



# Scientists of the Islamic world

## Mariam set bases for transportation, communication

This is the fifth of a six-part series of articles on Arab and Muslim scientists written by different professors of the Department of Mathematics and Natural Sciences of Gulf University for Science and Technology — Editor

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1. Are you ready to begin a journey in the history? A journey which will take you back thousands years ago to which is called the Islamic Golden Age? The Islamic Golden Age, also known as the Islamic Renaissance, is a period of cultural and intellectual growth and activity in different sciences fields throughout the Islamic world. However, how did the story begin? From the first word in Quran "Iqra'a", which means read and learn, a new concept and a new life have been revealed. Searching for the best options, finding the solutions, giving all the effort, and finally learning, learning, and continue learning forever, all of these concepts Muslims got and learnt from Islam. Actually, Islam is the most significant motivating factor for Muslims to be interested in sciences. For example, Muslims really got interested in mathematics, physics, astronomy, and other science starting from the Islamic mission "imarat al'ardh" which is stated in Qur'an and includes civilizing the globe. The Holy Qur'an verses encouraged Muslims to recognize the greatness of Allah in creating the university. Daily needs of Muslims; prayers time calculations, religious holidays, Zakat, shares of inheritance motivated them towards these interests as well. Muslims started searching and developing different sciences. Therefore, there were many learners, researchers, scholars, inventors and scientists in the Golden Ages. A matter of pride is that women and men, youth and old were engaged in these contributions with competitiveness. When we say Muslim scientists, the first thing that comes to the mind is famous names like Al Bironi, Al Khwarizmi, Ibn Al Haitham and IbnSeina. So what about women? Weren't there any women Muslim scientist? And the answer is: No, of course there are. We

just need to look deeply and clearly in history. By removing all the dust stuck to it, we will find a lot of names like: Mariam Al Asturlabi, Sutayta Al Mahameli, Raihana Al-hawarizmiya, Fatima Al Fahriyah and others.

2.Space sciences and astronomy:  
2.1 Mariam AL-Ijli AL-Astrulabi (10th century):

A Muslim Scientist and Scholar from the Islamic Renaissance Age: In Aleppo; north of Syria in the tenth century, a genius scientist Muslim woman called Mariam Al Astrulabi was known for her passion for space sciences and astronomy. Being the daughter of Kushiar Al Jili Al Asturlabi, an astrolabe maker and one of the most important astronomers in Aleppo, Mariam's interest in astronomy sciences grew as she grew up. She helped her father in maintaining and fixing astrolabes, was interested in manufacturing astronomic instruments. During the period from 944 - 967 AD while Mariam was working in space sciences at the royal palace of Saif Al-Dawlah, she developed astrolabes and manufactured a sophisticated one. She was also able to develop a sophisticated machine and satellites.

Due to prof. SaleemAl-Husaini (10), Mariam is one of the first Muslim and Arab women that set the bases for transportation and communication for the modern world. This work required working with complicated mathematical equations, which proved her abilities in this field. In spite of the few articles published about her in the Arabic language, she owes the favor of developing and manufacturing a sophisticated version of the astrolabe. Unfortunately, despite the importance of this woman and her inventions, the history has forgotten her and the teaching curriculum has completely ignored her. Moreover, when the modern history wrote about the glories of Muslims or Arabs in sciences, industry and medicine, it forgot the women who established the bases of transportation. She deserves to be renowned and honored exactly as other Arab and Muslim male scientists and inventors, including IbinHaitham, IbinSenaa and others.

2.2 What is astrolabe?  
Astrolabe is an astronomical instrument that has many uses. It portrays the movement of stars in the sky around the sky pole. The astrolabe built the foundations based on which the GPS was discovered and used to direct the planes. It developed the space sciences,

and thus enabled the man to reach the moon. Modern scientists considered astrolabe as a computer that helps in solving problems relating to the old astrolabe made by Muslim astrolabemakers Astrolabe made by computers time and position of the sun and the stars in the sky. The Astrolabe enables the astronomers and the navigators to determine the position and measure the altitude of the sun, moon, stars, and other celestial bodies. It also helps the observer to fix the azimuth (in Arabic terms "...").

