lens, a spectrum obtained with the Palomar 5-m telescope indicates a tentative redshift of $z\sim0.6$ for the lensing galaxy, and an infrared image from the NIRC on the Keck 10-m telescope has located the galaxy relative to the 4 lensed images. A preliminary lens model for the quad gives estimates for the time delays from around 10 days between the nearest components to around 200 days for images maximally separated on the time-delay surface. By the time of the meeting, radio variability data obtained at the Owens Valley Radio Observatory will be available to assess the viability of these lenses for time-delay measurements.

Session 24: The Distance Scale
Display Session, 9:20am - 6:30pm
Tucson Convention Center, Exhibit Hall

24.01

Cepheid Distances to the Sculptor Galaxies I. Discovery of Cepheids and the Distance to NGC 247

J.H. Catanzarite (Cypress Community College), W.L. Freedman (Carnegie Observatories), I.K. Horowitz (BYU), B.F. Madore (NED/IPAC/JPL)

We report on the discovery of Cepheid variables in the South Polar (Sculptor) Group galaxy NGC 247. The periods, colors and mean magnitudes of these stars were determined from BVRI CCD observations obtained between 1985 and 1992 at Cerro Tololo Inter-American Observatory (CTIO) and at Las Campanas Observatory (LCO). Light curves, period-luminosity relations, reddenings and a true distance modulus to NGC 247 will be presented. JHC was supported by NASA Grant NAG8-998, and by and NSF Research Opportunity Award; WLF was supported in part by NSF grant AST 91-16496.