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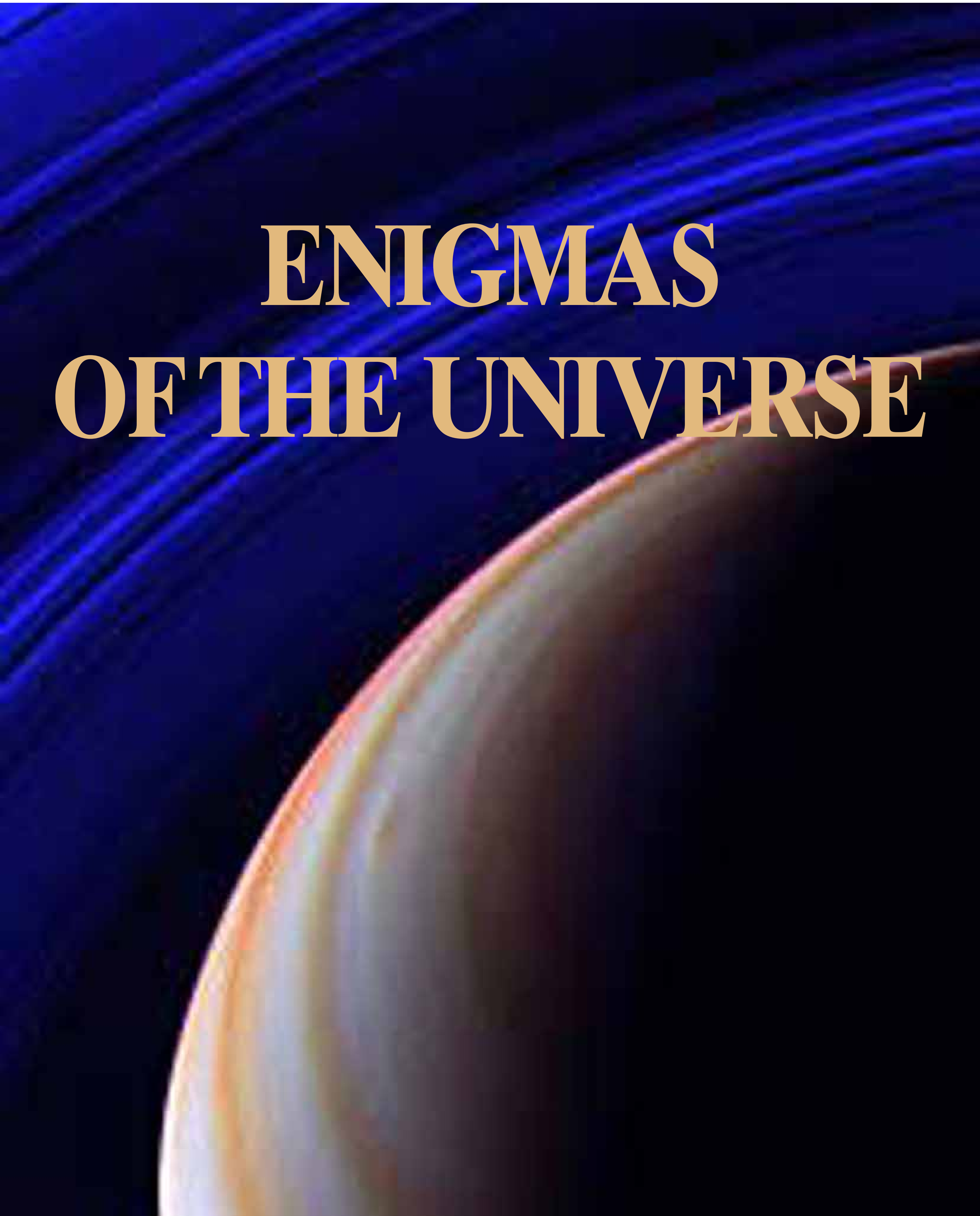
ENIGMAS OF THE UNIVERSE



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© NASA/JPL/Space Science Institute

Image of Saturn taken by the space probe Cassini, launched by NASA in 1997.