It can be used to specify the time during days and nights and find the time of a celestial events such as sun rise, sun set, and twilight, and to measure the height of a tower or the depth of a well. For Muslims, Astrolabe was of a great interest for its uses to find the prayer times, season periods, and to determine the direction of Al Qibla. A simple astrolabe consisted of a disk of metal or wood with the circumference marked off in degrees. There was also a movable pointer pivoted at the center of the disk called by Arab astronomers the alidade. By sighting with the alidade and taking readings of its position on the graduated circle, angular distances could be determined.

2.3 What happened after Mariam?

The Arab Muslims, started to find a way to develop this instrument and make it more efficient by developing its shape and size. For instance, they developed several kinds of astrolabes, including line astrolabe, spherical astrolabe, ring, flat and pocket astrolabe. Nowadays, it is hard not to acknowledge the favor of this fascinating instrument in our life. That is why we can see that different museums around the world keep several astrolabe models. The most important ones are the astrolabes at Paris Library and Alexandra Library.

3. Mathematics science and Algebra:  
Sutayta Al Mahameli: The First Expert Witness in the World (lived in the Abbasi era, (died in 377 H.)

3.1 Moving from the science of astronomy to the world of mathematics. Where we will find a great woman Muslim scientist; Amat Al-WahidSutayta Al-Mahameli Al-Baghdadiya. Sutayta lived in Baghdad in the second half of the 10th century. She was one of the most intelligent mathematicians in her time. Her educated family made her not just specialized in just one science but also helped her to be excelled in many fields, such as Arabic literature,

Hadith, and Fiqh, as well as Mathematics. Her father was the judge Abu Abdullah Al Hussein, the author of several famous books like "Kitabfe Al Fiqh" and "Salat Al Edayn". Her uncle was a Hadith scholar and her son was the judge Abu Hussein Bin Ismail Al-Mahameli who was known for his talent in judgment. Sutayta's talent in mathematics was really superb. Not only did she invent new equations and add a lot in mathematics by herself but also she invented solutions for complicated equations which have been cited by other mathematicians, which made aptitude in algebra. Although these equations were few, they demonstrated that Sutayta's skills in mathematics went beyond expectations.

3.2 How did Sutayta's skills in mathematics help people in the past?

In the past when people wanted to build their houses, they gave the building workers a contract paper. So for any reason if the builder built only half of the house or didn't build the house in correct basis or there was any failing in the building process, the owner of the house went to the judge to complain. The judge consulted math experts to help him making the decision. And one of these experts was Sutayta who used calculations and complicated algebraic equations to measure the building size, the ground, the amount of stones, the number of working hours, and etc. Nowadays, we call such person expert witness. Which means someone who is recognized by a court as an authority on a topic who has knowledge beyond that accessible to the average person. In order to be an expert witness, the person should have special qualifications, superb skills, special talents, and the ability to provide scientific and technical information. And with full of proud, Sutayta had them all, what made her the first expert witness in the world.

4. Hidden scientist:  
Rihanna bint Al-Husain Al-Khawarizmiya (lived in a contemporary period of Al-Bironi)

Talking about women Muslim scientists who added to different sciences never ends. Actually, a man scientist and an inventor, had a very intelligent lady assistant that without her, due to his declaration, he would not be able to invent or to find anything. He was the encyclopedic scientist Al-Bironi who contributed to mathematical geography, astronomic geography, astronomy, astrology, mathematics, physics, medicine, history and other fields and was the leader of geology. In the literature:

"Al-Bironi had written his book "Taftheemal'awa'llisina'altanjeem" twice; once with his own hand writing in Persian and the other in question and answer form to make it handy for beginner students by a lady of the astrology students in his time, Rayhanabint AlHusain Al-Khawarizmiya". Al-Bironi in one of his manuscripts said: "I would have not been able to do what I have done had it not been for a lady called Rihanna". It seems that there was a lady working around in the back ground that we don't know enough information about her and that we can refer the assistance of Al-Bironi bringing up many of his contributions to her. Accordingly, we can call Rihanna the hidden scientist.

4. The big invention "The University": Fatima Al-Fihri (died in 1180 G. - 265 AH)

I think now we reached a point where we can say that women Muslim scientists had left a mark in almost every science and knowledge we have nowadays. By talking about knowledge, knowledge is university. A university is the mother of knowledge. Whenever we mention knowledge, we are talking actually about university. However, who came with the idea of building a university where people will come and learn a specific science and then take a certificate for that? Have you ever thought about it before? You will be surprised if you know that the first known university in the world as university which is called Jame'ah has been built by a Muslim woman called Fatima Al Fehriah. Fatima AL Fehriah has actually constructed and supervised the building of the first university in history, 859 C.E., which is called Jame'at AL Qarawiyyin in Fez. It is a mosque and a university at the same time. Students travelled there from all over the world to study Islamic studies, astronomy, languages and sciences. This university has continued its activity from that time till today. This example shows the important role of women in the advancement of education and civilization.

