

COMETARY ASTROMETRY WITH THE SYDNEY OBSERVATORY ASTROGRAPH

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ABSTRACT. The New South Wales Branch of the British Astronomical Association is currently making use of the Sydney Observatory astrograph for cometary astrometry. Astrometric plates (16 x 16 cm) of P/Halley are being taken at a plate scale of 116 arcsec/mm with a field of 5 x 5 degrees. Plate measuring is accomplished by means of a mechanical single screw Hilger measuring machine. Plate reduction utilises the program supplied by the International Halley Watch organisation. Measurement and reduction is facilitated by the machine readable catalogue and plotting routines supplied by the United States Naval Observatory. Currently the BAA observing team is working towards achieving a 24 hr turnaround for plate reductions. This will enable useful contributions to be made during the critical pre-encounter periods.

1. INTRODUCTION

The technique of astrometry involves the taking of astrophotos of a precisely known scale for the purposes of accurately measuring the positions of stars, minor planets and comets. The southern hemisphere is particularly poorly covered by astrometric observers, and here the amateur has a chance to make significant contributions.

2. CONCEPTS

To measure accurately the positions of objects in the sky, three essential steps are involved:-

- i) taking a photograph (glass plate or sheet film),
- ii) measuring the distances on the plate between various reference stars and the object whose position is required,
- iii) scaling of these measurements to obtain the object's position in terms of Right Ascension and Declination.

Thus, the following are fundamental to the practice of astrometry:-

- i) a large image scale & distortion free field in the focal plane,

- ii) a dimensionally stable photographic film or plate,
- iii) sufficiently accurate measurement and reduction methods.

The astrograph also needs a relatively wide field so that sufficient catalogued reference stars may be found.

3. TECHNIQUES

When taking an astrometric plate exposures should be only long enough to record the "nucleus", plus stars down to mag 9-10 for reference purposes. The telescope is normally guided in such a way as to maximise the chance of recording a measurable comet image on the plate. Thus, the stars are recorded as short trails.

Measurement of these astrometric plates depends on the use of a simple mechanical (single screw) measuring machine. This consists of a travelling microscope on a stage which is moved by an accurately machined screw. Distances along this screw may be read to one micron by means of vernier scales.

Using a microcomputer, the reduction of the plate measurements (in microns) to accurate positions (in RA and Dec) is a relatively straightforward, though tedious procedure.

4. THE SYDNEY OBSERVATORY ASTROGRAPH

The Sydney Observatory astrograph is actually two astrographs and a 26cm guidescope mounted together. The small astrograph which we use has a 23cm, f/7.7 lens with a field of 5 x 5 degrees. Guiding is accomplished by means of a special guiding eyepiece which is mounted on an X-Y stage and can be offset from the optic axis of the guidescope.

5. INITIAL OBSERVATIONS BY BAA OBSERVERS

Initial trials (comets P/d'Arrest and P/Kopff) eventually yielded positions to an accuracy of about 1 arcsec.

Prior to the IHW trial run in March, 1984, an astrograph operating manual was compiled which includes programs in BASIC and HP41 programmable calculator notation.

6. CONCLUSIONS

During the 1985/86 return of P/Halley, the BAA (NSW Branch) observers will be involved with the IHW astrometry network and will operate the Sydney Observatory astrograph at the observatory site during this period. The relatively few southern hemisphere astrometric observers will play an important part in spacecraft encounters with Halley in 1986.