ENIGMAS OF THE UNIVERSE

From Alhazen Ibn Haitham's theory about the dark spots on the moon (11th century) to the recent discovery of exoplanets in April 2009, this issue, published on the occasion of the International Year of Astronomy, traces these steps in our long history of observing the stars.

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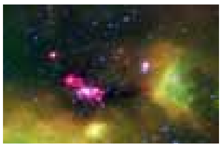

FROM CLOSED WORLD TO INFINITE UNIVERSE

A small sphere at the centre of a much larger sphere: this is how the earth and the universe were imagined in Greek antiquity. This image of a closed world was shattered by a gadget sold in shops. 400 years ago, Galileo observed the sky with a telescope he made himself. The world would never be the same. 4

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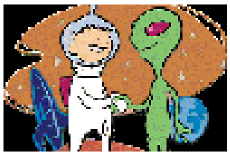

EXTRATERRESTRIAL LIFE: SURPRISES IN STORE?

Does the discovery of extrasolar planets mean the discovery of extraterrestrial life? During a UNESCO conference marking the International Year of Astronomy, three world renowned scientists, Lord Martin John Rees (United Kingdom), Jonathan P. Gardner (United States) and Françoise Combes (France), tackled the question from different perspectives. 15

ASTRONOMY : THE THREE TIERS OF RESEARCH

We have no reason to think that the planets in our solar system represent every type of planet in existence, according to the Swiss astrophysicist Michel Mayor, who discovered the first extrasolar planet with Didier Queloz in 1995. Last April, his team at the Geneva Observatory discovered the smallest exoplanet known today. 18

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On living with less, from three points of view

How to protect the poor from a crisis caused by a few of the rich?
This was the main question raised at the UNESCO Future Forum held last March. 22

© NASA

This view out the aft windows on Endeavour's flight deck was one of a series of images recorded by the STS-123 crew during the first full day in space.

400 years ago Galileo took the dark stains on the surface of the Moon to be seas. He was wrong. Today, we send missions to the Moon in search of water. Technological advances have been extraordinary: in the past 20 years 350 planets have been discovered outside of our solar system and several months ago the first images of them reached us via satellite. Telescopes on earth and in space explore the universe 24 hours a day, yet it is still remains largely unknown.

To help us penetrate his secrets the United Nations declared 2009 the International Year of Astronomy (IYA2009). Submitted by Italy, the homeland of Galileo, the initiative is lead by the International Astronomical Union and UNESCO.

With the motto "The Universe – yours to discover" the IYA2009 aims to stimulate interest in astronomy among the general public and especially youth. Activities are underway around the world and UNESCO has organised a series of events designed to both stimulate research and disseminate scientific knowledge.

Exhibitions for young and adults have been organised, as have scientific symposiums and debates with the wider public featuring many of the world's leading astronomical experts.

Among these, Françoise Balibar, Françoise Combes, Julieta Fierro, Zhao Gang, Jonathan P. Gardner, Michel Mayor, Lord Martin John Rees, George Saliba et Georges F. Smoot have contributed to this issue of The UNESCO Courier published with a view to popularise astronomical knowledge within the IYA2009 framework.

In terms of scientific research, the main topic discussed was that of dark matter and dark energy. "Ninety-five percent of the total energy of the universe is not visible in the sense we usually understand it, so we nicknamed it "dark matter" and "dark energy", said Nobel laureate Physics George F. Smoot. Françoise Combes of the Paris Observatory added "Scientists invented the notion of dark energy to explain a phenomenon discovered 10 years ago – the acceleration of the expansion of the universe. According to the theory most widely accepted up until then the universe has been expanding since the Big Bang and will contract in a "Big Crunch". Today we know this theory is false, yet it is still unclear what causes the acceleration."