5. Other Great Women Muslim Scientists:

In conclusion, there are a lot of great women in Muslim heritage, but unfortunately we don't know about them. Actually, there are 5 million manuscripts in the world, but only 50 thousands of them are edited. These 50,000 manuscripts are talking about subjects related to politics, religious arguments, poetry, and very few of

them are talking about sciences and technology. In these few, a lot of glittering names of women Muslim contributors in different fields were found. Zubaydabint Abu Ja'far Al-Mansur who came with the most unbelievable ambitious project. Of digging wells and building service stations all along the pilgrimage route from Baghdad to Mecca. Not only did she come up with the idea but also she supervised and financed it from her own money. Also there are Dhayfa Khatun who excelled in management and governance. As for women rulers and queens one should mention Sitt Al-Mulk, and Shajarat Al-Durr. 'AinZubaida- Makka

6. The story continued "MedicalCare in Islam": Rufayda Al-Aslamiyyah&Al-Shifabint Abdullah:

Moreover, women contributions reached also medical care issues. As examples for Muslim women who made significant contributions to medical care there are Rufayda Al-Aslamiyyah who is considered the first nurse in Islamic History, and Al-Shifabint Abdullah whose real name was Laila, but the people at that time used to call her Al-Shifa which means "healing" because of her profession as a nurse and medical practitioner. Not only did these great women specialize in scientific fields, but also all of them were well known for their amazing efforts and superb talent Islamic sciences, such as in Hadith transmission, fiqh, literature, and education.

7. If the rest of the 5 million manuscripts are edited, can you imagine how many hundreds of names of Muslim scientists, men and women, who contributed in different sciences, will be found?

- References:
1. <http://www.wisegeeek.com/what-is-the-islamic-golden-age.htm>
  2. <http://www.halimakrausen.com/womhist3.htm>
  3. [http://muslimheritage.com/topics/default.cfm?ArticleID=1204&sec\\_5](http://muslimheritage.com/topics/default.cfm?ArticleID=1204&sec_5)
  4. <http://www.youtube.com/watch?v=HM4Y4Cn1yEM>
  5. [www.thepirateking.com/historical/astrolabe.htm](http://www.thepirateking.com/historical/astrolabe.htm)
  6. [www.factmonster.com/ceb/sci/A0805131.html](http://www.factmonster.com/ceb/sci/A0805131.html)
  7. [www.thefreedictionary.com/azimuth](http://www.thefreedictionary.com/azimuth)
  8. <http://www.portsaidonline.com/community/viewtopic.php?f=18&t=26491>
  9. [www.wisegeeek.com/what-is-an-expert-witness.htm](http://www.wisegeeek.com/what-is-an-expert-witness.htm)
  10. [www.1001inventions.com](http://www.1001inventions.com)

### Nuclear programme capped but can be resumed

## Reversible Iran deal puts more pressure on final talks

VIENNA, Nov 28, (RTRS): By dropping earlier demands that Iran shut down an underground uranium enrichment plant and ship material out of the country as part of a preliminary deal, nuclear negotiators have kicked some of the toughest questions forward to talks for the next year.

The curbs to its nuclear programme that Iran agreed to on Sunday are easier to reverse than measures that were previously called for by the six global powers seeking to prevent Tehran from developing an atomic bomb, experts say.

To opponents of the deal, like Israel, which branded it an "historic mistake", that is a fatal flaw. But supporters say the compromise was necessary to halt Iran's nuclear advances so that the real bargaining could begin, and should help keep both sides focused on the final negotiations which lie ahead.

A senior Western diplomat acknowledged that Iran could resume its most controversial activity — production of 20 percent enriched uranium — if it should decide to abandon the deal or if final talks fail.

But by making it easier for inspectors to detect any such move, the preliminary accord requires Tehran to demonstrate its sincerity while a final deal is hammered out.

"This is all about testing their good faith. We would pick that up very quickly if they did it," the envoy said.

