

Accurate harmonic development of Lunar ephemeris LE-405/406

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Abstract. We discuss an accurate harmonic development of Lunar ephemeris LE-405/406

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By using a new method of spectral analysis of an arbitrary tabulated function of Sun/Moon/planets coordinates to Poisson series (Kudryavtsev 2004) we made accurate harmonic development of the long-term numerical lunar ephemeris LE-405/406 (Standish 1998). Spherical lunar coordinates r (geocentric distance), V (ecliptic longitude) and U (ecliptic latitude) are represented by Poisson series in the form used by analytical theories of lunar motion (Chapront-Touzé & Chapront 1983; Chapront & Francou 2003).

The complete solution LEA-406a includes 42 270 terms of minimal amplitude equivalent to 1 cm and is valid over 1500-2500. The simplified solution LEA-406b includes 7952 terms of minimal amplitude equivalent to 1 m and is valid over 3000 BC - 3000 AD. The maximum difference in lunar coordinates r , V , U calculated by means of the analytical development LEA-406a and numerical ephemeris LE-405/406 is respectively 1.7 m, 0."0038, 0."0013 over 1900 - 2100, and 3.2 m, 0."0056, 0."0018 over 1500 - 2500.

Over 3000 BC - 3000 AD the maximum difference in coordinates r , V , U calculated by means of LEA-406b and LE-406 is respectively 0.20 km, 0."42 and 0."33. It is better than accuracy of the modern analytical theory of lunar motion ELP/MPP02 by Chapront & Francou (2003) (in particular, over 1500 - 2500 the gain in accuracy is from a factor of 9 to a factor of 70 depending on the coordinate). The number of terms in series LEA-406a,-b is less than that in ELP/MPP02.

The Poisson series LEA-406a,-b analytically representing the lunar ephemeris LE-405/406 are available at: <<http://lnfm1.sai.msu.ru/neb/ksm/moon/LEA-406.zip>>.

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