TRABZON ÜNİVERSİTESİ İNSAN VE TOPLUM BİLİMLERİ FAKÜLTESİ

ULUSLARARASI KATILIMLI

YAVUZ SULTAN SELİM (BİLİM, DÜŞÜNCE, SANAT) SEMPOZYUMU

08-10 MAYIS 2025

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BĪRJANDĪ'S ḤĀSHIYA ʿALĀ SHARḤ AL-MULAKHKHAṢ

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Kadızāde'nin Mahmud Çağmīnī'ye ait el-Mulaḫḫaṣ fi'l-Heyʾeti'l-Basīṭa adlı esere yazdığı şerhe, ʿAbdülalī Bīrcendī'nin 920/1515 civarında kaleme aldığı haşiye, on dokuzuncu yüzyıla kadar—genellikle Kadızāde'nin Şerḥu'l-Mulaḫḫaṣ'ı ve Çağmīnī'nin Mulaḫḫaṣ'ı ile birlikte—okutulmuş ileri seviye bir metindir. Bu durum, Çağmīnī'nin Batlamyusçu astronomiye dair popüler düzeyde bir giriş eseri olarak kaleme aldığı metin üzerine yazılmış söz konusu haşiyenin altı asrı aşkın bir süre ilim dünyasında tedavülde kaldığı anlamına gelmektedir. Oldukça hacimli olan Bīrcendī haşiyesi, heyʾet disiplini dışında da zengin bir bilgi içeriğine sahiptir. Bu yönüyle, Yavuz Sultan Selim döneminde ileri seviyede bir öğrencinin karşılaşabileceği astronomik malzemenin kapsamını yansıtır. Ancak Bīrcendī'nin metni, özellikle köklü bir geleneğe sahip olan heyʾet disiplinine aşina olmayanlar için kolay okunabilir bir metin değildir. Çağmīnī'nin Mulaḫḫaṣ'ının, ibare ibare açıklanan ve görsellerle zenginleştirilen Kadızāde şerhinin aksine, Bīrcendī'nin haşiyesi figür içermeyen, seçme bölümlerden oluşur. Bu bakımdan, Bīrcendī'nin görüşlerini ve genel olarak şerh geleneğini anlamak maksadıyla, gök cisimlerine ait feleklerin sıralanışıyla ilgili Çağmīnī'nin ana metninde geçen bir ifadenin izini süreceğiz. Bunu, Kadızāde'nin konuyla ilgili yorumları ve ardından Bīrcendī'nin eklemeleri takip edecektir. Feleklerin sıralanışının tespiti noktasında tartışılan başlıca meseleler şunlardır: 1) okültasyon, 2) paralaks, 3) güneşortacılık (heliomiddleism), 4) özellikle Venüs feleğinin Güneş feleğinin altında mı yoksa üstünde mi yer aldığı sorusu etrafında şekillenen tartışmalar ekseninde uzaklıklar ve gök cisimlerinin büyüklükleri.

Introduction

In the early thirteenth century, in the region of Khwarizm in Central Asia, Maḥmud al-Jaghmīnī composed an extremely popular Arabic introduction to Ptolemaic theoretical astronomy entitled al-Mulakhkhaṣ fī al-hayʾa al-basīṭa (Epitome of simplified hayʾa) (Ragep, S. P., 2016). Classified as a "famous abridged (mukhtaṣar mashhūr)" textbook, over time there arose a plethora of works within Islamic lands dedicated to elucidating the subject matter of Jaghmīnī's concise base text (Ṭāshkubrīzāde, 1985: 1:349). Many of these also included the views of Ancient and later Islamic forebears, challenges to long-held positions, etymologies of words, and new (jadīd) scientific developments.

There are over sixty derivative works on Jaghmīnī's Mulakhkhaṣ, but Qāḍīzāde al-Rūmī's stands out, with over 515 extant copies of the work (Ragep, S. P., 2016: Appendix II). Composed and presented to Ulugh Beg in Samarqand in 814/1412 (some 200 years after Jaghmīnī flourished), Qāḍīzāde's Sharḥ al-Mulakhkhaṣ became a staple "intermediate-level (mutawassiṭ)" astronomical textbook in Ottoman madrasas. Among the twenty-five super commentaries or glosses on his commentary, the Gloss written by ʿAbd al-ʿAlī al-Bīrjandī (fl. 913/1507), as a memoir for his colleagues (ikhwān), became a standard "advanced-level (mabsūṭ)" textbook for instruction in the

Ottoman madrasas (and elsewhere), usually studied with Qāḍīzāde's commentary (Fazlioğlu, 2008: 29-30). (There are over 160 extant copies of the work.)