In terms of popularising science, the main concern for experts is educating youth and teaching astronomy in schools. "In my opinion, we should start teaching astronomy in primary school" declared Beatriz Barbuy, a Brazilian astronomer and recipient of the 2009 L'Oreal-UNESCO award for Women in Science. Interviewed during the preparation of this issue by the Brazilian journalist Dênio Maués Vianna, Barbuy explains: "The mysterious world of stars and galaxies greatly intrigues children. Astronomy is an excellent way to teach children not only about cosmic phenomena, but also mathematics, physics, optics, chemistry and even computer science and biology." She believes that the reason why astronomy appears inaccessible is because it's not sufficiently featured in school curriculums. The resulting lack of knowledge has a negative impact: "scientists are often frustrated to note that obscurantism sometimes prevails over the facts established by science" ».

Jasmina Šopova

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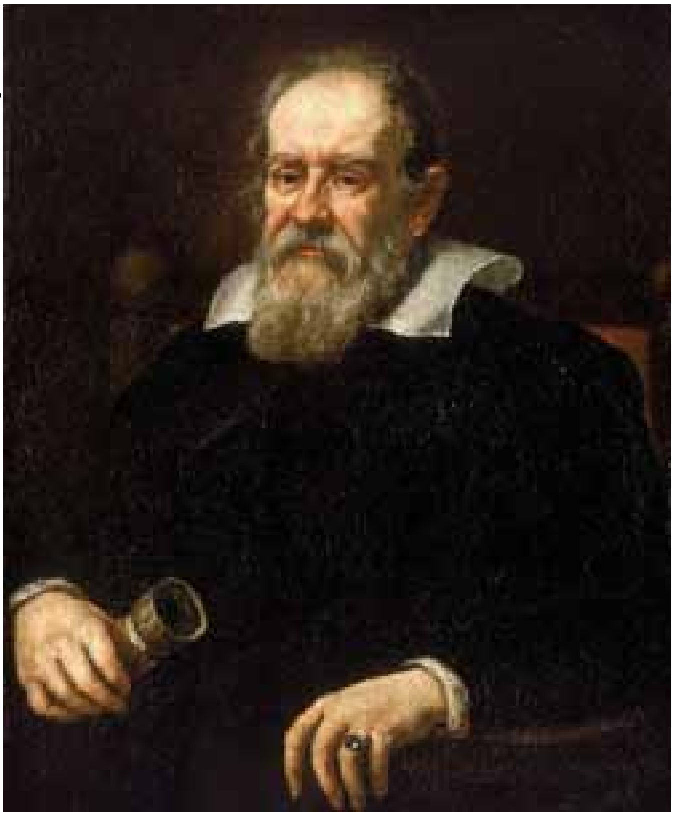
Children at Katha public school (Govinpuri slums, south Delhi, India), during an astronomy class.

A small sphere at the centre of a much larger sphere: this is how the earth and the universe were imagined in Greek antiquity. This image of a closed world was shattered by a gadget sold in shops. 400 years ago, Galileo observed the sky with a telescope he made himself. The world would never be the same.

FROM CLOSED WORLD TO INFINITE UNIVERSE



Portrait of Galileo painted by Justus Sustermans (1636).

This article is an extract from the lecture From Galileo to Einstein, delivered by Françoise Balibar at the launch of the International Year of Astronomy at UNESCO, 15 January 2009.

In 1639, nearly thirty years after the discovery we are celebrating today, Galileo, then aged 68, lost the use of his right eye. A year later, he became totally blind. In despair, he then wrote to his most faithful friend Elie Diodati, "Alas, honoured Sir, Galileo, your dear friend and servant, has become by now irremediably blind. Your Honour may understand in what affliction I find myself, as I consider how the heaven, the world, the universe, which by my observations and clear demonstrations I had amplified a hundred and a thousand times over what had been seen and known by the learned of all past centuries, has now reduced to the space occupied by my person."

