

ON FUTURE IAU RECOMMENDATIONS AND ORGANIZATION

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ABSTRACT. Following the presentations presented above, a brief discussion period addressed issues related to nomenclature, the draft resolution regarding the definition of the astronomical unit, recommendations for standardizing access to ephemerides, requirements for new working groups and the future of the Journées.

1. NOMENCLATURE

Participants discussed the possible formation of a Division I standing committee for nomenclature, which would address solely the issues of proper standardization of definitions and descriptions of technical terms related to fundamental astronomy. It was suggested that such a group might be composed of a limited number of subject-matter experts and instituted by the Division Organizing Committee with members proposed by Commission Presidents and the chair appointed by the Division President in consultation with the members of the Standing Committee. The membership as well as the group's continued existence would be reviewed by the Division at each General Assembly, but it is assumed that it would continue as a quasi-permanent activity and could be augmented with other subject matter experts upon recommendation by the chair of the Standing Committee and the approval of the Division Organizing Committee.

Such a committee would be expected to address, for example, the issues regarding clarifying nomenclature that were raised earlier in the meeting. These included suggestions regarding clear nomenclature for the current precession and nutation models as proposed by George Kaplan or nomenclature issues regarding the application of zonal tide corrections to the UT1 Earth orientation parameter. The consensus was that such a group would indeed be helpful but the specific details of its formation should await the details of the proposed reorganization of the structure of the IAU.

2. ASTRONOMICAL UNIT

The details of a proposed resolution regarding the definition of the astronomical unit to be presented at the IAU 2012 General Assembly were discussed at length. Participants agreed that a clear modern definition of the astronomical unit was required but there was need for further discussion regarding the specific details of that definition. There was general agreement that the astronomical unit be re-defined to be a conventional unit of length to be used with all time scales (including TCB, TDB, TCG, and TT), and that the Gaussian gravitational constant k be deleted from the system of astronomical constants. Participants also felt that the value of the heliocentric gravitation constant be determined observationally. This discussion and subsequent electronic correspondence among the participants resulted in the final draft resolution to be proposed at the 2012 IAU General Assembly (see Appendix 1).

3. ACCESS TO EPHEMERIDES

Following the earlier report of the IAU Commission 4 Working Group on Standardizing Access to Ephemerides, whose goal is to facilitate the use of ephemerides, there was discussion regarding the recommendation to work toward using the SPICE format developed of JPL.

4. WORKING GROUP ON ICRS

Participants discussed the need for a new Division I working group concerned with the mathematical models to be used in the future definition of the International Celestial Reference System. The group would deal with systematic effects in the definition and realization of the ICRS due to differences in modeling such effects as aberration, lensing, etc. It would be expected to report its recommendations at the 2015 IAU General Assembly and be composed of members who are actively concerned with the realization of the ICRS (e.g. GAIA and IVS).

5. WORKING GROUP ON ENSEMBLE PULSAR TIME

There was general agreement that a Division I Working Group devoted to the topic of creating a time scale based on pulsar observations would be very useful to establish the long-term stability of time scales. That group would be expected to coordinate observing efforts and standardize analysis procedures. The goal would be to work toward an ensemble pulsar time and to report at the 2015 General Assembly on the feasibility of such a project. Members would be expected to come from Commissions 4 and 31.

6. JOURNÉES AS A MEETING OF IAU DIVISION I ?

There was considerable discussion on the proposal to work toward making future Journées meetings a means to organize a scientific meeting of IAU Division 1 members between meetings of the IAU General Assembly. There was general agreement on the principle but concerns were expressed regarding the funding necessary for the meeting.

APPENDIX 1 - IAU 2012 RESOLUTION PROPOSAL

Re-definition of the astronomical unit of length

The XXVIII General Assembly of International Astronomical Union,
noting

1. that the International Astronomical Union (IAU) 1976 System of Astronomical Constants specifies the units for the dynamics of the solar system, including the day ($D = 86400$ s), the mass of the Sun, M_S , and the *astronomical unit of length* or simply the *astronomical unit* whose definitionⁱ is based on the value of the Gaussian gravitational constant,
2. that the intention of the IAU 1976 definition of the astronomical unit was to provide accurate relative distances in the solar system when absolute distances could not be estimated with high accuracy.
3. that, to calculate the heliocentric gravitation constant, GM_S , in Système International (SI) unitsⁱⁱ, the Gaussian gravitational constant k , is used, along with an astronomical unit determined observationally,
4. that the IAU 2009 System of astronomical constants (IAU 2009 Resolution B2) retains the IAU 1976 definition of the astronomical unit, by specifying k as an “auxiliary defining constant” with the numerical value given in the IAU 1976 System of Astronomical Constants,
5. that the value of the astronomical unit compatible with Barycentric Dynamical Time (TDB) in Table 1 of the IAU 2009 System ($149\,597\,870\,700$ m $\pm$ 3 m), is an average (Pitjeva and Standish 2009) of recent estimates for the astronomical unit defined by k ,
6. that the TDB-compatible value for GM_S listed in Table 1 of the IAU 2009 System, derived by using the astronomical unit fit to the DE421 ephemerides (Folkner et al. 2008), is consistent with the value of the astronomical unit of Table 1 to within the errors of the estimate; and

ⁱThe IAU 1976 definition is: “The astronomical unit of length is that length (A) for which the Gaussian gravitational constant (k) takes the value of 0.017 202 098 95 when the units of measurements are the astronomical unit of length, mass and time. The dimensions of k^2 are those of the constant of gravitation (G), i.e., $L^3M^{-1}T^{-2}$. The term “unit distance” is also for the length A .”

ⁱⁱusing the equation $A^3k^2/D^2 = GM_S$ where A is the astronomical unit and D the time interval of one day, and k the Gaussian gravitational constant

considering

1. the need for a self-consistent set of units and numerical standards for use in modern dynamical astronomy in the framework of General Relativity,
2. that the accuracy of absolute distance measurements provided by modern observations makes the use of relative distances unnecessary,
3. that modern planetary ephemerides can provide GM_S directly in SI units and that this quantity may vary with time,
4. the need for a unit of length approximating the Sun-Earth distance, and
5. that various symbols are presently in use for the astronomical unit,

recommends

1. that the astronomical unit be re-defined to be a conventional unit of length equal to 149 597 870 700 m exactly, as adopted in IAU 2009 Resolution B2,
2. that this definition of the astronomical unit be used with all time scales (including TCB, TDB, TCG, and TT),
3. that the Gaussian gravitational constant k be deleted from the system of astronomical constants,
4. that the value of the heliocentric gravitation constant, GM_S , be determined observationally in SI units, and
5. that the unique symbol “au” be used for the astronomical unit.

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