

JD3

**Precession-Nutation and
Astronomical Constants in the
Dawn of the 21st Century**

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INTRODUCTION OF JD 3 ON 'PRECESSION, NUTATION AND ASTRONOMICAL CONSTANTS IN THE DAWN OF THE 21ST CENTURY'.

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Precession/nutation part

Due to the adoption of the new International Celestial Reference Frame (ICRF), the Earth's Orientation Parameters (EOP) will be revised and their definitions will need to be re-examined and clarified. This implies that precession/nutation formulation will be also revised in the future.

The precession/nutation theories for a non-rigid Earth suffer from a lack of dissipation in the core and from a mismodeling of the ocean and of the atmospheric effects. The scientific community is examining these questions. The IAU community is consequently not yet ready to adopt a new precession/nutation geophysical model but the users may use the International Earth Rotation Service (IERS) empirical series.

In order to review those questions and prepare the future research, the Scientific Organizing Committee (SOC: P. Bretagnon, V.A. Brumberg, N. Capitaine, V. Dehaut (Chair), T. Fukushima, E. Groten, H. Kinoshita, B. Kolaczek, D.D. McCarthy, P.K. Seidelmann and P.T. Wallace) has proposed invited talks on the current situation concerning :

- (1) the formulation of precession/nutation (N. Capitaine, see paper 1),
- (2) the planetary theories and their relation to precession/nutation (P. Bretagnon, see paper 2),
- (3) the precession/nutation for a rigid Earth (J. Souchay and H. Kinoshita, see paper 3),
- (4) the DExxx JPL ephemerides precision and accuracy (E.M. Standish, see paper 4),
- (5) the observations of the Celestial Ephemeris Pole (CEP) and in particular the pole offset from which precession/nutation corrections can be derived (M. Feissel and A.M. Gontier, see paper 5),
- (6) the relativistic effects on precession/nutation (S.A. Klioner and M. Soffel, see paper 6),
- (7) the best available nutation series from the theoretical and observational point of view (P.M. Mathews and T.A. Herring, see paper 7),

The SOC wanted also that one invited speaker (J. Kovalevsky, President of Division 1) presents the consequences for the astronomers of a change in the precession/nutation model that will follow the adoption of the new ICRF (see paper 8 of J. Kovalevsky and D.D. McCarthy).

Astronomical constants part

The present situation, the progress and plans concerning (1) the best estimation of astronomical constants, (2) the standards of fundamental astronomy, and (3) the relativity in celestial mechanics and astrometry were further topics of the Joint Discussion 3. The SOC has proposed three additional invited talks on these topics, respectively presented by (1) D. McCarthy (see paper 9), (2) P.T. Wallace (see paper 10), and (3) V.A. Brumberg and B. Guinot (see paper 11).

discussion

The invited talks have prepared us to an interesting discussion.

Resolutions B4, B5, B6 and B7 are the consequences of what has been presented or discussed.

Indeed, Resolution B4 is concerned with the imperfections of the non-rigid Earth nutation theories that still need an important effort from the scientific community.

Resolution B5 asks for a new WG to be formed in order to examine and clarify the consequences for precession/nutation from the adoption of the new ICRF.

Resolution B6 concerns some clarifications in the frame of general relativity, consequences of the reference systems and time scales.

Resolution B7 is a resolution issued from two JD: JD 3 (this one) and JD 7 on the new ICRF; it recommends that high-precision observing programs be organized in order to maintain the ICRF at the highest possible accuracy and in order to obtain high-accuracy precession/nutation. This resolution explicitly mentioned Very Long Baseline Interferometry (VLBI) and Lunar Laser Ranging (LLR), while other techniques as the Global Positioning System (GPS) may also play an important role in the future.

list of invited talks

1. Capitaine N., "Overview, Formulation and Current Situation for Precession/Nutation."
2. Bretagnon P., "The Planetary Theories and the Precession of the Ecliptic."
3. Souchay J. and Kinoshita H., "The theory of the Nutation for a Rigid Earth Model: Current State of the Situation."
4. Standish E.M., "Fundamental Arguments of the Current Nutation Theory; Dynamical Reference Frame."
5. Feissel M. and Gontier A.-M., "Observations of the Celestial Motion of the Earth's Pole."
6. Klioner S.A. and Soffel M., "Relativistic Considerations for Precession and Nutation."
7. Mathews P.M. and Herring T.A., "Observational and Theoretical Modeling of Nutation."
8. Kovalevsky J. and McCarthy D.D., "Astronomical Effects of Current Changes in Fundamental Astrometric References."
9. McCarthy D.D., "Latest Best Estimates of Astronomical Constants."
10. Wallace P.T., "SOFA (Standards Of Fundamental Astronomy); Progress and Plans."
11. Brumberg V.A., Guinot B., and RCMA SWG members, "General Relativity and the IAU Resolutions; Report of the IAU WGAS Sub-Working Group on Relativity in Celestial Mechanics and Astrometry (RCMA SWG)."