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## Section [One]
## Concerning That When the Colatitude of a Fixed Star is Greater Than the Excess of the Local Latitude over the Obliquity, It Might Become Invisible or Visible after Having Been Either Permanently Visible or Permanently Invisible

[1] In Chapter Three of Book II, it has been stated that there would be a time when a permanently invisible star would become visible, on the condition that its colatitude be greater than the excess of the local latitude over the obliquity. And there would also be a time when a permanently visible [star] would become invisible, also on this condition. To clarify this problem, we say that it has been explained in the same chapter that each of these [fixed] stars has two circuits: one latitudinal circuit about the zodiacal orb's pole that never becomes larger or smaller; and the other a diurnal circuit about the equinoctial pole. This [latter] circuit becomes greater or smaller due to the motion of the star in the sequence of the zodiacal signs and [due to] the increase or decrease of its distance from the equinoctial. Because whenever the distance of the stars from the equinoctial becomes greater, a [given] star will become closer to the equinoctial pole; thus, its circuit will become smaller. Conversely, when the distance becomes less, the circuit will become larger. The largest circuits that are permanently visible are those whose distance from the equinoctial pole is in the amount of the local latitude. Therefore, every star whose distance from the equinoctial is equal to the local colatitude is on this circuit, and every star whose distance from the equinoctial is greater than this is permanently visible. That whose distance is less than this has both visibility and invisibility. The distance [from] the equinoctial will increase or decrease up to the limit whereby the star in longitude reaches the

beginning of Cancer or Capricorn. After that [point], if it has been increasing it will decrease, and if it has been decreasing, increase. Thus, for every star whose distance from the equinoctial is assumed to increase, its maximum increase [in distance] will be when it reaches one of [these] two points. And when it reaches one of these two points and its distance [from the equinoctial] becomes[1] greater than the local colatitude, it will not fall on a permanently visible or permanently invisible circuit. And because the zodiacal orb's pole moves about the equinoctial pole with the primary motion, it will have a circuit, and on its circuit it has an altitude above which it cannot go, which is equal to the sum of the local latitude and the obliquity (*mayl-i aʿẓam*); this is because the altitude of the equinoctial pole is equal to the local latitude and the distance of the zodiacal orb's pole from it is equal to the obliquity. There is an altitude that it cannot be less than, and that is in the amount of the excess of the local latitude over the obliquity; the reason is that since [the distance] from the horizon to the equinoctial pole is equal to the local latitude, and the pole of the zodiacal orb is closer to the horizon by the amount of the obliquity, [then] between the horizon and the zodiacal orb's pole there remains the amount of the excess of the local latitude over the obliquity. Therefore, every star whose distance from the pole of the zodiacal orb, i.e., its colatitude, is this amount when it [i.e., the star] is at the beginning of a solstice will rotate along a [day-] circle that is tangent to the horizon. If its colatitude is less than this amount, it will fall on circuits that are either permanently visible or permanently invisible. And if it is greater than this amount, it will never fall on these circuits. And this is an elucidation of the problem as much as possible.

[2] An example of this is that the latitude of the star Canopus is 75° south; its colatitude is 15°. When it is at the beginning of Cancer, the

1. "becomes" should be "does not become", as it was revised in some copies.

declination of its degree is close to the obliquity. Thus, at the time when [the first of] Cancer is at midheaven in a city whose latitude is 36°, it will be 36° from the horizon to the equinoctial pole below the Earth. At this time, the zodiacal orb's pole that is below the Earth is at its closest position to the horizon, [and the distance] between it and the horizon is in the amount of the excess of the local latitude over the obliquity, approximately 12°. The distance of Canopus from the [ecliptic] pole, i.e. its colatitude, is 15°; thus, it has risen 3° above the horizon. And when it reaches the first of Leo, and it comes to be 3° less in the declination of its degree, its distance from the equinoctial [equator] will become greater by this amount, [so] it will fall on a permanently invisible circuit. Thus, as long as it is in the signs of Gemini and Cancer, it will become visible [and invisible]; in the other ten signs, it will be permanently invisible. One can depict this on a globe.

## Section [Two]
## On Why the Eccentric Orb Was Chosen for the Sun over the Epicycle

[1] In Chapter Four of Book II, it has been stated that the eccentric orb and the epicyclic orb amount to the same thing in accounting for the variation in the movement of the Sun, and, whichever is posited, the intended result will be obtained. However, the eccentric is more nearly simpler, for the reason that the motion of the Sun on the circumference of the epicycle and the motion of the epicycle on the circumference of the deferent will result in an eccentric circuit for the body of the Sun. Thus, from the positing of an epicycle, there follows the positing of an eccentric, [whereas] from the positing of an eccentric there does not follow the positing of an epicycle. For this reason, Ptolemy posited an eccentric for the Sun. For an explanation of this matter, [let] us conceive the Sun to have a deferent orb whose center