Islam and Science

The 'Conceptual' Scientific Revolution

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Session Overview

- **Part 1:** Transfer of Science to the Islamic Civilisation and the No-Conflict Model
- **Part 2:** Creation of New Astronomy and its Golden Age

Part 1

Transfer of Science to the Islamic Civilisation and the No-Conflict Model

Pre-History to Ancient Period

1. **Pre-History:** Adam and names – First Recorded Scientific Activity

2. **Ancient Historical Period:** Egyptians, Babylonians, Greeks, Persians, Chinese, and Indians

Umayyad Period

3. Transfer of Science to the Muslim World: Umayyad Period

- Translation movement
- Khalid b. Yazin b. Mu’awiyya
- **694/5CE** Administrative reform
- **Purpose**: to liberate the economy

The First Translation

Khalid b. Yazid b. Mu’awiya

“Khalid b. Yazid b. Mu'awiya was known as the wise man of the family of Hakim al-Marwan. He was distinguished in his own right, and was enterprising and full of love for the sciences. At one point it *‘occurred to him’* to pursue alchemy, for which he gathered a group of Greeks from Egypt who had mastered Arabic. He then ordered them to translate the books of alchemy from Greek and Coptic into Arabic. This was the first translation in Islam from one language to another.

Ibn al-Nadim. *Kitab al-Fihrist.* Seventh Treatise

Khalid b. Yazid: Filling the Motivational Gap

Dinar Dated 694/95

Abd al-Malik ibn Marwan

"The king of Byzantium wrote to him (Abdul Malik) the following message: 'You have introduced in your official documents *(tawamir)* something referring to your prophet. Abandon it, otherwise you shall see on our *dinars* the mention of things you detest.' That angered Abd al-Malik, so he sent for Khalid ibn Yazid ibn Mu'awiya, who was greatly learned and wise, in order to consult with him upon this matter. Khalid then told him, 'have no fear o commander of the faithful! Prohibit their *dinars* and strike for the people new mint with the mention of God on them, as well as the mention of the Prophet (PBUH), and do not absolve them of what they hate in the official documents. And so he did!"

Abu Hilal al-'Askari. *Kitab al-awa'il*.

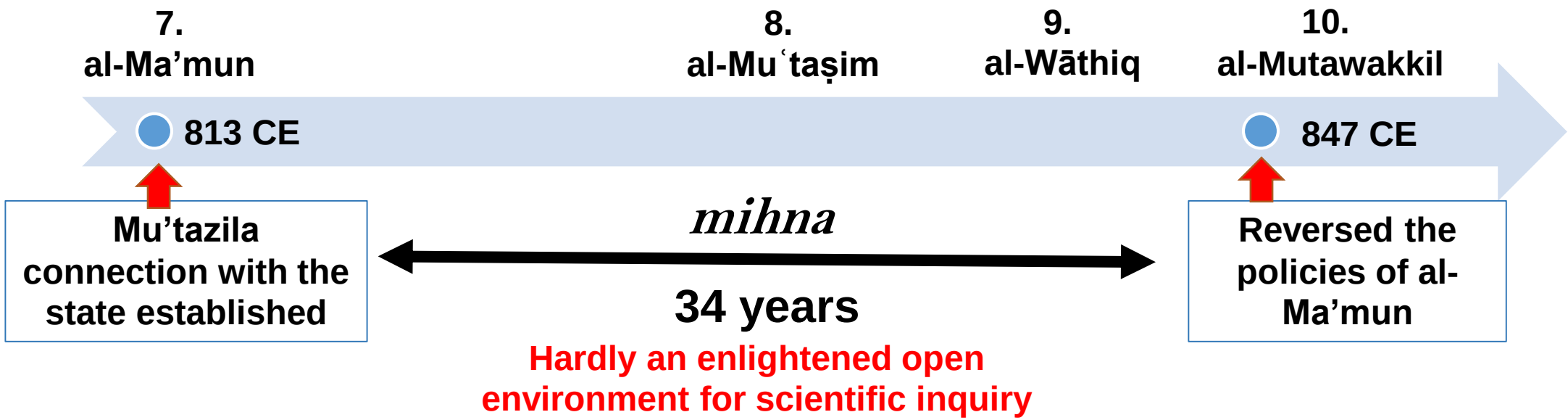
Abbasid Period

3. **Transfer of Science to the Muslim World: Abbasid Period**
   - House of wisdom
   - Patronage/commissioning of science
   - Not restricted to Ma'mun/Mutazilites
   - Corrected defects in Greek science
   - **9th CE:** Creation of New Disciplines

