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A Survey of the Almagest

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Dated Observations in the Almagest

The analysis and criticism of ancient observations lie outside the scope of this book which is concerned more with the theoretical structure of Ptolemaic astronomy than with the reliability of its empirical basis. Therefore the following list has been appended only for purposes of reference. It contains all the observations mentioned in the Almagest to which a precise date can be ascribed, excluding, for instance, a number of Hipparchian observations to which the references are vague [see III, 1; Hei 1, 196]. The 94 entries are numbered and arranged in chronological order according to the Julian dates calculated by Manitius (line 1). These dates may in some cases be one day wrong. The second line quotes the date of the observation as given in the Almagest with a reference to the place where it is first mentioned. Line 3 gives the time of the day as indicated by Ptolemy. Then follows the nature and the immediate result of the observation (line 4), and in line 5 it is indicated how it was used by Ptolemy in the general theoretical framework of his book. In some cases the final line 6 gives references to authors who have discussed the observation in question, or corrected the date and time given by Manitius.

- 1 721 B.C. March 19 [Man 1, 219].
Mardokempad 1 Thoth 29/30 [IV, 6; Hei 1, 302].
A little more than one hour after sunrise.
Babylon.
Beginning of total *lunar eclipse* (E₁ page 170).
Used with 2 and 3 for determining the epicycle radius of the Moon (page 171 ff.).
Boll 1909, col. 2353 / Ginzel 1889, page 232 / Newcomb, page 35 / Zech 1851, page 13.
- 2 720 B.C. March 8 [Man 1, 220].
Mardokempad 2 Thoth 18/19 [IV, 6; Hei 1, 303].
Midnight.
Babylon.
Maximum of partial *lunar eclipse*, 3 digits southern (E₂ page 170).
Used with 1 and 3; also with 69 for correcting ω_t of the Moon (page 180); and with 6 for calculating the radices of the lunar theory (page 182).
Boll 1909, col. 2353 / Ginzel 1899, page 233 / Newcomb, page 36 / Zech 1851, page 13.
- 3 720 B.C. Sept 1 [Man 1, 220].
Mardokempad 2 Phamenoth 15/16 [IV, 6; Hei 1, 303].
After moonrise.
Babylon.

- Beginning of partial (more than 6 digits northern) *lunar eclipse* (E₃ page 170).
Used with 1 and 2.
Boll 1909, col. 2353 / Ginzel 1899, page 233 / Newcomb, page 36 / Zech 1851, page 13.
- 4 **621 B.C. April 22** [Man 1, 306].
Nabopolassar 5 (Nabonassar 127) Athyr 27/28 [V, 14; Hei 1, 418].
Towards the end of the 11th night hour.
Babylon.
Beginning of partial (3 digits southern) *lunar eclipse*.
Used with 5 for finding the minimum apparent diameter of the Moon (page 208).
Boll 1909, col. 2353 / Ginzel 1899, page 233 / Newcomb, page 36 / Zech 1851, page 13.
- 5 **523 B.C. July 16** [Man 1, 308].
Kambyses 7 (Nabonassar 225) Phamenoth 17/18 [V, 14; Hei 1, 419].
One hour before midnight.
Babylon.
Maximum of partial (6 digits northern) *lunar eclipse*.
Used with 4 (page 208).
Known from Babylonian records, see Kugler 1907, pp. 61–75.
Boll 1909, col. 2354 / Ginzel 1899, page 233 / Newcomb, page 37 / Newton 1970, page 136
and 140 f. / van der Waerden 1958 b / Zech 1851, page 13 and 27–30.
- 6 **502 B.C. Nov 19** [Man 1, 241].
Darius 20 Epiphi 28/29 [IV, 9; Hei 1, 132].
When 6½ equinoctial hours had passed after nightfall.
Babylon?
Maximum of partial (3 digits southern) *lunar eclipse* (E₄ page 170).
Used with 2 for finding the radix of the lunar motion in latitude.
Boll 1909, col. 2354 / Ginzel 1899, page 233 / Newcomb, page 37 / Newton 1970, page 140 f. /
van der Waerden 1958 b / Zech 1851, page 13.
- 7 **491 B.C. April 25** [Man 1, 239].
Darius 31 (Nabonassar 256) Tybi 3/4 [IV, 9; Hei 1, 329].
In the middle of the 6th night hour.
Babylon?
Maximum of partial (2 digits southern) *lunar eclipse* (E₅ page 170).
Used with 54 for correcting ω_a of the Moon (page 181).
Boll 1909, col. 2354 / Ginzel 1899, page 233 / Newcomb, page 37 / Zech 1851, page 14.
- 8 **432 B.C. June 27** [Man 1, 143].
Apseudes (Archont of Athens) Phamenoth 21 [III, 1; Hei 1, 205].
Morning.
Athens – Meton and Euctemon, or their pupils.
Time of *summer solstice* (S₁, page 130).
Used with 16 and 92 for determining the tropical year (page 132).
Rome 1937, page 216.
- 9 **383 B.C. Dec 23** [Man 1, 247].
Phanostratos (Archont of Athens) Poseidon s.d. (Nabonassar 366 Thoth 26/27) [IV, 11;
Hei 1, 340].
One half hour before the night was over.
Babylon?
Beginning of small *lunar eclipse* (E₆ page 170).
Used with 10 and 11 by Hipparchus for determining the epicycle radius of the Moon on the
eccentric hypothesis (page 177).
Boll 1909, col. 2356 / Ginzel 1899, page 233 / Newcomb, page 37 / Newton 1970, page 141 f. /
van der Waerden 1958 b / Zech 1851, page 14.

