A Giant Step: from Milli- to Micro-arcsecond Astrometry
Proceedings IAU Symposium No. 248, 2007
W. J. Jin, I. Platais & M. A. C. Perryman, eds.

doi:10.1017/S1743921308020024

A project of teaching ground-based astrometry

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Abstract. The optical ground-based astrometry of solar system objects may have its accuracy strongly improved by using new methods for making observations and reductions of them. New photometric methods of observating the mutual phenomena occurring in the solar system, may provide astrometric data with a higher precision than the classical direct imaging. In order to help preparing observers for the future campaigns of observations (2008–2010) and to promote this kind of high-accuracy astrometry, we plan to organize a spring school in 2008 in Beijing, China, for PhD and post-doctoral students, and for interested young astronomers.

Keywords. astrometry, eclipses, ephemerides, occultations, solar system: general

1. Introduction

The astrometric observations of the solar system bodies are fundamental for several purposes:
– space navigation (ephemerides);
– dynamics, stability, evolution, scale of the solar system;
– impact hazard assessment (ephemerides);
– space and ground based observations (ephemerides);
– physics of the surfaces and interiors of solar system objects;
– gravitational and relativistic studies;
– reference systems.

Hence, we might develop campaigns of observations in order to gather high accuracy-observations allowing theoretical developments. The goal of the proposed spring school is to help students and young astronomers to organize or to participate in campaigns of astrometric observations. The program of the Spring School is as follows.

2. The courses of the spring school

2.1. *Fundamental astrometry*

– definition of a measurement on the celestial sphere, absolute, relative or direct measurement;
– focal plane observations, the methods for their reduction;

– astrometric reduction of optical ground-based observations, the gnomonic projection, biases from telescopes, from the sky;
– the link methods, star catalogues;
– the methods of reduction without reference stars.

2.2. *Detectors, telescopes and images*

– making of images, diffraction, refraction, atmospheric effects;
– the case of extended objects: solar system bodies ; the reflection laws on the surface of the bodies, the centre of mass and the photocenter;
– electro-magnetic signal, the optical wavelengths;
– the astrometric and photometric detectors, CCD, the reduction of a CCD image;
– scanning of photographic plates;
– the objects to be observed, planets, inner satellites, outer satellites, large objects, asteroids, fast objects, comets˙

2.3. *Astrometry through photometry*

– astrometric observation without an angular measure, elements of photometry;
– occultations (occultations by the Moon, occultations of stars);
– the mutual occultations and eclipses, occurrence during the planetary equinoxes;
– the observation and reduction of the mutual events;
– the phase defect, albedo;
– analysis of the photometric light curves;
– preparation for the observational campaigns in 2008-2010.

2.4. *Practical astrometry at night*

– CCD observation and reduction;
– observation of different objects: asteroids, inner and outer natural planetary satellites;
– the case of giant planets.

3. Conclusion

It seems interesting to start a spring school on astrometry by focusing on making observations for a specific campaign of observations using the opportunity of the equinox on Jupiter and Saturn allowing the occurrence of mutual occultations and eclipses. Tutorials and recommendations will be provided mostly for these observations, their reduction and their astrometric interest but general information will be given in order to have a link with classical astrometry.