These three textbooks studied progressively formed a curriculum for the subject of hayʾa or the structure of the universe, both the upper bodies of the celestial region and the lower bodies of the terrestrial realm (Ragep, F. J., 1993: 1:33-41; Ṭāshkubrīzāde, 1985: 1:348-49). But unlike Qāḍīzāde's commentary, which is a phrase-by-phrase elucidation of Jaghmīnī's Mulakhkhaṣ which includes the base text along with the commentary and additional illustrations, Bīrjandī's Gloss contains choice selections without figures, which makes it rather difficult to read without being well-schooled in Qāḍīzāde's commentary. This most likely explains why the two works were regularly studied together; one often finds the two bound in a codex.

Bīrjandī's massive Gloss provides a wealth of information beyond the subject of hayʾa; thus, it indicates the range of astronomical material that an advanced-level student would have covered during the period Sultan Selim Yavuz flourished. But Bīrjandī's Gloss is not an easy read for anyone unfamiliar with the long tradition of hayʾa. So, to get a sense of Bīrjandī's views, and also the commentary tradition, we trace a single statement by Jaghmīnī in the base text, followed by some of Qāḍīzāde's comments on it, and then Bīrjandī's additional points.

But since the statement deals with the ordering of the celestial planets and orbs, which held an important place in the tradition of Islamic astronomy, some background information is needed.

Background

Ptolemy (fl. 140 CE) established the celestial order in his Almagest (IX.1) and Planetary Hypotheses: with the Earth at the center, then came the spheres of the Moon, Mercury, Venus, the Sun, Mars, Jupiter and Saturn; note that the Sun is in the middle.

The ways in which this order was determined were based on occultations, parallax determinations, the principle of nesting of the orbs, the inadmissibility of a void, ordering based on speed, and the economy of nature. But Ptolemy had doubts about the positions of Mercury and Venus, inasmuch as no parallax could be found for them, and he was unaware of any visible occultations (or eclipses) of the Sun other than by the Moon. Thus, he settled on what he considered the "most plausible" arrangement (Toomer, 1998: 419-20; Goldstein, 1967: 8, 31; Hullmeine, 2024: 276-77).

Due to this uncertainty, some pre- (and post-) Ptolemaic astronomers suggested placing one or both of the inferior planets (Mercury and Venus) above the Sun. Nevertheless, most Islamic astronomers accepted Ptolemy's standard order, including Jaghmīnī. But in the thirteenth century, Ptolemy's distances and ordering were challenged by Muʾayyad al-Dīn al-ʿUrḍī (d. ca. 664/1266) and Quṭb al-Dīn al-Shīrāzī (d. 710/1311) who decisively asserted the impossibility of the Sun's orb being above the orb of Venus. They claimed that there was not enough space below the Sun's orb to accommodate Venus's orb; this was based on proof detailed in their sections on distances and sizes of the planets in their respective works on astronomy (Saliba,

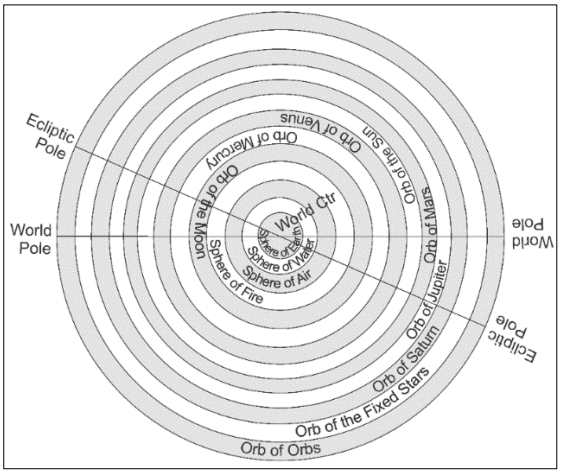
1990: 303; Shīrāzī, Nihāyat, II.2, IV.9; Shīrāzī, Ikhtiyārāt, II.2, IV.2; Shīrāzī, al-Tuḥfa, II.5, IV.2). This controversy was presumably resolved in the fifteenth century by the eminent astronomer Jamshīd al-Kāshī, who reaffirmed Ptolemy's standard celestial order in his treatise Sullam al-samāʾ (Stairway to Heaven) employing precise recalculations of Ptolemaic values (Bohloul, 2008; Ragep, S. P., forthcoming, Brepols; Ragep, S. P., forthcoming, TÜBA).