An agonizing statement of a man to whom blindness had given the ability to "see", with the eyes of the mind, the position he would forever hold not only among worldly things but in the history of man. As if physical blindness had given him the power to adopt what would be posterity's point of view on his achievements, namely, as Alexandre Koyré (French philosopher and historian of science, of Russian origin, 1892-1964) has so justly coined it: going from a closed world to an infinite universe.

A closed world

The closed world view has its origin in Greek philosophy. For most Greek astronomers and philosophers, from the 4th century on, the earth is a small sphere (the most symmetrical surface) occupying the centre of another much larger rotating sphere, which carries the stars. Different cosmological devices are added during the nearly twenty centuries which separate the 4th century B.C. from Galileo's time, in order to account for the movements of the sun, moon and planets (wandering celestial bodies) in the intermediate space between the two spheres. The point here is that outside of the celestial sphere there is no space, no matter, nothing. The whole world is enclosed, or, so to speak, encapsulated, inside this second sphere; a sphere where, large as it may be when compared to the size of his earthly residence, man is imprisoned.

Cosmology and Astronomy

A second point: cosmology (as a set of conceptions about the structure of the universe) and astronomy (defined as observation of the appearances of the heavens) are inextricably combined in such a model. Thomas Kuhn (American philosopher and historian of science, 1922-1996) sees in this combination the origin of the "unreasonable effectiveness" of western science. According to Kuhn's view, the requirement that cosmology should supply both a world-view and an explanation of observed phenomena has channelled the universal psychological compulsion for being part of the universe into a drive for scientific explanations – thus enhancing the power of cosmological thought. The devastating result is that "the astronomer may on occasions destroy, for reasons lying entirely within his speciality, a world-view that had previously made the

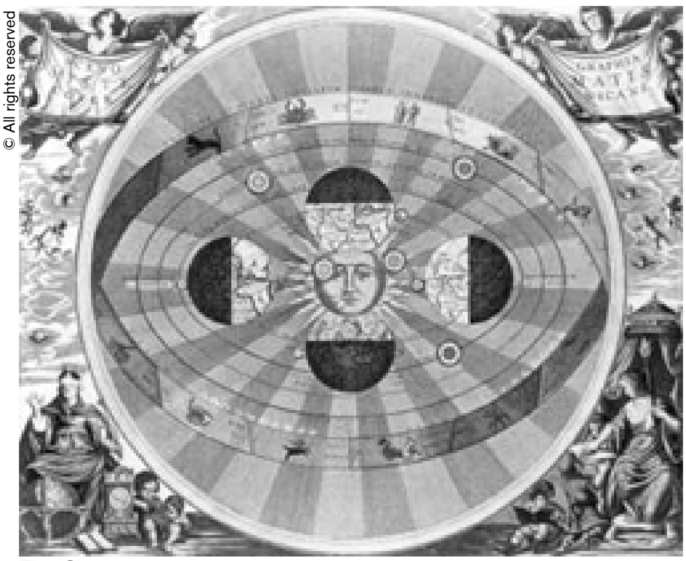
Ptolemy, 2nd century Greek geographer and astronomer.

universe meaningful for the members of a whole civilization, specialist and non specialist alike". This is precisely what happened in 1609: Galileo's astronomical observations destroyed the world-view, common to both the educated and the "man in the street."

Both the Copernican and Ptolemaic systems, which clashed in the 17th century, are cosmological and astronomical at the same time. This is explicit in the title Galileo gave to his first Dialogue: "Dialogue Concerning the two Chief World Systems", where the two systems, Ptolemaic and Copernican, appear on the same footing, alternative systems within the same intellectual framework, where any change in astronomical explanation (as that proposed by Copernicus in 1543, in his De Revolutionibus Orbium Coelestium) entails a change in man's cosmological conceptions about the structure of the world.

