PC20100704 Occultation July 04, 2010

(last updated 2009 10 20)

Across the globe pictured above, the three solid lines correspond to the northern limit, centerline, and southern limit of Pluto's shadow. The northern and southern limits correspond to a radius of 1400 km. The upper and lower dashed lines indicate the effects of unknown systematic errors such as catalog zone errors. The shaded area represents where the sun is more than 12 degrees below the horizon.

Table 1: Prediction Details	
Geocentric Mid-time (yyyy month dd hh:mm:ss)	**2010 July 04 01:59:38± 00:00:13[1] UT**
Minimum Geocentric Separation	**0.0474± 0.0153[1] arcsec**
Position Angle (Pluto relative to the star; measured north through east)	173.69 degrees
Geocentric Velocity	23.61 km/sec
Occultation Star UCAC2 magnitude	15.3[2]

[1]One standard deviation of random error.
[2]The UCAC bandpass (579-642nm) is between V and R.

Table 2: Reference Star Position			
Reference star position: (UCAC2, at epoch of event)	**RA (h:m:s; J2000)**	**Dec (d:m:s; J2000)**	**Notes**
PC20100704 Catalog	18 15 42.1163± 0.1595	–18 16 41.272± 0.140	
PC20100704 Measured[3]	18 15 42.1073± 0.0080	–18 16 41.155± 0.009	From 3 USNO 61-inch telescope frames. See Note 4.
Table 3: Projected KBO Offsets from Reference Ephemeris at the Time of the Event			
Body	**RA (arcsec)**	**Dec (arcsec)**	
Pluto	–0.0886± 0.0109	+0.187± 0.013	See Notes 5 and 6

[3]Measured position corresponds to RA offset of -0.1333" and Dec. offset of +0.117".

[4]All "offsets" are defined in the ("corrected" – "reference") or ("observed" – "calculated") sense. The offsets should be added to reference positions to get the measured positions, which we use to calculate the prediction.

[4]Data analyzed using UCAC2 reference network. A weighted average of the data from the two telescopes was used to calculate the RA and DEC. The errors given are 1

standard deviation.

[5]The reference position for Pluto is that given by JPL Horizon's ephemeris (Varuna source file: PLU017; Earth center source file: DE405).

[6]Data from the du Pont 2.5m, USNO 61-inch, and Lowell Astrograph telescopes over the span of 5 years were reduced with respect to stars in the UCAC2 catalog. A model was developed to fit the residuals obtained from our measured positions compared to that of the object's JPL ephemeris. All residuals obtained from the different telescopes were consistent with the model. The model includes the first-order effects of errors in the orbital elements of Pluto: (i) constant offsets in RA and Dec, (ii) linear (in time) offsets in RA and Dec, (iii) sinusoidal terms with the Earth's orbital period, and (iv) sinusoidal terms with the Pluto-Charon mutual orbit. The model was propagated to obtain the predicted position and error of the Pluto at the time of the occultation. The errors listed for the Pluto are 1 standard deviation.

Table 4: Site Information

Site	East Longitude	Latitude	Site Altitude[6] (km)	Distance[7] (km)	Velocity (km/s)
Boyden Observatory	26 24 17	–29 02 20	1.395	1591 S.	23.75
Las Campanas	–70 42 00	–29 00 30	2.282	15 N.	23.97
Pico dos Dias	–45 34 57	–22 32 04	1.864	701 N.	24.04
SAAO	20 48 36	–32 22 54	1.789	1730 S.	24.04
Geocenter	----------	---------	center of Earth	1089 N.	23.61

[6]Altitude of each observatory is measured in kilometers above sea level.

[7]"Distance" refers to the closest approach distance of the "Site" to the center of Pluto's shadow in the shadow plane. The errors on all closest approach distances are ±343 km (one standard deviation). "S." means the site is south of the center of Varuna's shadow. "N." means the site is north of the center of Pluto's shadow.

Table 5: PC20100704 Occultation Predictions for Individual Sites

Site	Pluto Immersion (UT)[9]	UT Mid-Time	Pluto Altitude	Solar Altitude[9]	PlutoEmersion (UT)[9]
Boyden Observatory	----------	01:56:17	17°	----------	----------
Las Campanas	02:00:51	02:01:49	60°	----------	02:02:47
Pico dos Dias	01:59:21	02:00:12	83°	----------	02:01:02
SAAO	----------	23:02:02	19°	----------	----------
Geocenter	01:59:00	01:59:37	----------	----------	02:00:14

[9]The errors on all times are ±0:12 (12 seconds; one standard deviation). The solar altitude is given for locations where it is relevant (solar altitude greater than -18°). No entry in the immersion and emersion columns indicates that the occultation is not predicted to be visible at that site.

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