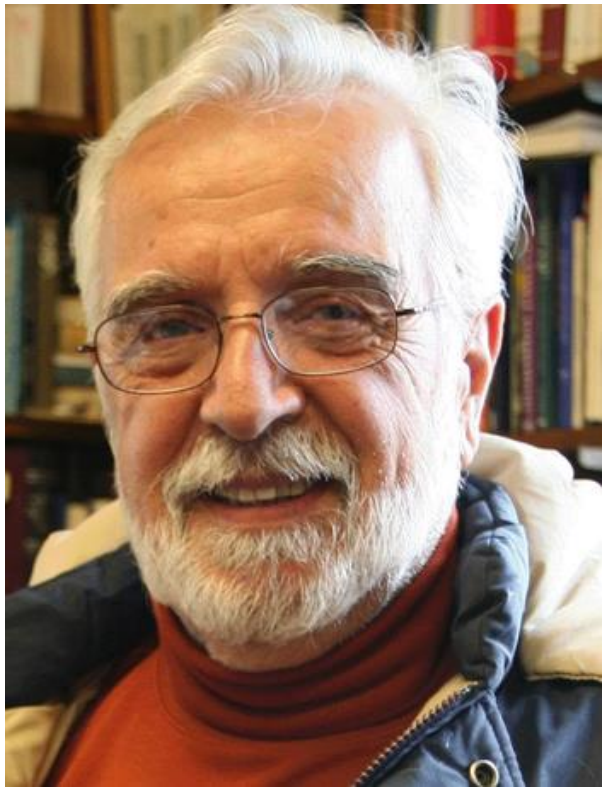
Mu’tazilites & Ma’mun Connection

Problem with the Classical Narrative

– Mu’tazila connection with state was **short-lived**



Mu'tazilites & Ma'mun Connection

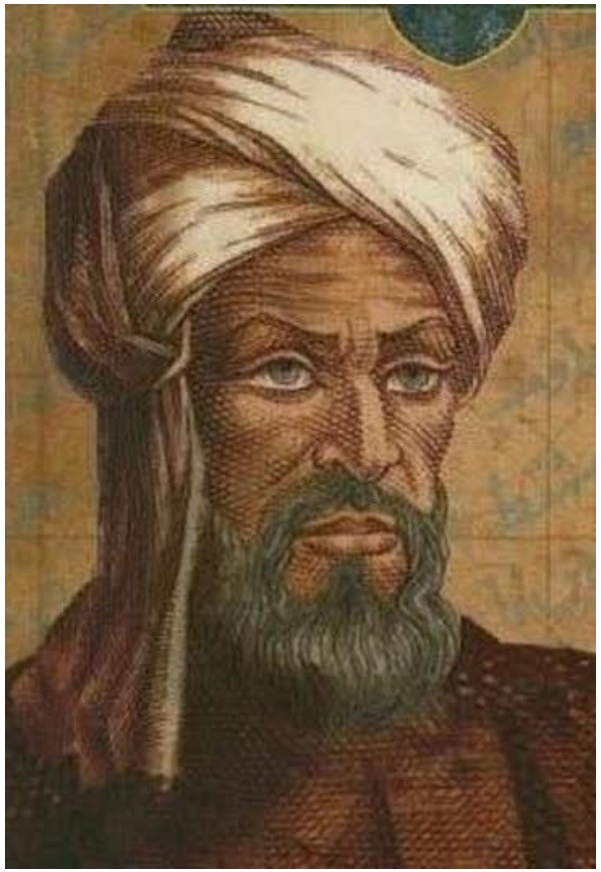


George Saliba

"…it was during the reign of this last caliph that the greatest amount of translations from Greek sources were ever accomplished and mostly by the prolific translator of the time, the famous Hunain ibn Ishaq (d. 873), who worked as a physician at al-Mutawakkil's court. The books that were translated from Greek, mostly during the time of al-Mutawakkil, **far outweigh** those that were patronized by al-Ma'mun. In fact I know of only one surviving book that is expressly designated as having been translated at the order of al-Ma'mun."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 14

Creation of New Discipline



Muhammad ibn Musa al-Khwarizmi
780-850CE

Al-Khwarizmi composed his book on **Algebra** to answer the need of men who "constantly required it in cases of inheritance, legacies, partition, lawsuits, and trade, and in all their dealings with one another, or where the measuring of lands, the digging of canals, geometrical computations, and other objects of various sorts and kinds are concerned…."

