

**Commission A3 Fundamental Standards  
Resolutions for consideration for the XXXII General Assembly  
15 April 2024**

**Resolution to establish a standard Lunar Celestial Reference System (LCRS) and Lunar Coordinate Time (TCL)**

The XXXIInd International Astronomical Union General Assembly,

*Considering*

1. that the Resolution A4 of the XXIst General Assembly (1991), modified by Resolutions B1.3-B1.5 of the XXIVth General Assembly (2000), has defined the Barycentric Celestial Reference System (BCRS), and the Geocentric Celestial Reference System (GCRS), within the framework of General Relativity,
2. that the time coordinates of the BCRS and GCRS are designated Barycentric Coordinate Time (TCB) and Geocentric Coordinate Time (TCG), respectively,
3. that an analogous system of space-time coordinates for use in the lunar environment has not been defined,
4. that the high precision of many types of scientific measurements, including those involving astrometry, geodesy, time, and frequency, will require the practical application of such a framework in the lunar environment, and
5. that the theoretical work of an extension of this framework to the lunar environment has already been performed,

*Recommends*

1. the same techniques used to construct the GCRS be used to construct an analogous Lunar Celestial Reference System (LCRS), with its time coordinate designated Lunar Coordinate Time (TCL),
2. the LCRS metric tensor, the LCRS gravitational potentials, and the transformation between the BCRS and the LCRS be defined exactly as given in the relations in IAU Resolution B1.3 of the XXIVth General Assembly (2000), with the substitution of quantities related to the Moon for those related to the Earth,
3. the unit of measurement of TCL be consistent with the SI second,
4. the reading of TCL be 1977 January 1,  $0^{\text{h}} 0^{\text{m}} 32.184^{\text{s}}$  exactly when the reading of TCB be 1977 January 1,  $0^{\text{h}} 0^{\text{m}} 32.184^{\text{s}}$  at the center of the Moon, and

5. the transformation between TCL and TCB be given by the relations in IAU Resolution B1.5 of the XXIVth General Assembly (2000), with the substitution of quantities related to the Moon for those related to the Earth.

### *Notes*

*The same formulae can apply for any celestial reference system in the Solar System by substituting quantities referred to the appropriate celestial body.*

*Note that 1977 January 1,  $0^h 0^m 32.184^s$  is the common value for coordinate times Terrestrial Time (TT), TCG, TCB and now TCL, arbitrarily set to coincide with that of TT at the geocenter on 1977 January 1,  $0^h 0^m 0^s$  TAI. The value of TT at that instant was set to ensure an approximate continuity with the previous time argument of ephemerides, Ephemeris Time (ET) (Resolution A4, Recommendations III and IV of the XXIst General Assembly (1991)). TCL has no historical relation to the other time scales so its initial epoch is entirely arbitrary and is set here for specificity.*

### *References*

M. Soffel, S. A. Klioner, G. Petit, P. Wolf, S. M. Kopeikin, P. Bretagnon, V. A. Brumberg, N. Capitaine, T. Damour, T. Fukushima, B. Guinot, T.-Y. Huang, L. Lindegren, C. Ma, K. Nordtvedt, J. C. Ries, P. K. Seidelmann, D. Vokrouhlický, C. M. Will, and C. Xu. *The IAU 2000 Resolutions for Astrometry, Celestial Mechanics, and Metrology in the Relativistic Framework: Explanatory Supplement*. *Astron. J.*, **126**: 2687–2706, December 2003. doi:10.1086/378162.