"Any agreement like this represents an element of compromise. Given where we were six months ago, to get the two sides together to agree something, there had to be some compromise from both sides."

Instead of requiring Iran to take steps that would be hard to undo, the powers' demands focused on stopping the higher-grade enrichment and halting future progress in other parts of the nuclear programme for six months, while increasing inspections to determine if Iran is complying.

For their part, the United States and European Union have protected their future negotiating position by leaving most of their economic sanctions against Iran in place.

"Each side would retain enough leverage — one, in the form of continued economic penalties; the other in the form of a continued nuclear programme — to maintain incentives for



Iran's ambassador to the International Atomic Energy Agency (IAEA) Reza Najafi waits ahead of the Board of Governors meeting at the UN atomic agency headquarters in Vienna on Nov 28. (AFP)

a grander bargain and guard against the other's potential renegeing," said Iran expert Ali Vaez of the International Crisis Group think-tank.

The most controversial part of Iran's nuclear programme has been its enrichment of uranium, which is first turned into a gas and then spun at high speeds in centrifuges to increase the concentration of the fissile isotope that is needed to make either fuel for a reactor or the core of an atomic bomb.

Tehran says it is refining uranium only for peaceful purposes and has the right to do so under international treaties. Western countries believe it

has no such right and no legitimate need for an enrichment programme of its own.

In addition to lower-grade work which began in 2007, Iran has since 2010 been enriching uranium to 20 percent purity, which Western countries see as a small technical step from reaching the 90 percent level needed to make a bomb.

In fruitless meetings during 2012, the powers sought a confidence-building, interim deal that would require Iran to stop its higher-level enrichment, close its Fordow enrichment site and send its stockpile of the higher-

level uranium abroad.

Those demands were dubbed "stop, shut, ship" by diplomats. In the end, the Nov 24 deal in effect dropped two of the three demands: it obliges Iran to "stop" 20 percent enrichment but says nothing about "shutting" Fordow or "shipping" material out.

The same number of centrifuges can continue to spin, producing lower-level enriched uranium at Fordow — built deep inside a mountain near the holy Shi'ite Muslim town of Qom to shield it from any military attacks — and at Iran's other enrichment plant close to the central town of Natanz.

And instead of sending out the stockpile of 20 percent uranium, Iran will dilute it or convert the gas to a less proliferation-sensitive oxide powder.

The United States says this will "neutralise" the material. But experts say Iran could in theory convert the powder back, although it has agreed not to build a facility to do so.

"This is not a roll-back of the programme," said Olli Heinonen, former deputy director of the International Atomic Energy Agency (IAEA) and now an expert at Harvard University. Instead, he said, it represents a "tem-

porary halt" of many of the nuclear programme's elements.

Apart from the enriched uranium, Western countries are also concerned that Iran could produce plutonium at Arak, an unfinished research reactor where Tehran says it intends to make medical isotopes. Plutonium can be used as an alternative to enriched uranium to build a bomb core.

Sunday's deal requires Iran to halt activity at Arak, although it may contain a loophole allowing it to build components off-site. In comments unlikely to go down well in Western capitals, Iranian Foreign Minister Mohammad Javad Zarif said on Wednesday that construction would continue at Arak, though he said there would be no new equipment installations.

Western officials and experts accept that the deal leaves Iran's nuclear programme largely in place for now.

"For the time being, Iran will be allowed to retain most of its current infrastructure, which will have to be substantially reduced at a later stage," said Robert Einhorn, the US State Department's non-proliferation adviser until earlier this year.

"But the first step will prevent Iran from sharply ramping up its capabilities in the next six months," he wrote in Israel's Haaretz newspaper.

Former chief UN nuclear inspector Herman Nackaerts said Iran, if it wanted to, could quickly resume higher-level enrichment at Fordow, but because of expanded inspections, including daily visits by IAEA monitors, it would easily be caught if it did so.

"It is technically easy to do that and it can quickly be done," Nackaerts, who retired in September, told Reuters. "Of course, when the inspectors are there every day they will notice that."

Western diplomats acknowledge that Iran's commitments are largely reversible so far, but say the deal takes care of the most urgent concerns while talks are under way.

"This first stage is one where the programme is slowed in some ways, capped in others, but Iran can resume quickly," said a second Vienna-based diplomat.

"The main issues that we were concerned about are all covered by this. As we move on we will tackle more and more difficult things," said the first senior Western diplomat.