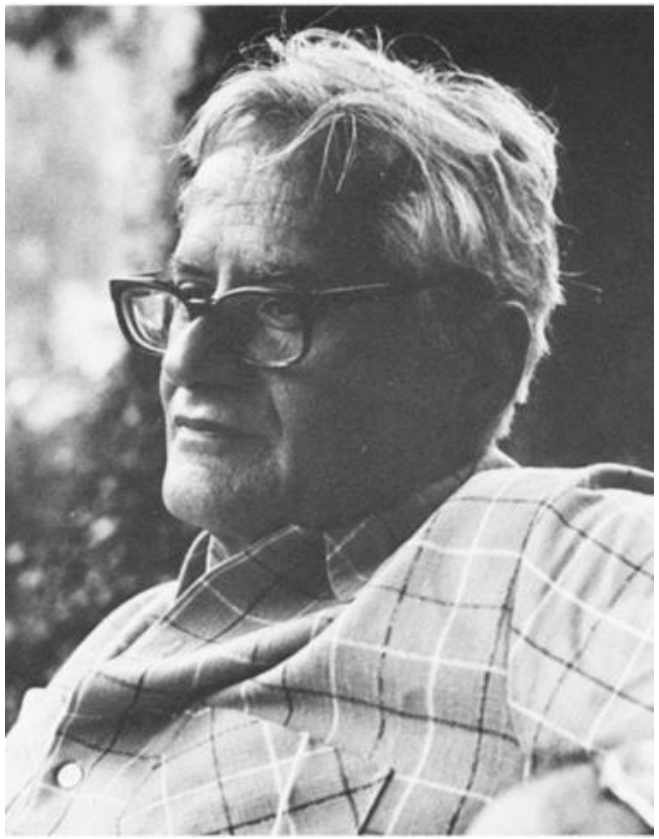
The Algebra of Muhammad ben Musa, tr. Frederic Rosen, London, 1831, p. 3

Diwan Employee Qualifications

"He must – in addition to our books – investigate matters relating to the land surveying, so that he would know the right angled triangles, the acute, and the obtuse angled triangle; the vertical plumb lines, the various squares, the arcs and the curves, and the vertical lines. His knowledge should be tested on the land and not in books, for the one who reports is not like the eye witness. And the non Arabs used to say: 'whoever was not an expert in matters related to water distribution, the digging of trenches for drinking water, the covering of ditches, and the succession of days in terms of length increase and decrease, the revolution of the sun, the rising of the stars, the conditions of the moon when it becomes a crescent as well as its other conditions, and the control of weights, and the surface measurement of the triangle, the square, and the polygons, the erection of arches and bridges as well as water lifting devices and the norias by water side, and the conditions of the artisans and the details of calculations, he would be defective in his craft."

Ibn Qutayba al-Dīnawarī al-Marwazī (d. 879), *Adaab al-Kaatib*

Conflict Model Propagated in Europe

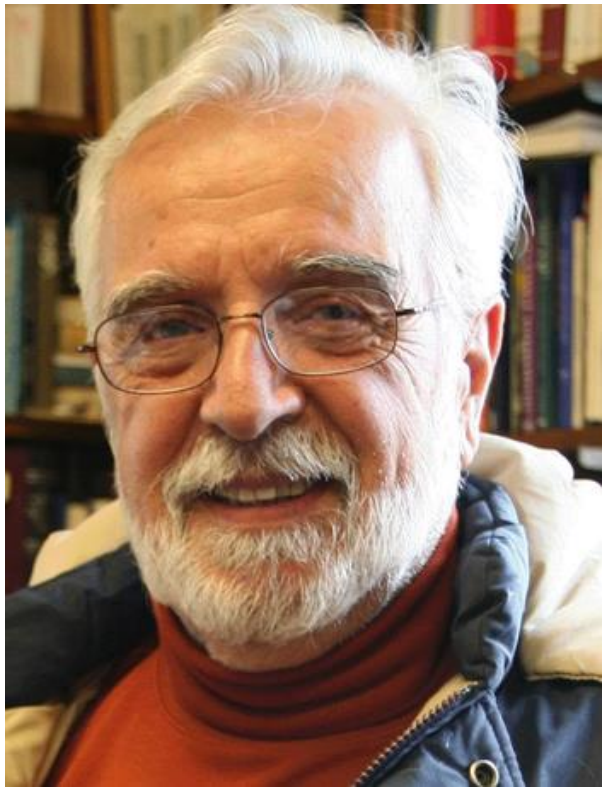


Franz Rosenthal
1914-2003

"It is probably no accident that the Mu'tazilah should have flourished during the decisive years of Greco-Arabic translation activity, that is, from the last decades of the eights century until the reign of Caliph al-Ma'mun (813-833) and his immediate successors. Rather, Mu'tazilah influence on the 'Abbasid rulers ought to be regarded as the real cause of an official attitude toward the heritage of classical antiquity that made impressive provisions for its adoption in Islam."

