Surveys with a 4 m Liquid Mirror Telescope

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Abstract. We describe an international project of construction and operation of a 4 m Liquid Mirror Telescope (LMT) led by E. Borra. A LMT, whose main advantage is its very low cost, is particularly well suited for the search and study of gravitational lenses, type Ia supernovae, faint nearby red, brown and white dwarfs, halo stars with high proper motions and, more generally, all variable phenomena like quasars, variable stars, micro-lensing effects, etc.

1 Technical Description of the 4 m LMT

The surface of a reflecting rotating liquid takes the shape of a paraboloid which is the ideal surface for the primary mirror of an astronomical telescope. The focal length F of the mirror is related to the gravity g and to the angular velocity of the turntable ω by

$$F = \frac{g}{2\omega^2} \tag{1}$$

Liquid mirror telescopes cannot be tilted and hence cannot track like conventional telescopes do. In order to track images through narrow- and wide-band filters or slitless spectroscopy, one can use a technique called time delayed integration (TDI), also known as drift scan, in which the CCD detector tracks the charges by electronically stepping its pixels. The information is stored on disk and the night observations can be coadded with a computer to give long integration times (see Borra 1982 and Borra et al. 1992 for more details).

2 Science with a LMT

Thanks to its very low cost ($\sim$ 1–2 millions US$), a 4 m LMT can be entirely dedicated to a scientific project and, in spite of its relatively restricted field of view ($\sim 1\,°$), several scientific drivers could be carried out like statistical determination of the cosmological parameters H_0 and q_0 based upon surveys for gravitational lenses (Surdej and Claeskens 1997) and supernovae, search for low surface brightness and star-forming galaxies, observational studies of quasars and large scale structures, detection of high stellar proper motions, trigonometric parallaxes, a wide range of photometric variability studies (photometry of micro-lensing effects and of variable AGN over day to year time scales) and also a unique database for follow-up studies with the VLT.

Operation of a LMT from La Silla (latitude of 29 degrees 15 minutes South) would enable to cover approximately 90 square degrees of sky at high galactic latitude ($|b| > 30°$), passing very near to the south galactic pole. At the same time,

such a LMT survey would probe regions near the galactic center, offering unique data for studies of the galactic structure, stellar populations, including accurate measurements of stellar proper motions (cf. red, white, brown dwarfs, faint halo stars, etc.), trigonometric parallaxes and detection of stellar microlensing effects caused by bulge stars, dark compact objects, etc.

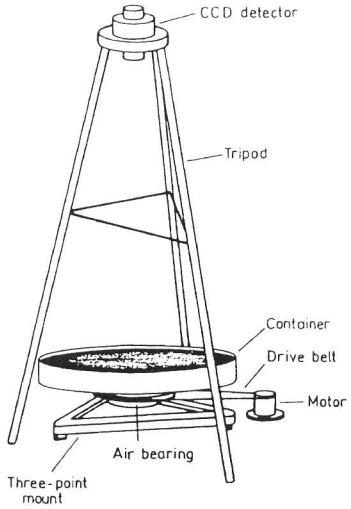

Fig. 1. Entire telescope system.

References

See the WWW bibliography available at the URL:
http://wood.phy.ulaval.ca/lmt/home.html
http://vela.astro.ulg.ac.be/grav_lens/grav_lens.html

Visit our LMT web page at the URL: http://vela.astro.ulg.ac.be/lmt/

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