- 10 **382 B.C. June 18** [Man 1, 248].
Phanostratos (Archont of Athens) Skirophorion s.d. (Nabonassar 366 Phamenoth 24/25) [IV, 11; Hei 1, 341].
In the advanced first hour of the night.
Bahylon?
Beginning of partial *lunar eclipse* lasting three hours (E₇ page 170).
Used with 9 and 11.
Boll 1909, col. 2356 / Ginzel 1899, page 233 / Newcomb, page 38 / Zech 1851, page 14.
- 11 **382 B.C. Dec 12** [Man 1, 249].
Euandros (Archont of Athens) Poseidon I s.d. (Nabonassar 367 Thoth 16/17) [IV, 11; Hei 1, 342].
In the advanced fourth hour of the night.
Babylon.
Beginning of total *lunar eclipse* (E₈ page 170).
Used with 9 and 10.
Boll 1909, col. 2356 / Ginzel 1899, page 233 / Newcomb, page 38 / Zech 1851, page 14.
- 12 **259 B.C. Dec 21** [Man 2, 27].
I Calippus 36 Poseidon 25 (Nabonassar 454 Phaophi 16) [VII, 3; Hei 2, 32].
Beginning of the 10th hour of the night.
Alexandria – Timocharis.
Conjunction of Moon and β Scorpii.
Used in the theory of precession.
Fotheringham and Longbottom 1915, page 384 and 386.
- 13 **294 B.C. March 9** [Man 2, 24].
I Calippus 36 Elaphebolion 15 (Nabonassar 454 Tybi 5) [VII, 3; Hei 2, 28].
Beginning of the third hour of the night.
Alexandria – Timocharis.
Occultation of α Virginis by the Moon.
Used with 15 for determining the rate of precession (page 247).
Fotheringham and Longbottom 1915, page 384 and 386 / Knobel 1915.
- 14 **283 B.C. Jan 29** [Man 2, 22].
I Calippus 47 Anthesterion 8 (Nabonassar 465 Athyr 29/30) [VII, 3; Hei 2, 25].
End of the third hour of the night.
Alexandria – Timocharis.
Occultation of the Pleiades by the Moon.
Used with 51 for determining the rate of precession (page 247).
Fotheringham and Longbottom 1915, page 384 and 387.
- 15 **283 B.C. Nov 9** [Man 2, 25].
I Calippus 48 Pyanepsion (Nabonassar 466 Thoth 7/8) [VII, 3; Hei 2, 29].
When $9\frac{1}{2}$ hour of the night had passed.
Alexandria – Timocharis.
Conjunction of α Virginis and the Moon.
Used with 13 (page 247).
Encke 1859 determined the date as Nov 8 and found the minimum distance to be $1'20''$.
Fotheringham and Longbottom 1915, page 384 and 387.
- 16 **280 B.C.** [Man 1, 145].
I Calippus 50, end of the year [III, 1; Hei 1, 207].
No time of the day recorded.
Alexandria? – Aristarchus.
Time of *Summer solstice* (S₂ page 130).
Used with 8 and 92 (page 132) and by Hipparchus with 44.