Rosenthal, *Classical Heritage*, P. 4f

Conflict Model Propagated in Europe



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"In this manner, the already established conflict model that had been propagated in Europe since the age of reason, as a conflict between science and religion, was now transferred to Islamic civilization in the form of Mu'tazilites versus tradionalists."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 52

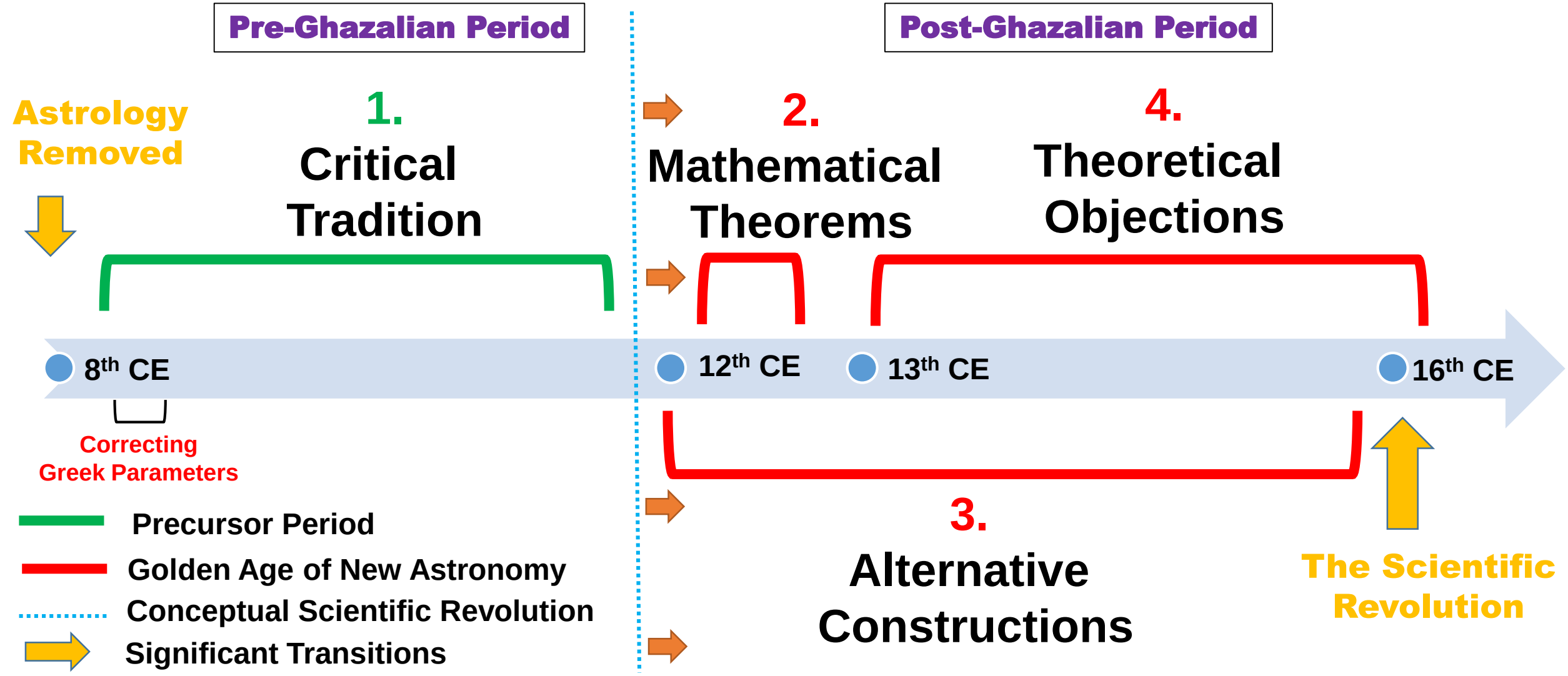
Summary of 'No-Conflict'

- Abdul Malik's administrative reforms preceded Abbasids.
- Diwan translations opened the doors for further advanced translations
- Diwan employees were more educated class and competitive
- New science of hay'a (New Astronomy) was created at the same time period.