Jaghmīnī, who composed the Mulakhkhaṣ in 602-3/1205-6, was obviously not aware of the later challenges to Ptolemy's order by ʿUrdī and the author of the Tuḥfa, or Kāshī's masterful resolution. He presents the standard Ptolemaic order of the arrangement of the orbs, with an illustration, and without comments (Ragep, S. P., 2016: 86-89; see **Table 1**).

Table 1. Jaghmīnī, al-Mulakhkhaṣ, Introduction: On An Explanation of the Divisions of the Bodies in General Terms

All the orbs are spherical in shape and these spheres enclose one another. The Earth is in the middle, then the water that encloses it, then the air, then the fire, then the orb of the Moon, then the orb of Mercury, then the orb of Venus, then the orb of the Sun, then the orb of Mars, then the orb of Jupiter, then the orb of Saturn, then the orb of the Fixed Stars, **and then the Orb of Orbs**, which is called the Greatest Orb; it is the orb that encloses all the bodies, nothing being beyond it, neither vacuum nor plenum. Every enclosing [orb] is contiguous with that enclosed by it, which is adjacent to it according to the aforementioned arrangement. To the totality of these bodies -the elements, the orbs and what is within them- is extended the name "The World." This is its illustration.

Illustration of the Orbs



Jaghmīnī never discusses the ways the arrangement among the orbs was determined, but Qāḍīzāde and Bīrjandī do. In his commentary on the Mulakhkhaṣ, Qāḍīzāde's lengthy comments on celestial order all follow directly after Jaghmīnī's statement: "**and**

then the Orb of Orbs" (falak al-aflāk) (bolded here and in Table 1); in the Ḥāshiya, Bīrjandī' s additions are selectively made from Qāḍīzāde's comments.

What follows below are four excerpts taken from Qāḍīzāde's Sharḥ (following Jaghmīnī's falak al-aflāk). Bīrjandī's glosses are to the bolded, underlined parts of Qāḍīzāde's commentary. Each excerpt is related to celestial ordering: 1) occultations; 2) parallax; 3) heliomiddleism; and 4) distances and the planetary bodies.

1. Occultation

QĀḌĪZĀDE, Sharḥ al-Mulakhkhaṣ, Süleymaniye Library, Ayasofya, No: 2662, ff. 8b-9a; autograph copy dated 820/1417

بعض الثوابت ينكسف بزحل المنكسف بالمشتري المنكسف بالمرّيخ المنكسف بالزهرة المنكسف بعطارد المنكسف بالقمر الكاسف للشمس ولا شكّ أنّ فلك المنكسف فوق فلك الكاسف لكنّه بقي الأمر في كون فلك الشمس تحت فلك المرّيخ وفوق فلك الزهرة إذ طريقة الكسف لا تتمشى بين الشمس وغير القمر من الكواكب

Some of the fixed stars are occulted by Saturn, which, [in turn], is occulted by Jupiter, which is occulted by Mars, which is occulted by Venus, which is occulted by Mercury, which is occulted by the Moon, which occults [eclipses] the Sun. And there is no doubt that the orb of the occulted body is above the occulting body. But the matter remained of whether the Sun's orb was below the orb of Mars and above the orb of Venus, since the path of occultation does not travel between the Sun and any planet other than the Moon.

BĪRJANDĪ, Ḥāshiya ʿalā Sharḥ al-Mulakhkhaṣ, Istanbul, Süleymaniye Library, Carullah, No: 1462, f. 41a; copied 1057/1647 in Erzurum.

قوله وأمّا بعض الثوابت ينكسف بزحل قد تقرّر عندهم أنّ الثوابت كلّها على فلك واحد بناء على ما قال بطلميوس من أنّا لا يردّ ما يقال في أنّ الثوابت البعيدة عن ممرّ السيّارات يحتمل أن تكون في فلك آخر تحت فلك نثبت فضلاً في الفلكيات فلا القمر ثم إنّ الكاسف إنّما يُعرف من المنكسف متى خالف لون أحدهما لون الآخر فأيّهما ظهر لونه عند الكسف عُلم أنّه كاسف والآخر منكسف كذا ذكره العلّامة

[Qāḍīzāde] said: some of the fixed stars are occulted by Saturn: It was decided among them that all the fixed stars were on a single orb based upon what Ptolemy said, namely that we cannot set forth excess in the celestial orbs. But what is said is irrefutable, namely that the fixed stars that are far removed from passing over the planets might be on another orb that is beneath the Moon's orb. Furthermore, the occulting [body] is only known from the occulted [body], when the color of one of them differs from the color of the other. So whichever one's color appears during the occultation, one [then] knows that it is the occulting body and the other is the occulted. This is what the Most Learned [Shīrāzī] stated.