The earth is no longer the centre of the universe

No wonder then that the dispute surrounding the Copernican (1473-1543) heliocentric explanation was itself felt to be not a mere controversy restricted to scientists (astronomers) but a threat to the established general order, relying as this latter did on a geocentric world-view. No wonder too that Galileo's observations and interpretations of evolving bright spots as evidence of mountains on the Moon, something anyone could understand in relation to his own experience of the sun rising on the top of a mountain before it illuminates the valley, were much more threatening to the established world-view than the other important scientific event of that same year 1609, Kepler's (1571-1630) Astronomia Nova [1571-1630]. All the more so inasmuch as Galileo's observations involved an instrument derived from a gadget sold on the open market, an instrument of such simplicity that anyone might believe he could build one himself. But who could read Astronomia Nova apart from specialists? Who would care about the elliptical planetary trajectories exhibited by Kepler?



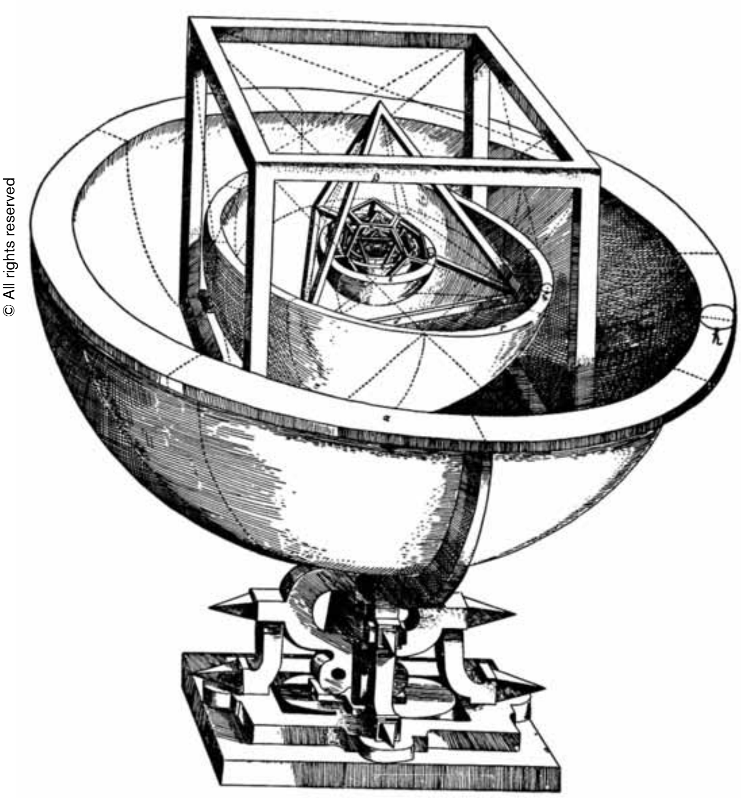
The Copernican system.

Such an achievement as Kepler's could be interpreted as a change in world-view only by astronomers themselves, while the disclosure of mountains on the moon had the effect that anyone looking at the Moon could no longer see it as a perfectly polished celestial body, radically different from the earth.

Once the Moons of Jupiter ("which had been invisible to everyone until now", writes Galileo) had been seen (even if Galileo was for a time the only one who had really seen them, with the exception of Kepler who, as a professional astronomer, was clever enough to adjust the instrument Galileo had sent to him, to his own eyes), the thought that their movement around Jupiter itself should take them outside the celestial sphere "behind" the spherical surface on which Jupiter was supposed to be located, could occur to anyone willing to think seriously about it. As a consequence, the world could no longer be restricted to the space inside the celestial sphere. Even worse: the earth could not be located at the centre of the universe (this is what Sigmund Freud later called the first of three humiliations inflicted upon human narcissism, the other two being Darwinian evolution and Freud's own discovery of the Unbewusst).

