

Acceptance Speech of
PROFESSOR FEDERICO CAPASSO
Co-Winner of the 2005
King Faisal International Prize for Science

Sunday 10 April 2005 (1.3.1426H.)

Your Royal Highness, Prince Sultan Ibn Abd Al Aziz

Your Royal Highnesses

Your Excellencies

Distinguished Guests

It is a great honor to receive the King Faisal Prize in Physics and to share it with two distinguished scientists: Profs. Frank Wilczek and Anton Zeilinger.

This prize reflects the appreciation and the high regard in which science is held in the Islamic world, a tradition that goes back to the birth of Islam.

In 2003 I received an honorary doctorate from the University of Bologna (Italy). Founded in 1088 A.D., it is Europe's oldest University. On that occasion I learned that early medieval students and scholars in Bologna were studying on texts of geometry, mathematics and astronomy of the ancient Greeks, translated into Latin from the Arabic language.

After Islam's rapid spread from Spain to India, the city of Baghdad was founded in 762 A.D., and here within a few decades the "Muslim quest for knowledge greatly expanded, the manifestation of an insatiable curiosity".¹ In Baghdad Muslims founded a great school of translation, the goal of which was to translate as much as they could find of science, astronomy,

mathematics, music, geography and philosophy—whatever remained of Classical Greek knowledge.¹

The so-called Golden Age of Islam began around 1000 A.D. and lasted for over two centuries. During this period the great scientists of Islam wrote hundreds of science books. They did much more than translating Greek texts and in addition to their pioneering works in mathematics (such as major advances in modern algebra) they made seminal contributions to many fields of *experimental* science (optics, geology, chemistry, astronomy, medicine). In their writings they *emphasized the central role of observation and experimentation*, thus anticipating the experimental method of Francis Bacon and Galileo Galilei by five centuries. Many distinguished scholars have documented this point.

On May 11, 1991 at the general meeting of the *Accademia dei Lincei*, the world's first scientific academy, of which Galileo Galilei was one of the founding members, Nobel laureate in Physics and famous Pakistani scientist Abdus Salam gave a remarkable speech entitled: "Islam and Science: Harmony or Conflict?"²

One of the central points of his talk was that western science has its roots in both Greek *and* Islamic civilizations. He emphasized that the "notion that Muslim scientists blindly followed the Greek's theoretical tradition, adding nothing to the scientific method" is wrong. He cited Al-Biruni (973-1048 A.D), an illustrious experimental scientist and mathematician, who can be considered one of fathers of modern geology. He was the founder of geodesy and wrote on and devised methods of measuring latitudes, heights of mountains and the radius of the earth.

Al Biruni openly criticized certain medieval superstitions and reliance on the so-called Aristotelic dogma (the famous Latin dictum "Ipse dixit") and relentlessly insisted on *observation and experimentation* as central to human inquiry.²

As pointed out by G. Briffault³: “Greeks systematized, generalized and theorized but in general the patient avenues of observation of detailed and prolonged observations and experimentation were alien to Greek temperament. What we now call science was born as a result of a new spirit of investigation, of new methods of experimentation, observation and measurement, that were introduced into Europe by the Arabs”⁴.

In the words of Abdus Salam: “these promising beginnings did not lead to stable changes in scientific methodology and hundred years after the seminal work of Al Biruni and Ibn al-Haytam, the creation of high-level science in Islam experienced a halt. Humanity had to wait 500 years before one could reach again, through the works of Tycho Brahe and Galileo Galilei and their contemporaries, the same levels of maturity and the same insistence on observation”²

Recently Prof. Giorgio Salvini, a distinguished high-energy physicist and honorary president of the Accademia dei Lincei, also emphasized the great early contributions of Islam to science. In his contribution to the recent XVI Amaldi Conference on Problems of Global Security he proposed exchanges and encounters of teachers and students of secondary schools from America, Europe and Islam as means for reciprocal understanding between the cultures of Islam and of the West and as a concrete step towards promoting peace.⁵

Much of my current research is in optics. I therefore want to mention Ibn Al-Haytam (965-1039 AD), who can be considered one of its fathers. His main work on optics, the *Kitab al-Manazir*, was well known in the West as *Thesaurus Opticus*. He built instruments to study optical phenomena such as the reflection of light from surfaces of different shape and he studied the structure of the eye, correctly describing the process of vision. The above book contains the oldest existing diagram illustrating the eye and its connection to the central nervous system.⁶ Ibn Al-Haytam also anticipated Fermat’s celebrated principle, on which the Snell’s law of refraction of light is based, by lucidly stating, “that a ray of light in passing into an element follows the easiest and fastest path”.

As a working scientist I find it inspiring that modern science has its roots in two great civilizations, the Islamic and the Greek, and that it experienced a new birth and renaissance in the 15th and 16th centuries Europe. The roots of science are therefore as global as its practice. Being a patrimony of the world, they can help promote further understanding and respect between the West and Islam.⁵

I would like to thank the King Faisal Foundation, chaired by His Royal Highness Prince Abd Allah Al-Faisal, for this great honor and for the opportunity to spend with my wife Paola, who has supported me patiently for so many years, and my daughter Luisa, an exciting week in one of the cradles of civilization.

I also would like to thank my native country Italy who gave me an excellent education and the United States for accepting me first as an immigrant and then a citizen. I was fortunate to join the legendary Bell Laboratories in 1976 and do there the research for which I am recognized today: it was an unforgettable experience!

Finally I would like to thank my many collaborators who contributed so much to my research on Quantum Cascade Lasers and in particular Prof. Jerome Faist, Dr. Alfred Y. Cho, Ms Deborah Sivco, Prof. Carlo Sirtori, Prof. Claire Gmachl, and Mr. Albert Hutchinson.

1. Jeff Matthews in:

<http://faculty.ed.umuc.edu/~jmatthew/naples/blog27.htm#arabinf>

See also Jason Goodwin in:

<http://pages.slc.edu/~eraymond/ccorner/exchange/iraq.html>

2. Abdus Salam, *Rend. Suppl. Acc. Lincei*, **2**, 191 (1991).

3. Robert Briffault, *The Making of Humanity*. London: 1938
4. I have translated this quotation from the Italian text of Ref. 1
5. Giorgio Salvini: “Islam and the West. Peace and secondary school exchanges”, talk presented at the XVII International Amaldi Conference on Problems of Global Security, hosted by the International Centre for Theoretical Physics (Trieste, November 2004). In Press.

<http://www.lincei.it/rapporti/amaldi/index.php?lg=e>
6. Karima Burns in: <http://www.islam-online.net/english/Science/2001/02/article16.shtml>