Part 2

Creation and the Golden Age of the New Astronomy

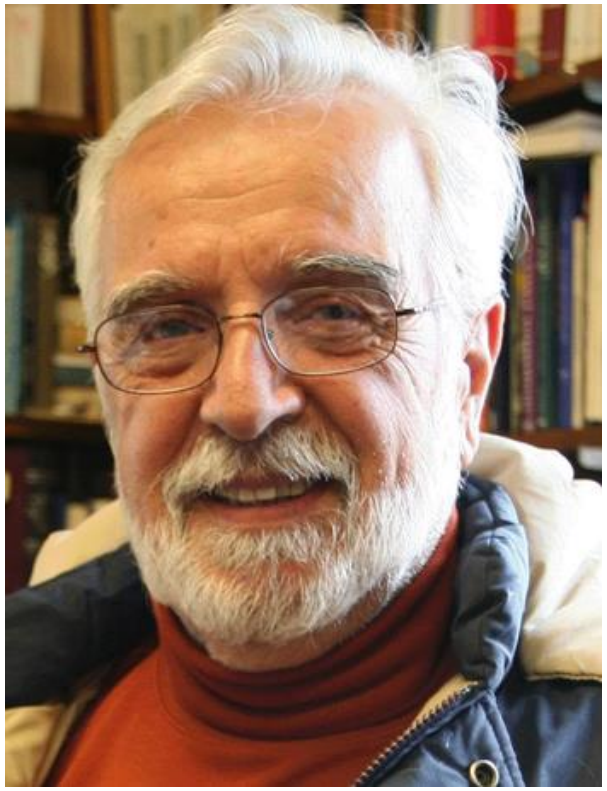
New Astronomy
8th to 15/16th CE



Correcting Greek Parameters in 8th/9thCE

1. Mean length of the lunar month **29;31,50,8,9,20d instead of 29;31,50,8,20d**
2. Motion of precession **1°/66 or 70 years instead of 1°/100 years**
3. Inclination of the ecliptic **23;33° instead 23;51,21°**

Correcting Greek Parameters



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"Who trained those astronomers to conduct such refined observations and to determine such precise values that have obviously withstood the test of time as we still find them in current use?"

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 81

1. Critical Tradition
9th Century

Muhammed b. Musa b. Shakir
800-873CE

Muhammad ibn Zakariya al-Razi
854-925CE

Muhammed b. Musa b. Shakir:

– Earlies objections to Ptolemaic observational parameters/cosmological questions

Muhammad ibn Zakariya al-Razi

–*Shukuk ala Jalinus* – restricted to medical and philosophical doubts

1. Critical Tradition

11th Century

Ibn al-Haytham
965-1040 CE

- Best-preserved and most elaborate text in the genre of shukuk

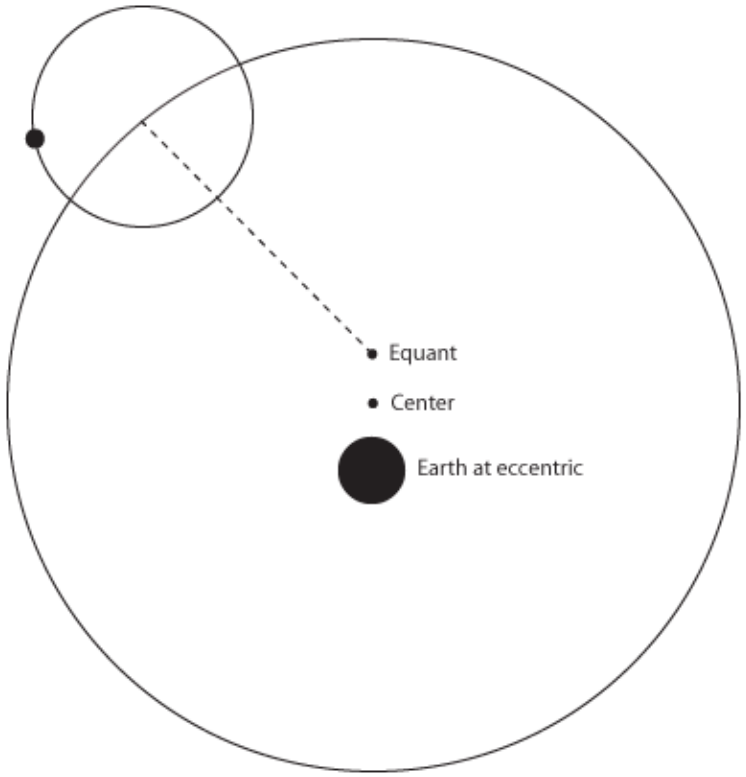
- **Al-Shukuk 'ala Batlamyus**

several of Ptolemy's works in which he found fault.