The infinite universe

The "closed world" picture had lost its coherence and does not conform to observation. But what about the "infinite universe" Koyré alludes to? That the closed world has been burst open does not necessarily imply an infinite size for the universe. The question here is that of the physical reality of infinity. It is well known that Kepler objected to the idea of an infinite universe on the ground that such an entity would accommodate regions devoid of matter – which was pure non-sense according to his views: space without matter is nothing, it simply does not exist. Galileo is more subtle and ambivalent on this matter. He refuses



Kepler's model of the universe, based on five regular polyhedra.

to identify the inertial movement (the one which is comme nullo) with translations at uniform speed, on the ground that the mobile would then be taken to infinity, which he finds unrealistic. At the same time, by destroying the idea that the cosmos is structured by a hierarchical order (the perfect and eternal heavens as opposed to the corruptible and instable Earth), he introduces the idea of a universe whose spatial structure is uniform, free of any natural hierarchy, and without any reference to a world of values, a world where all points are on the same footing. In other words, a Euclidean geometrical space, including infinity in its definition, on which the mathematization of physical world, i.e. modern physics, relies.

No doubt we would not be celebrating Galileo's astronomical discoveries with such ceremony had they not led to the foundation of "modern science". By replacing the hierarchical structure of space by the uniformity which characterizes geometric spaces, Galileo made it possible for geometry, and more generally speaking, mathematics, the application of which had been up to then (from the time of Greece on) restricted to understanding the movements of perfect celestial objects, to become part of the explanation of terrestrial phenomena, no longer considered less perfect than celestial ones.

The Serpents star cluster, at some 8,484 light years from Earth. Photo taken with the infrared Spitzer Space Telescope.

Three centuries later, in 1919, Einstein, Galileo's direct heir, not so much as concerns his astronomical discoveries as his project for the mathematization of nature, having painfully worked out his so called "general theory of relativity", came to realize that this physico-mathematical theory, intended as a theory of gravitation, was in fact a theory of the universe itself – therefore a cosmology. The entanglement of astronomy and cosmology, which had been crucial to the birth of modern science, ended in the absorption of cosmology by science: cosmology had become a branch of physics.

Françoise Balibar,
Professor Emeritus of Physics
at the University of Paris – Diderot
Author of
Galilée: Le messager des étoiles
(with Jean-Pierre Maury),
Gallimard, 2005 and
Einstein : Decoding the Universe,
Abrams, 2001.

The Apollo 11 Mission and Galileo's observations, whose respective 40th and 400th anniversaries we are celebrating this year, confirmed discoveries with the naked eye almost a millennium ago by the Arab polymath Alhazen - a man ahead of his time who determined the future of astronomy.

OVER THE MOON

UNESCO welcomes the Apollo 11 astronauts: N. Armstrong, E. Aldrin and M. Collins. 8 October 1969.

Millions around the world held their breath on 20 July 1969, as the United States' Eagle lunar module touched down in the Moon's Sea of Tranquillity – without making a splash! Despite its name, the Sea of Tranquillity does not contain a single drop of water. Instead, it is covered with volcanic rocks which flowed some 3 to 4 billion years ago, as lava. The quirky name, however, is reminiscent of a once popular theory explaining the Moon's appearance from Earth. As Italian painter and scientist Leonardo da Vinci wrote in his Codex Leicester, "The luminous part of the Moon is water, which has been stirred up by the winds."

You might be forgiven for thinking that a scientific explanation for the Moon's appearance was not practically possible – that is until Italian astronomer Galileo Galilaei turned his telescope towards the night sky 400 years ago. Now enter Alhazen, or Ibn Haitham (965-1040), an Iraqi scientist working at the turn of the first millennium near Al-Azhar mosque in Cairo, and dubbed the founding father of modern optics. Among a number of major contributions, he answered one of the most intriguing questions faced by science: what gives rise to the dark figure in the Moon's face.

Mystery solved

This phenomenon had been the subject of much speculation since antiquity, resulting in numerous extravagant theories. Half a dozen of these, at least, were explored by Alhazen in his work The Trace on the Moon's Face. Here, he showed that none of the theories examined made predictions that agreed with observational evidence. He put each candidate theory to the test using some crucial observations, most notably the fact that the figure in question always appears constant in terms of positioning, size, shape, and darkness.

