The Approach, *Almagest* X.7 (H.I.2.321)

研究院的三轮月食后，我们展示了通过三角方法计算出不规则和位置的比值，以及向上点的位置。以同样的方法，从三个acronychal oppositions和太阳的平均轨道出发，每个天体，我们通过最精确的方式计算出和位置的分离，从而展示了不规则的比值和向上点。

Just as in the case of the moon, having taken three lunar eclipses, we demonstrated trigonometrically the ratio of the irregularity and the position of the apogee, in the same way here too, from three acronychal oppositions according the mean course of the sun, for each of these bodies, having observed as accurately as possible by means of astrolabic instruments, and from the mean courses of the sun at the observations, further calculating to more precision the time and the position of the separation, we demonstrate from these the ratio of eccentricity and the apogee.

The Plan, *Almagest* X.7 (H.I.2.324)

γεγράφωσαν δὴ ἐν τῷ τοῦ ζωδιακοῦ ἐπιπέδῳ γ ἴσοι κύκλοι, ὧν ὁ μὲν τὸ κέντρον φέρων τοῦ ἐπικύκλου τοῦ Ἄρεως ἔστω ὁ ΑΒΓ περὶ κέντρον τὸ Δ, ὁ δὲ τῆς ὁμαλῆς κινήσεως ἐκκέντρος ὁ ΕΖΗ περὶ κέντρον τὸ Θ, ὁ δὲ ὁμόκεντρος τῷ ζωδιακῷ ὁ ΚΛΜ περὶ κέντρον τὸ Ν, ἡ δὲ διὰ πάντων τῶν κέντρων διάμετρος ἡ ΞΟΠΡ. ὑποκείσθω δὲ τὸ μὲν Α, καθ' οὗ ἦν τὸ τοῦ ἐπικύκλου κέντρον ἐν τῇ αʹ ἀκρωνύκτῳ, τὸ δὲ Β, καθ' οὗ ἦν ἐν τῇ βʹ, τὸ δὲ Γ, καθ' οὗ ἦν ἐν τῇ γʹ ἀκρωνύκτῳ, καὶ ἐπεζεύχθωσαν αἵ τε ΘΑΕ καὶ ΘΒΖ καὶ ΘΗΓ καὶ ΝΚΑ καὶ ΝΛΒ καὶ ΝΓΜ, ὥστε τὴν μὲν ΕΖ τοῦ ἐκκέντρου περιφέρειαν μοιρῶν εἶναι τῶν τῆς αʹ περιοδικῆς διαστάσεως μδ, τὴν δὲ ΖΗ τῶν τῆς βʹ ϕεκη, καὶ πάλιν τὴν μὲν ΚΛ περιφέρειαν τοῦ ζωδιακοῦ τῶν τῆς φαινομένης αʹ διαστάσεως ξζ, τὴν δὲ ΛΜ τῶν τῆς βʹ ϕγ. εἰ μὲν οὖν αἱ ΕΖ καὶ ΖΗ τοῦ ἐκκέντρου περιφέρειαι ὑπὸ τῶν ΚΛ καὶ ΛΜ τοῦ ζωδιακοῦ περιφερειῶν ὑπετείνονται, οὐδὲν ἀλλο πρὸς τὴν δείξιν ἐπετείνουσα ἐπὶ τῆς ἐκκεντρότητος ζητοῦμεν· ἐπεὶ δ' αὐτάρκης ἐν τάς ΒΑ καὶ ΒΓ τοῦ μέσου ἐκκέντρου ὑποτείνουσα μὴ δεδομένας, ἐὰν δ' ἐπιζεύξωμεν τὰς ΝΣΕ καὶ ΝΤΖ καὶ ΝΗΥ, πάλιν τὰς ΖΗ καὶ ΖΗ τοῦ ἐκκέντρου περιφερειάς αἱ ΣΤ καὶ ΤΥ τοῦ ζωδιακοῦ ὑποτείνουσι μήδε αὐτάρκης δηλονότι δεδομέναι, δεήσει πρότερον δοθῆναι τὰ ΚΣ καὶ ΛΤ καὶ ΜΥ διάφορα τμήματα, ἵνα ἀπὸ τῶν συζυγουσῶν περιφερειῶν τῶν τοῦ ζωδιακοῦ τῶν τῆς θεατήσας μηδενὶ ϕη λύθη. εἰ μὲν οὖν αἱ ΕΖ καὶ ΖΗ τοῦ ἐκκέντρου περιφερεῖαι ὑπὲτείνονται, οὐδὲν ἀλλο πρὸς τὴν δείξιν ἐπετείνουσα μὴ δεδομένας, ἐὰν δ' ἐπιζεύξωμεν τὰς ΝΣΕ καὶ ΝΤΖ καὶ ΝΗΥ, πάλιν τὰς ΖΗ καὶ ΖΗ τοῦ ἐκκέντρου περιφερειάς αἱ ΣΤ καὶ ΤΥ τοῦ ζωδιακοῦ ὑποτείνουσι μήδε αὐτάρκης δηλονότι δεδομέναι, δεήσει πρότερον δοθῆναι τὰ ΚΣ καὶ ΛΤ καὶ ΜΥ διάφορα τμήματα, ἵνα ἀπὸ τῶν συζυγουσῶν περιφερειῶν τῶν τοῦ ζωδιακοῦ τῶν τῆς θεατήσας μηδενὶ ϕη λύθη.
Let 3 equal circles have been produced in the plane of the ecliptic, of which let that carrying the epicycle of Mars be $ABG$ about center $D$, let the eccenter of regular motion be $EZH$ about center $Q$, let the [circle] concentric with the ecliptic be $KLM$ about center $N$, and let the diameter through all three centers be $XOPR$. Let point $A$ be assumed at which was the center of the epicycle for the 1st acronychal opposition, $B$ at which it was at the 2nd acronychal opposition, and $G$ at which it was at the 3rd acronychal opposition. Let $QAE$, $QBZ$, $QHG$, $NKA$, $NLB$, $NGM$ have been joined, such that arc $EZ$ of the 1st interval of motion is 81 44 degrees, and arc $ZH$ of the 2nd is 95 28. Furthermore, arc $KL$ of the ecliptic is 67 50 degrees of the first interval of the apparent [motion], and arc $LM$ is 93 44 of the second.

Now, if $EZ$, $ZH$ of the eccenter subtended $KL$, $LM$ of the ecliptic, we would want nothing else for the proof of the eccentricity, but since they are subtended by $AB$, $BG$ of the middle eccenter, which are not given, and if we join $NSE$, $NTZ$, $NUH$, again $ST$, $TU$, themselves clearly not given, subtend arcs $EZ$, $ZH$ of the eccenter. In order that the ratio of eccentricity be accurately proven from the corresponding arcs $EZ$, $ZH$, and $ST$, $TU$, the differences cut off, $KS$, $LT$ and $MY$ must first be given. Since, however, how much they are is not grasped accurately before the ratio of eccentricity and the apogee, nevertheless, they will be given nearly, even if each has not been carried through accurately, because their differences will not be large. We will first make the calculation as if the deviations of arcs $ST$, $TU$ compared to arcs $KL$, $LM$, were not important.