1. **The Almagest,**
2. **The Planetary Hypotheses**
3. **The Optics**

1. Critical Tradition

11th Century

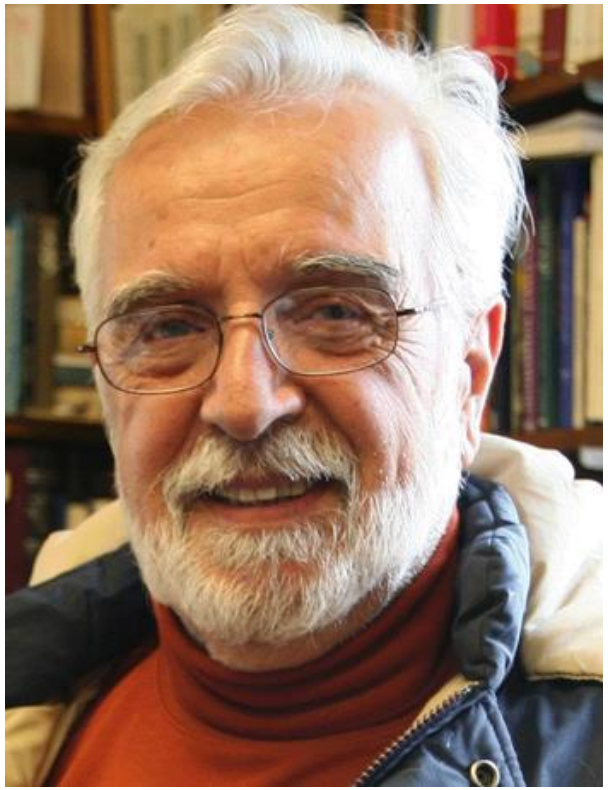


The equant problem

"It became clear, from all that which was demonstrated so far, that the configuration, which Ptolemy had established for the motion of the five planets, was a false configuration (hay'a batila), and that the motions of these planets must have a correct configuration, which included bodies moving in a uniform, perpetual, and continuous motion, without having to suffer any contradiction, or be blemished by any doubt. That configuration must be other than the one established by Ptolemy"

al-Shukuk 'ala Batlamyus

1. Critical Tradition
11th Century

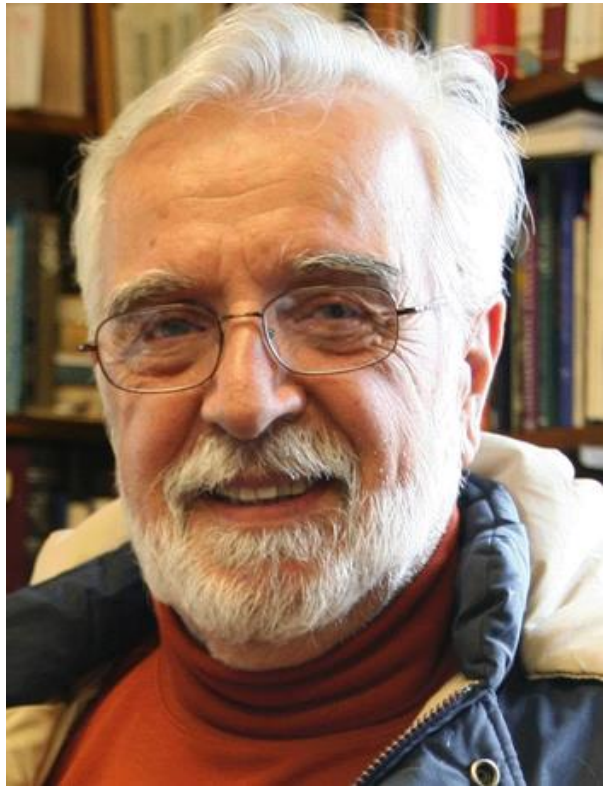


George Saliba

"It is like assuming the world is made of a sphere and then for purposes of demonstrating how it moves one ends up representing the world with the mathematical figure of a triangle."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 104

