Workshop
"A new reduction of old observations in the Gaia era"
to be held in Paris on June 20-22, 2012

1) Abstract:

The arrival of the Gaia astrometric star catalogue will change completely the astrometric accuracy of new observations. More, it will also allow to re-reduce old observations with the Gaia accuracy. At the present time, we wish to select old observational data of selected objects of the Solar System that worth to be re-analyzed. A first work has been made by digitizing Galilean satellite plates reduced with the UCAC2 catalogue. This has provided very interesting results (Robert et al. 2011). The large amount of possible old data to be studied makes necessary to start now the selection and digitizing of old plates. We wish to organize in 2012 a workshop on this topic.

2) Scientific rationale:

Old observations are full of information which has never been extracted because of the lack of tools. Old astrometric data are still used in the dynamical studies of Solar System objects. Moreover, the idea to go back to these data and to find new information is not new but many questions arise: are we able to analyze and reduce these old data with today tools in order to get data with today accuracy? If so, are all old observations worth for a new analysis? Will the scientific goals be reached through these new data? The present project is to organize the search and the selection of old observations in order to avoid useless works on useless data and to start reduction and analysis of selected data.
In 2012, we plan to:

- create a working group gathering interested scientists
- start a program for a new analysis of selected old observations
- prepare the arrival of the Gaia astrometric star catalogue

The genesis of this project comes from several new works which have been made recently and have made clear the possible benefits of a new astrometric reduction:
- the monitoring of the Solar System bodies need astrometric observations covering a large interval of time to quantify secular effects like tidal accelerations (Lainey et al., Nature, Volume 459, Issue 7249, pp. 957-959 2009). More, the use of old accurate astrometric observations allows building more accurate ephemerides the extrapolation of which in the future being easier. Such ephemerides may be more useful for the preparation of space projects. It has been shown that observations made far in the past (in fact, observations made on a long interval of time) with a medium astrometric accuracy are more useful for dynamics than recent observations made on a short period of time with a high astrometric accuracy (Emelianov et al., Planetary and Space Science, Volume 58, Issue 1, 2010, pp.411-420, Desmars, 2007, PhD, Paris Observatory).
- the arrival of the GAIA mission will bring us a new astrometric star catalogue of very high accuracy, allowing us to make astrometric reduction far in the past since the proper motion of the stars will be sufficiently accurate to get positions in the past with a higher accuracy than using old astrometric catalogues. More, the large number of astrometric stars will allow the reduction of small fields recorded in the past and

never reduced with a sufficient accuracy (Arlot et al., GREAT workshop, Pisa, Italy 2011).
- a new reduction of photographic plates of the Galilean satellites made at the USNO (Washington DC) during the period 1967-1998 has shown that the use of a high accurate scanner allows to improve the internal accuracy of the measurements and to provide RA and DEC positions since the old reduction procedures provided only relative positions (Robert et al., Monthly Notices of the Royal Astronomical Society, Volume 415, Issue 1, pp. 701-708, 2011).

When understanding the interest of a new reduction of old observations, an important question arises: how to select old observations since several tens of thousands of astrometric observations were made during the past century. A fast study of the needed accuracy shows that only observations starting after the appearance of photographic plates are worth to be re-reduced. We may consider the following data:

- Photographic plates made during the period 1890-2000. All plates are not interesting and we do not think that a systematic digitization is useful. Only plates from which scientific information may be taken are worth to be analyzed. All plates are not interesting: either they are no more in good shape, or they were not made with a sufficiently astrometric accuracy. Each project of re-reduction must be supported by a scientific purpose. The photographic plates may be scanned today thanks to fast accurate measuring machine of new generation and then more easily reduced.
- CCD observations made more recently may be worth to be re-reduced too: at the beginning of the CCD era, small fields were very common and it was difficult to reduce these images because of the lack of astrometric reference stars. Reductions were made using approximate methods such as calibration with specific star fields which did not allow to get a sufficient astrometric accuracy.

The present project plans to search, find, identify and select the observations that may be interesting for a new reduction as follows:
-contact with observatories or institutes owning old observations and asking them for inventories of these observations, being sure to have the metadata necessary for the reduction
-select some sampling of these observations in order to perform a new reduction, first using a catalogue such as the UCAC2
-asking for resources for starting re-reduction of complete series of observations selected in 2) in order to reach scientific goals
-perform the reduction with the available star catalogues, keeping in mind that a new reduction should be made quickly as soon as the GAIA catalogue is available.
-be ready when the Gaia catalogue will be published to start the program of reduction of the selected observations.

Our purpose is also to organize an international working group gathering scientists from the observatories and institutes interested in the analysis of old data in order to discuss of all the problems related to a new reduction of old observations in the Gaia era.

3) Meeting program:

The workshop will make a link between Gaia observations, the Solar System astrometric community and planetology.
It will take place in Paris on June 2012 and will gather between 30 and 50 participants from collaborative institutes and from other interested institutes even outside the Solar System community

Preliminary program is:

- Solar System objects astrometric accuracy in the Gaia era
- New problems in the astrometric reduction of ground based observations after the Gaia accuracy
- Need for observations made in the past depending for dynamics and other studies
- Selection of old observations worth to be re-analyzed or to be re-reduced with the Gaia catalogue
- Digitization of photographic plates: technological problems
- Inventories of observational archives and metadata

More on: http://www.imcce.fr/hosted_sites/naroo/

4) Preliminary list of speakers:

- D. Pascu (US Naval observatory)
- C. Murray, N. Cooper (Queen Mary College of London)
- E. Khrutskaia (Pulkovo Observatory)
- N. Emelianov (Sternberg Institute, Moscow)
- M. Stavinschi, A. Nedelcu (Bucharest Institute of Astronomy)
- J.E. Arlot, D. Hestroffer, V. Lainey, W. Thuillot, V. Robert (IMCCE)
- Z.H. Tang (Shanghai Observatory)
- J.P. De Cuyper (Royal Observatory of Belgium)

5) Proposed financial supports:

- GRAM
- FP7 ESPaCE program
- French Foreign Affairs
- Internal resources of involved countries
- Paris Observatory Scientific Council