All agreed that occultation as a way to determine celestial order was irrefutable, i.e., that the orb of the occulting body is beneath the orb of the occulted body. But as a method, occultation had limitations: not all occultations were detectible; and reports of occultations were often erroneous, with alterative explanations offered, such as sunspots (Goldstein, 1969).

2. Parallax

QĀḌĪZĀDE, Sharḥ al-Mulakhkhaṣ, Ayasofya, No: 2662, f. 9a.

بطريقة أخرى هي اختلاف المنظر فإنّ المرّيخ ليس له اختلاف المنظر أصلاً بخلاف الشمس فيكون فوقها وسيتّضح لك هذا المعنى في باب القسي إنشاء الله تعالى

… with another method, namely parallax [used to determine whether the Sun's orb was below the orb of Mars and above the orb of Venus] Mars has no parallax, in contrast to the Sun, so it is above [the Sun]. And the meaning of this will be clarified for you in the chapter On Arcs, God Almighty willing.

BĪRJANDĪ, Ḥāshiya ʿalā Sharḥ al-Mulakhkhaṣ, Carullah, No: 1462, f. 41b.

قوله بطريقة أخرى هي اختلاف المنظر يمكن معرفة ذلك بالأبعاد فإنّ بعد كوكب إذا كان أكثر من بعد كوكب آخر كان فلكه فوق فلكه لكنّ معرفة الأبعاد يتوقّف على حسابات كثيرة وقد يقع الخطاء في الحساب فلا اعتماد على تلك الطريقة ولقد اقتضى حساب القدماء أن يكون فلك الزهرة تحت فلك الشمس وحساب صاحب التحفة اقتضى عكس ذلك

[Qāḍīzāde] said: with another method, namely parallax This can be known by distances. For when the distance of a planet is greater than the distance of another planet, then its orb is above the orb [of the other planet]. But knowing the distances depends on multiple calculations, and errors may occur in the calculation, so that method is unreliable. Indeed, the calculation of the Ancients determined that the orb of Venus is below the orb of the Sun. [On the other hand], the calculation of the author of the Ṭuḥfa determined the opposite of that.

In the chapter On Arcs, Jaghmīnī gives only a definition of parallax (Ragep, S. P., 2016, 122-23, I.4[15]), which Qādīzāde explains (as promised) along with an illustration (f. 35a-35b). Bīrjandī's stance on the unreliability of calculations is interesting; I suspect who is doing the calculations must be a factor given that Bīrjandī has no objections to Kāshī's calculations. Indeed, Bīrjandī includes a description of a treatise by Kāshī on finding the parallax for Venus that does not depend on Venus being at the meridian at noon (rendering it invisible), but is dependent on using the dioptra and making "multiple calculations" (ff. 41b-42b).

3. Heliomiddleism

QĀḌĪZĀDE, Sharḥ al-Mulakhkhaṣ, Ayasofya, No: 2662, f. 9a.

فذهب بعض القدماء إلى أنّها فوقهما استحساناً لتوسّط الشمس بين السيّارات **بمنزلة شمسة القلادة**

Some of the Ancients maintained that [the Sun] was above [Venus and Mercury], deeming it elegant that the Sun was in the middle between the wandering planets, **similar to the pendant of a necklace.**

BĪRJANDĪ, Ḥāshiya ʿalā Sharḥ al-Mulakhkhaṣ, Carullah, No: 1462, f. 42b.

قوله بمنزلة شمسة القلادة هي خَرَزة كبيرة في وسطها والظاهر أنّ تسميتها بها لأجل تشبيهها بالشمس لتوسّطها بين الخرزات الأخرى الصغيرة التي هي شبيهة بالكواكب وكلام الشارح مبني على عكس ما ذكرنا

[Qāḍīzāde] said: similar to the pendant of a necklace It is a large gem in the middle [of a necklace], and evidently it is so named [shamsa] on account of its similarity to the

Sun [shams], due to its being in the middle of the [necklace] between the other small gems that resemble the planets. The words of the Commentator [Qāḍīzāde] are based on the contrary to what we have reported.