1. Critical Tradition
11th Century

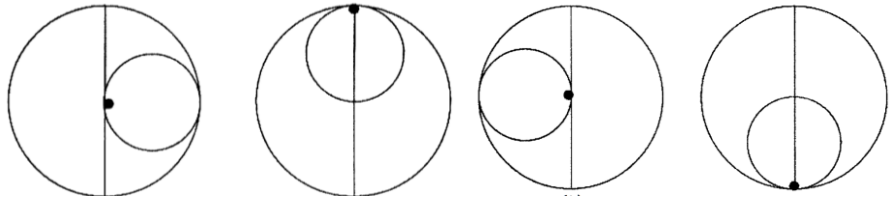


George Saliba

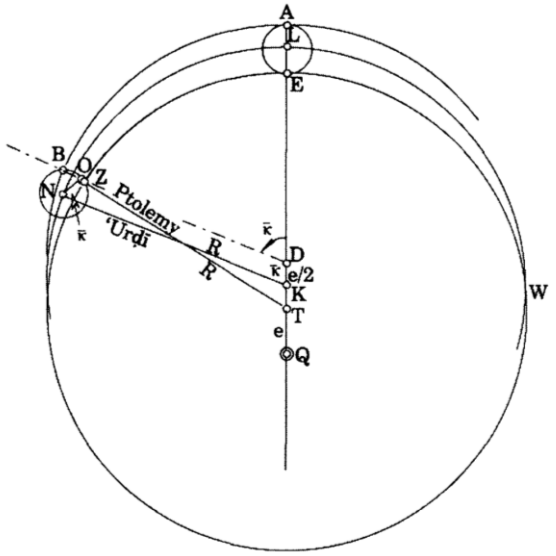
"…at no time before Ibn al-Haitham was this new understanding of the fundamentals of new astronomy so well articulated."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 104

2. Mathematical Theorems: Tusi Couple & Urdi Lemma



Tusi's Couple



'Urdi's Lemma

The combined effect of Tusi's two circles successfully produced a straight motion by combining two circular motions. used extensively as a substitute for the equant.

New deferent with a center at **K,** halfway between the center of the Ptolemaic deferent **T** and the equant **D**

3. Alternative Constructions

Whole Reconstruction

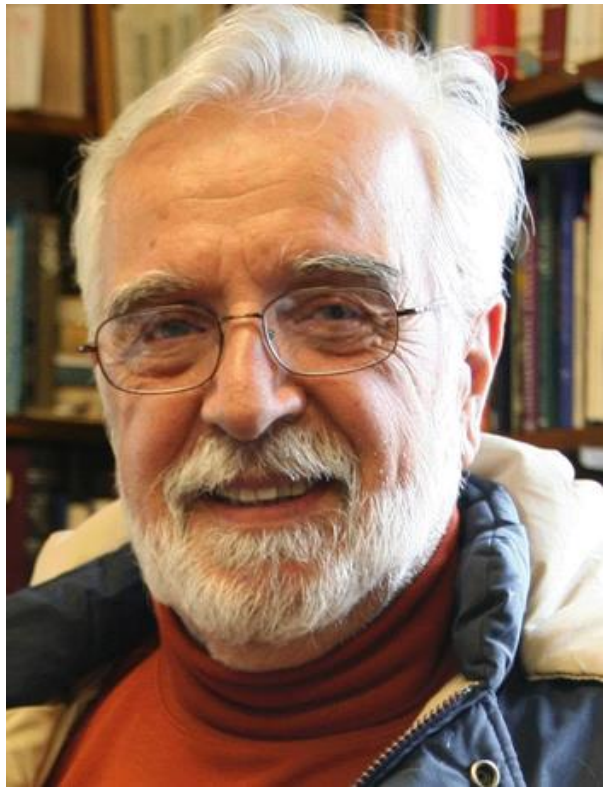
- Muʾayyad al-Dīn al-ʿUrḍī (d.1266CE)
- Ibn al-Shatir (d.1375CE)

4. Theoretical Objections

Mercury's Model

- **Shirazi (d.1311):** Tusi's Couple (ninth models)
- **Qushji (d.1474):** Urdi's Lemma - another way of thinking about mathematics?
- **Khafri (d.1550):** four different models not having intrinsic truth which he called ***wujuh*** (approaches)

