A DUAL CCD MOSAIC CAMERA SYSTEM SEARCHING FOR MASSIVE COMPACT HALO OBJECTS (MACHOs)

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ABSTRACT: The Macho Collaboration uses a dedicated 1.27-m telescope (The Great Melbourne Telescope) at Mount Stromlo to make photometric measurements of tens of millions of stars per night searching for the gravitational microlensing signature of MACHOs in the halo and disk of the Milky Way. A prime focus corrector and dichroic beamsplitter provide red (6300 - 7800 Å) and blue (4500 - 6300 Å) foci with one degree fields. A two by two mosaic of 2048 x 2048 pixel CCDs in each focal plane provides simultaneous images of 0.5 square degrees. By August of 1994, more than 20,000, 32 megapixel images will have been collected of fields in the Large Magellanic Cloud (LMC), Small Magellanic Cloud and the bulge of the Milky Way. We have implemented an online analysis system which produces photometric reductions of a night's data (five Gbyte of images) within 24 hours. This system allows us to identify and follow interesting events in real-time. In this search, we have identified more than 60,000 variable stars, and a preliminary analysis of their types and distribution will be presented. Microlensing events toward the LMC and the bulge have been discovered and detection efficiencies are being calculated to constrain the MACHO content of the Milky Way's halo.

A. G. Davis Philip et al. (eds.), New Developments in Array Technology and Applications, 285–286.

DISCUSSION

HOWELL: How do you store the data? Do you send x, y and mags to LLNL each day? How do you get image data from Mt. Stromlo to LLNL?

COOK: Images are archived on eight mm exabyte tapes, and copies are distributed to the various collaboration sites. Most of the data reduction during our first two years has been done in Australia, but the analysis has been done in California. The reduced data are collected on exabyte tapes and sent to Livermore every few weeks.

GLASS: Do you propose to release data about the variable stars to the general community within a finite time?

COOK: Our collaboration has decided to release our data four years after it is obtained. We also are open to proposals to collaborate on non-Macho aspects of our data at any time.

FLORENTIN-NIELSEN: What are the approximate values of the mass of the deflecting objects that you have from your microlensing events so far?

COOK: Because of the degeneracy of mass, distance and transverse velocity of the lens, one must appeal to a particular model of lens distribution to estimate a mass. For a generic halo model (which has not been corrected for our detection efficiency) the most probable mass of our 7x amplitude event is about 0.1 M_o, but the 50% confidence limits extend from 0.03 M_o to 0.5 M_o.

WEST: If and when your alert system is running, how soon would you be able to tell other observers about an event? And if spectra could be taken (at the maximum) what could you expect to be seen in these?

COOK: We are beginning our alert system by only notifying the CTIO 0.9-m. After the system has worked well, we may distribute alerts publicly. The OGLE collaboration is currently making available alerts from their survey. As for spectra, I would expect that they would show nothing abnormal which would the case for microlensing as opposed to some stellar phenomenon.

POLOJENTSEV: What was the reason to delay of the reduction of observation with CCD?

COOK: As we began data collection, the scale of the databases containing reduced photometry overwhelmed the facilities in the dome and database construction and analysis was moved to Livermore. This process was impeded by the necessity of archiving image data utilizing the vast majority of our exabyte writing capability.

PENNY: Does the gravitational lens resolve the stellar disks?

COOK: This is a possibility, but for lens masses in the Jupiter range and larger and for giants or dwarfs in the LMC, the Einstein ring diameter is large enough compared to the angular diameter of the source that the source can be considered a point.