A Giant Step: from Milli- to Micro-arcsecond Astrometry
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The Infrared Astrometry today

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Abstract. Infrared Astrometry is one of the seven subdivisions of astrometry that detects emission in the range from 0.7 to 350 μm. Specific features and some problems of this one are discussed here and more details are provided on our web site "INFRARED ASTROMETRY" with the following URL http://www.mao.kiev.ua/IR. This web page includes 7 sections that will be expanded and regularly updated.

Keywords. infrared: general, catalogs, astrometry

What is Infrared Astrometry? Entire definition of astrometry was presented by Kovalevsky in his book "Modern Astrometry" (Kovalevsky 2002). One can only add that astrometry as well as astronomy can be divided, depending on the range of electromagnetic spectrum where the objects are detected, or photons energy, into the following seven astronomical or astrometrical subdivisions. They are as follows:

(1) Gamma-ray Astrometry,
(2) X-ray Astrometry,
(3) Ultraviolet Astrometry,
(4) Visual Astrometry,
(5) Infrared Astrometry,
(6) Submillimetr Astrometry,
(7) Radio Astrometry.

Thus, the Infrared Astrometry is one of the above seven subdivisions that detects emission in range from 0.7 to 350 μm. Evidently, it is a new direction in Astrometry.

The terrestrial atmosphere is more opaque for IR radiation than in visual optics. Beginning from 0.7 mkm it is transparent only within some bands because the absorption by water vapour and carbon dioxide. Due to this and some other circumstances, the ground-based IR observations are more complicated in comparison with the visual ones.

The Space observations are free from these deficiencies. The advantages of the space IR observations, in comparison with the ground-based ones, were demonstrated by the satellite IRAS survey. This advances in space IR observations were connected tightly with the progress in technology of IR sensors.

Successful ground-based near infrared observations (DENIS and 2MASS surveys) became possible due to a good progress in CCD and IR array detectors, as well as the progress in the full automation of telescope control and the computer data processing. But the next advance in infrared astrometry, the same as in optical one, will be connected probably with an implementation of two space-based interferometer projects Gaia, and SIM, which promise manifold increasing of the accuracy of observed stars and other objects. If these projects are successful they would extend infrared coordinate system to ICRS.

The IR Reference Catalogue which contains precise positions and proper motions is necessary both for presenting coordinate system and organizing various observations in this spectral range. Now such a catalogue can be created by identification of IR stars

from the catalogues IRAS PSC, DENIS, and 2MASS with their optical counterparts from precise astrometrical space catalogues HIPPARCOS and TYCHO or ACT and TYCHO2.

Specific features of this new direction, its 25 years history and some problems in more detail are discussed on the web page "INFRARED ASTROMETRY" created at the web site of the Main Astronomical Observatory of the National Academy of Sciences of Ukraine. Internet address of this one is `http://www.mao.kiev.ua/IR`. Now this web-page includes 7 sections:

(1) Inevitability of Infrared Astrometry,
(2) Short History,
(3) Peculiarity of IR Observations,
(4) Infrared Astrometry Program,
(5) Designing and Manufacturing of IR Astrometric Instruments,
(6) Creating and Extending of an IR Reference Catalogue,
(7) Connection of the Optical, IR and Radio Coordinate System.

It is proposed that this one will be expanded and regularly updated. Main goal of this page is to develop a new direction in Astrometry – "IR Astrometry".

Conclusion

The projects Gaia and SIM, when they are realized after 10 or 20 years, will help to solve many problems of Astrometry and Astronomy at the level of some microarcsecond accuracy. Practically it is Astrometry of the far future.

But the today Infrared Astrometry based on identification method, which help to improve the bad positions in the infrared catalogues, is appeared only 25 years ago. The first problem was solved by this one is the problem of the IRAS PSC position melioration. In the result the catalogue CPIRSS (Hindsley & Harrington 1994) and some others (Kharin 1992, Kharin 1997) were compiled on the basis of identifications of the IRAS PSC infrared sources with their optical counterparts from precise astrometrical catalogues in the FK5 system.

The today Infrared Astrometry is presented now by two ground-based catalogues. These are the DENIS and the 2MASS. Their positional accuracies in α and δ are $0\overset{''}{.}3$ and $0\overset{''}{.}2$, respectively. It is the level of the visual optical astrometrical accuracy at the end of the last century.

Improvement of bad position above two catalogues may be also achieved by identifying them with contemporary precise catalogues which are in ICRS coordinate system. On the basis of such identification the IR Reference Catalogue containing precise positions and proper motions of sources may be compiled. It is necessary both for presenting ICRS coordinate system in infrared and organizing various observations in this spectral range.

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