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second time it has not reached the head, no solar eclipse will occur within five months, because in both [cases] the latitude was southerly. For southerly latitudes not many solar eclipses are possible. [However] this is possible in the [case of the] Moon, because southerly and northerly [latitudes] do not affect lunar eclipses. Sometimes seven months may elapse between two solar eclipses, such that at the first eclipse the Sun has not yet reached the tail and the Moon's latitude is northerly, and at the second eclipse [the Sun] has passed the head, so long as the [Moon's] latitude is still northerly. In lunar eclipses this is not possible, because in lunar eclipses the distance from the node must be less than it is in northerly solar eclipses.

[6] These rules apply to the northern habitations. In the southern ones, the opposite must be conceived. It is even possible for two solar eclipses to occur within the span of one month: one in northern habitations at a very northerly latitude, and the second in southern habitations at a very southerly latitude; but it is not possible in the same habitations. It often happens that solar and lunar eclipses occur within half a month [of each other]. This is all to be said in this chapter—God is all-knowing.

CHAPTER FOURTEEN

On Conjunctions and on Visibility and Invisibility of the Planets

[1] Since the position of a planet on the zodiacal orb is the endpoint of a line extending from the center of the World through the center of the body of the planet to the surface of the zodiacal orb; and since their true positions on the [zodiacal] equator in terms of degrees are where the latitude circle at the endpoint of the [above-mentioned] line intersects the zodiacal equator (if the planet has latitude, otherwise, at the endpoint of the line on the zodiacal equator), therefore, any two plan-

ets that are on one latitude circle, or one latitude circle passes through the two endpoints of their lines, will come together at the same degree on the [zodiacal] equator. This situation is called conjunction. The most complete conjunction occurs between two planets that are on two [different] orbs but coincide in latitude on the same side [of the zodiacal equator], such that one line extending from the center of the World passes through the center[s] of both planets. Such a situation is called latitudinal conjunction. Due to the parallax, for planets below the orb of Mars, it sometimes happens that a latitudinal conjunction occurs but, as observed, one does not occult the other, or one occults the other and yet there is no latitudinal conjunction.

[2] Since the rays of the Sun obscure the planets, their conjunctions with the Sun are not perceptible, except [in the case of] the solar eclipse, which is due to its conjunction with the Moon. What Abū ʿAlī Sīnā [Avicenna] said, that "I saw Venus like a black spot on the [Sun's] face," is possible, because when Venus is at epicyclic perigee, its diameter is about 5′ or more, and the Sun's diameter is 32′; thus, a sixth of the Sun's diameter is obscured by the body of Venus. There is no doubt that the rays of Venus and any other planet cannot vie in strength and dominance with the rays of the Sun, since, even if the whole body of the Sun were eclipsed and nothing more remained of the amount of the planet's body, the World would still be much brighter than the night with several thousand stars. Therefore, that amount of the Sun['s body] that is covered by Venus is not comparable with the rest of the body with respect to rays and light. For this reason, it appears like a black spot on its face. The purpose of this explanation is that there are many people who, out of ignorance, deny and object when they hear this.

[3] As for visibility and invisibility, they vary among the [wandering and fixed] stars: first, due to the smallness and largeness of the star's body; second, due to its ascendancy or deficiency of light; third, due

to different periods of rising and setting; fourth, due to the latitude [and] the declination [of the celestial body] in a direction opposite the locality (*ufuq*); and fifth, due to fast and slow speeds.[1] This latter [sic] is the main reason, to some extent, that the star Canopus is invisible for nearly half the year, while the star Vega, for example, is never invisible.

[4] Of the wandering planets, none appears earlier than Venus while retrograding and both its latitude and declination are northerly, whereby it does not remain invisible for more than two days in this situation. In some localities, Venus can be seen both morning and evening on a day of combust; hence, it will not be invisible [on that day]. During retrogradation, Venus has larger size, more light, and greater latitude, which do not occur for other planets. Furthermore, the planet Venus during its direct motion and the planet Mars have the longest periods of invisibility among the planets, since their speed is close to that of the Sun, and it takes longer for them to be elongated from it; their bodies in that state appear extremely small because they are at apex. As for the invisibility of the Moon, it is due to the vanishing of its light, as we have said. Its period of concealment is not less than two days or more than three. In these climes, it is usually the case that [the Moon] becomes visible when its altitude at sunset is [at least] 8 degrees, or when [the time] between its setting and sunset is four-fifths of an hour.[2] This is all that is to be said in this chapter, and with this we conclude Book II—God is the best granter of success and provider of succor.

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1. A, F, G, N: fourth, due to fast and slow speeds; and fifth, due to the latitude and the declination in a direction opposite the locality.

2. Here we follow Giahi Yazdi, who provides an explanation for how Ṭūsī arrived at these parameters for lunar visibility (Hamid-Reza Giahi Yazdi, "Naṣīr al-Dīn al-Ṭūsī on Lunar Crescent Visibility and an Analysis with Modern Altitude-Azimuth Criteria," *Suhayl* 3 (2002-3): 231-43, on 240-41).