4. Theoretical Objections



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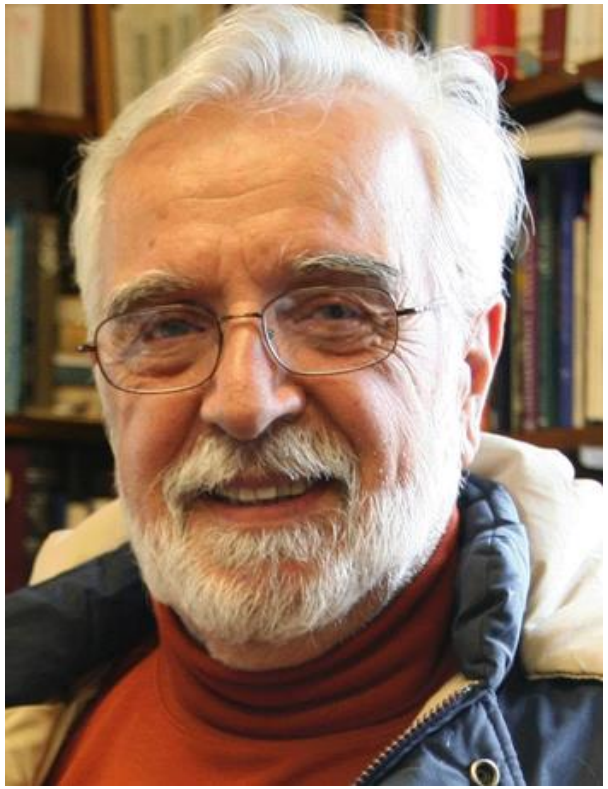
"…the discipline of mathematics seems to have received a very interesting boost toward the sixteenth century when its relationship to astronomy was finally correctly understood at the hand of someone like Khafri (d. 1550) who could finally see that mathematics was **just a tool** that could be used to describe physical phenomena, and that it did not retain the Truth itself."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 129

4. Theoretical Objections

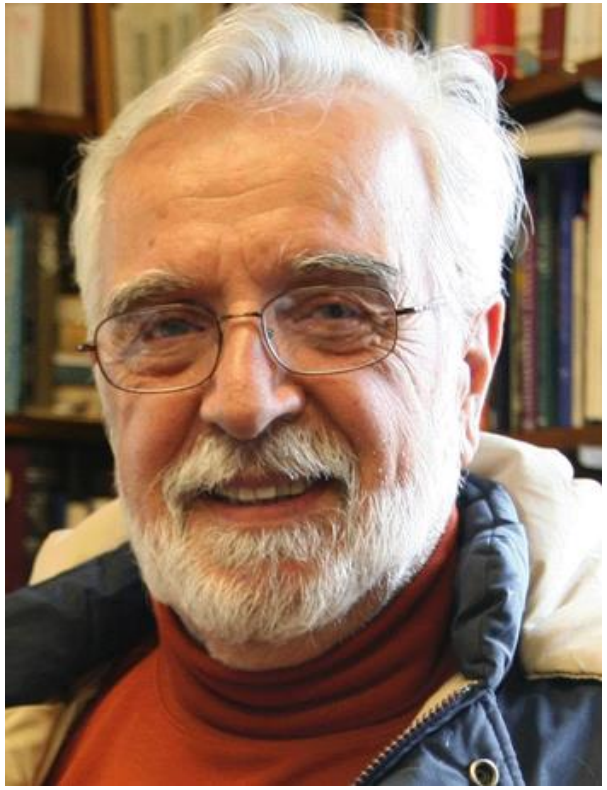


George Saliba

"Seen as a tool, mathematics in the hands of Khafri would become just another language of science, a tool to describe physical phenomena, and nowhere required to embody the truth or the correct representation, as was apparently thought by Shirazi before."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 167

Tradition Of Reconstructing Ptolemaic Astronomy



George Saliba

"Islamic astronomy that was not a mere regurgitation of the older Greek astronomy, nor was it a total break from it, and yet was in a position to lay the ***foundation for a revolutionary upset*** of that astronomical tradition."

Islamic Science and the Making of the European Renaissance, MIT Press (April 1, 2007), p. 173

Concluding Remarks

- **Part 1:** The transfer of science into Islamic civilisation was driven by the internal administrative reforms of Abdul Malik ibn Marwan (NO-Conflict Model), and NOT influenced by the ideological conflict between the Mu'tazilites and Traditionalists (Conflict Model)

- **Part 2:** The post-Gazalian period heralded a Conceptual Scientific Revolution and the Golden Age of New Astronomy.