DAILY POLYNOMIAL COEFFICIENTS FOR LUNAR COORDINATES

Notes and formulae

On the following pages (previously pages D23–D45 of *The Astronomical Almanac*), for each day of the year, the apparent right ascension (α) and declination (δ) of the Moon are represented by economised polynomials of the fifth degree, and the horizontal parallax (π) is represented by an economised polynomial of the fourth degree.

The formulae to be evaluated are of the form:

$$a_0 + a_1 p + a_2 p^2 + a_3 p^3 + a_4 p^4 + a_5 p^5$$

where a_5 is zero for the parallax.

The time-interval from 0^h TT is expressed as a fraction of a day to form the interpolation factor p, where $0 \leq p < 1$, and the polynomial is evaluated directly, or by re-expressing it in the nested form:

$$((((a_5 p + a_4)p + a_3)p + a_2)p + a_1)p + a_0$$

to avoid the separate formation of the powers of p. Alternatively this nested form for α and δ may be written as:

$$b_{n+1} = b_n p + a_{5-n}, \text{ for } n = 1 \text{ to } 5,$$

where $b_1 = a_5$ and b_6 is the required value. For the parallax a_5 is zero, so that:

$$b_{n+1} = b_n p + a_{4-n}, \text{ for } n = 1 \text{ to } 4,$$

where $b_1 = a_4$ and b_5 is the required value.

The polynomial coefficients are expressed in decimals of a degree, even for α, and the signs are given on the right-hand sides of the coefficients to facilitate their use with small calculators. Subtract 360° from α if it exceeds 360°. In order to obtain the full precision of the polynomial ephemeris the interpolating factor p must be evaluated to 8 decimal places (10^{-3} s); estimates of the precision of unrounded interpolated values are:

RA	Dec	HP
$\pm 0^s.0003$	$\pm 0''.003$	$\pm 0''.0003$

Particular care must be taken to ensure that the coefficients are entered with the correct signs.

Example. To calculate the apparent right ascension (α) the declination (δ) and the horizontal parallax (π) for the Moon on 2005 January $21^d\ 13^h\ 23^m\ 48^s.32$ UT, using an assumed value of $\Delta T = 66^s$.

TT = $13^h\ 24^m\ 54^s.32$, hence $p = 0{\cdot}558\ 962\ 04$

	right ascension	declination	horizontal parallax
	°	°	°
b_1	+0·000 4168	+0·000 2292	−0·000 001 40
b_2	−0·005 2744	+0·002 1170	−0·000 035 92
b_3	−0·025 4703	−0·018 8050	+0·001 079 22
b_4	+0·177 0575	−0·604 2205	−0·004 636 01
b_5	+13·125 9863	+1·947 3336	π = +0·903 445 57
b_6	α = 78·181 1085	δ = +26·963 4195	
	= $5^h\ 12^m\ 43^s.466$	= +26° 57′ 48″.31	= 54′ 12″.404