Qādīzāde's words echo those of Naṣīr al-Dīn al-Ṭūsī, which harkens back to Ptolemy (Almagest, IX.1), who reasoned that placing the Sun in the middle of the universe was "more in accordance with the nature [of the bodies]" (Ragep, F. J., 1993: 1:110-11, II.2[4]; Ragep, F. J., forthcoming, Brepols; Toomer, 1998: 419-29). In his Gloss, Bīrjandī notes the similarity of the word shamsa [pendant] to Sun [shams]. He then remarks that this interpretation of the Sun's middleism stands in opposition to his earlier gloss in which he reported that Shīrāzī placed Venus above the Sun.

4. Distances and the Planetary Bodies

QĀḌĪZĀDE, Sharḥ al-Mulakhkhaṣ, Ayasofya, No: 2662, f. 9a-9b.

وظنّ بعض المتأخّرين كمؤيّد الدين العرضي وصاحب التحفة أنّ فلك الشمس بين فلكيهما بل جزم باستحالة كون فلك الشمس فوق فلك الزهرة **بدليل لاح له في الأبعد والأجرام**

Some of the later scholars, such as Muʾayyad al-Dīn al-ʿUrḍī and the author of al-Tuḥfa [Shīrāzī] believed that the orb of the Sun was between the orbs [of Venus and Mercury]; indeed, he [they?] decisively asserted the impossibility of the Sun's orb being above the orb of Venus **with a proof that appeared in [their chapters on] distances and sizes**

BĪRJANDĪ, Ḥāshiya ʿalā Sharḥ al-Mulakhkhaṣ, Carullah, No: 1462, f. 44a-44b.

قوله بدليل لاح له في الأبعد والأجرام وذلك لأنّه استخرج صاحب التحفة أبعد أبعاد عطارد وأقرب أبعاد الشمس فوجد ما بينهما فضاء لا يسع تدوير الزهرة فضلاً عن ممثّلها وفرض في هذا الفضاء فلكاً آخر لكوكب الكيد والفاضل المحقّق الراصد استأنف حساب الأبعاد والأجرام بطريق دقيق فوجد فضاء ما بين فلكي عطارد والشمس بحيث يسع ممثّل الزهرة الكاشي فوقع ترتيب الأجرام على ما اختاره بطلميوس من غير تمحّل وتعسّف وألّف في ذلك رسالة سمّاها بسلّم السماء فمن أراد تحقيق ذلك فليطالعها

[Qāḍīzāde] said: with a proof that appeared in [their chapters on] distances and sizes. This is because the author of the Tuḥfa derived the farthest distance of Mercury and the nearest distance of the Sun and then found that there was empty space between them that was not wide enough to accommodate Venus's epicycle, much less its parecliptic. [Shīrāzī] assumed another orb [to fit into] this empty space for the planet Kaid (Kennedy, 1957: 45). The eminent, meticulous observer al-Kāshī undertook anew the calculation of the distances and sizes in a precise way and then found [enough] space between the orbs of Mercury and the Sun to accommodate Venus's parecliptic. So the arrangement of the [planetary] bodies came to be according to what Ptolemy had chosen, without manipulation or arbitrariness. [Kāshī] composed a treatise on this that he called Sullam al-samāʾ [Stairway to heaven]. So whoever wants to confirm this, let him study [that treatise].

Discussion of planetary sizes and distances of the celestial bodies was often included in a chapter or section of a hayʾa work; however, Jaghmīnī omitted any such discussion in the Mulakhkhaṣ. He did compose a short tract dealing with volumes of the celestial

bodies (Ragep, S. P., 2023), but, as far as I am aware, neither Qāḍīzāde nor Bīrjandī refer to it. Bīrjandī's concluding sentence underscores the complexities of how scientific theories on celestial ordering were received (and rejected), and he reminds us that the history of science is not linear.

Conclusion

One cannot overstate the significant role that Jaghmīnī's al-Mulakhkhaṣ, Qāḍīzāde's Sharḥ, and Bīrjandī's Ḥāshiya ʿalā Sharḥ al-Mulakhkhaṣ played in the teaching, dissemination, and institutional instruction of Islamic astronomy. Based on textual evidence, they were studied within various Islamic institutions (madrasas, mosques, observatories, and courts) as well as by individual scholars for centuries throughout the Islamic world and South Asia. But we have yet to analyze how Qāḍīzāde's Sharḥ, and Bīrjandī's Gloss compare with the many other derivative works on al-Mulakhkhaṣ- a rather daunting, but exciting, endeavor for future research.

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