- 17 272 B.C. Jan 18 [Man 2, 199].
 Dionysius 13 Aegon 26 (Nabonassar 476 Athyr 20/21) [X, 9; Hei 2, 352].
 Early Morning.
 Alexandria?
Occultation of β Scorpii by Mars at a longitude of $212^{\circ};15$.
 Used for 'testing' the Mars theory.
 Man 2, 406, Note 6.
- 18 272 B.C. Oct 12 [Man 2, 167].
 Philadelphus 13 (Nabonassar 476 Mesore 17/18) [X, 4; Hei 2, 310].
 During the 12th hour of the night.
 Alexandria – Timocharis.
Conjunction of η Virginis and Venus at a longitude of $154^{\circ};10$ (V_1 page 299).
 Used with 80 for determining ω_a of Venus (page 307); and for determining the radices of the Venus theory (page 308).
- 19 272 B.C. Oct 16 [Man 2, 168].
 Philadelphus 13 Mesore 21/22 [X, 4; Hei 2, 311].
 Morning.
 Alexandria – Timocharis.
Longitude of Venus = $158^{\circ};50$.
 Used to prove that 18 was not a maximum elongation.
- 20 265 B.C. Nov 15 [Man 2, 150].
 Dionysius 21 Scorpion 22 (Nabonassar 484 Thoth 18/19) [IX, 10; Hei 2, 288].
 Morning.
 Alexandria?
Longitude of Mercury = $213^{\circ};20$ (M_1 page 310).
 Used with 84 to correct ω_a of Mercury (page 324); also for determining the radices of the Mercury theory (page 324).
- 21 265 B.C. Nov 19 [Man 2, 151].
 Dionysius 21, Scorpion 26 (Nabonassar 484 Thoth 22/23) [IX, 10; Hei 2, 289].
 Morning.
 Alexandria?
Longitude of Mercury = $214^{\circ};05$.
 Used to prove that 20 was not a maximum elongation.
- 22 262 B.C. Feb 12 [Man 2, 132].
 Dionysius 23 Hydron 21 (Nabonassar 486 Choiac 17/18) [IX, 7; Hei 2, 264].
 Morning.
 Alexandria?
Position of Mercury relative to δ Capricorni giving a maximum western elongation of $25^{\circ};50$ at a longitude of $292^{\circ};20$ (M_2 page 310).
 Used with 23 and 25 for determining the motion of the apsidal line of Mercury (page 312).
 Czwalina 1959.
- 23 262 B.C. April 25 [Man 2, 133].
 Dionysius 23 Tauron 4 (Nabonassar 486 Mechir 1) [IX, 7; Hei 2, 265].
 Evening.
 Alexandria?
Maximum eastern elongation $24^{\circ};10$ of Mercury at a longitude of $53^{\circ};40$ (M_3 page 310).
 Used with 22 and 25.
 Czwalina 1959.
- 24 262 B.C. Aug 23 [Man 2, 134].
 Dionysius 24 Leonton 28 (Nabonassar 486 Payni 30) [IX, 7; Hei 2, 267].
 Evening.

- Alexandria?
Position of Mercury relative to α Virginis giving a maximum eastern elongation of $21^{\circ};40'$ at a longitude of $169^{\circ};30'$ (M_4 page 310).
 Used with 26 and 28 for determining the motion of the apsidal line of Mercury (page 312).
 Czwalina 1959.
- 25 257 B.C. May 28 [Man 2, 133].
 Dionysius 28 Didymon 7 (Nabonassar 491 Pharmuti 5/6) [IX, 7; Hei 2, 265].
 Evening.
 Alexandria?
Position of Mercury relative to α and β Geminorum leading to a maximum eastern elongation of $26^{\circ};30'$ at a longitude of $89^{\circ};20'$ (M_5 page 310).
 Used with 22 and 23 (page 312).
 Czwalina 1959.
- 26 245 B.C. Nov 19 [Man 2, 135].
 Chaldaic era 67 Apellaios 5 (Nabonassar 504 Thoth 27/28) [IX, 7; Hei 2, 268].
 Morning.
 Babylon?
Position of Mercury relative to β Scorpii giving a maximum western elongation of $22^{\circ};30'$ at a longitude of $212^{\circ};20'$ (M_6 page 310).
 Used with 24 and 28 (page 312).
 Czwalina 1959.
- 27 241 B.C. Sept 4 [Man 2, 223].
 Dionysius 45 Parthenon 10 (Alexander 83 [= Nabonassar 507] Epiphi 17/18) [XI, 3; Hei 2, 386].
 Dawn.
 ?
Occultation of δ Cancri by Jupiter at a longitude of $97^{\circ};33'$.
 Used for 'testing' the Jupiter theory.
- 28 237 B.C. Oct 30 [Man 2, 135].
 Chaldaic era 75 Dios 14 (Nabonassar 512 Thoth 9/10) [IX, 7; Hei 2, 267].
 Early morning.
 Babylon?
Position of Mercury giving a maximum western elongation of 21° at a longitude of $194^{\circ};10'$ (M_7 page 310).
 Used with 24 and 26 (page 312).
 Czwalina 1959.
- 29 229 B.C. March 1 [Man 2, 247].
 Chaldaic era 82 Xanthikos 5 (Nabonassar 519 Tybi 14) [XI, 7; Hei 2, 419].
 Evening.
 Babylon?
Position of Saturn relative to γ Virginis at a longitude of $159^{\circ};30'$ (P_5 page 273).
 Used with 74 for 'testing' the Saturn theory (page 289 f.).
- 30 201 B.C. Sept 22 [Man 1, 251].
 II Calippus 54 (Nabonassar 546) Mesore 16 [IV, 11; Hei 1, 344].
 Middle of the third hour [of the night].
 Alexandria.
 End of a *lunar eclipse* lasting 3^h (page 170).
 Used with 31 and 32 by Hipparchus for determining the epicycle radius of the Moon on the epicyclic hypothesis (page 177).
 Boll 1909, col. 2358 / Ginzel 1899, page 233 / Newcomb, page 38 / Newton 1970, page 137 / Zech 1851, page 15.