For instance, he ruled out the theory that the dark figure was an image of Earth's oceans and mountains reflected on the Moon's mirror-like surface. Based on the law of reflection, he showed that the Moon's changing angle with respect to an observer on Earth meant that any such image had to change with time – which is obviously not the case.

A couple of other theories were written off based on similar arguments. Firstly, that the dark figure is a shadow caused by dramatic lunar features such as mountains and craters. This time, Alhazen argued that the Moon's changing orientation with respect to the Sun meant that any shadowy patterns had to also change with time – flying in the face of empirical evidence.

And secondly, that the dark figure is caused by a vaporised substance ever present between the Moon and Earth. He argued that if this were true, observing the Moon from different Earthly locations would show the vaporised substance against different parts of the Moon, if not outside the Moon altogether!

© NASA

Have you ever wondered what gives rise to the dark figure on the Moon's face?

Solar eclipses – something of a laboratory for physicists and astronomers – enabled Alhazen to rule out yet another exotic theory: the dark figure is a transparent region in the lunar body. If this were true, asked Alhazen, why doesn't sunlight shine through it during an eclipse of the Sun?

Moonlight, Alhazen concluded, can only be adequately explained using the phenomenon of diffuse reflection – that is, reflection from a rough surface. Further, the Moon does not reflect light in any other way. What gives rise to the dark figure, he explained, is the fact that its material, because of its different optical properties simply reflects less light!

Date with the Moon

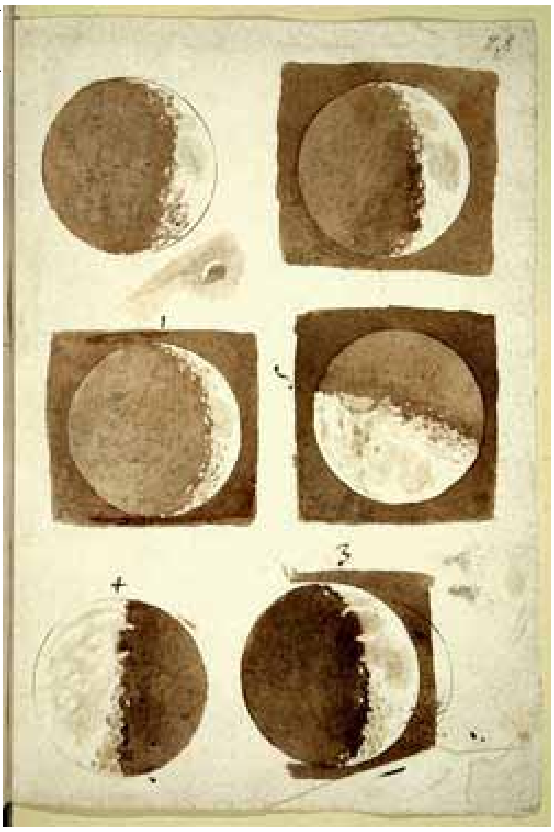
Although, astonishingly, Alhazen made his lunar discoveries based on observations with the naked eye, the study of the visual and magnifying properties of lenses was in fact launched with his Book of Optics. This new understanding of the lens, based on geometry and experiment, underpinned the craft of the Dutch spectacle-makers who, by holding one lens in front of another, invented the telescope, enabling Galileo to revolutionise astronomy.

In December 1609, hunting for the unexpected, Galileo used a 20-fold magnification telescope to observe the Moon. He could make out mountains, craters, and what he wrongly thought were seas (i.e. water). We now know, from lunar samples collected by Apollo missions (1966-1972), along with a certain amount collected by Russia's robotic Luna missions (1958-1976) that lunar maria are covered with dark rocks (basalts) – confirming Alhazen's basic conclusions about the make-up of our closest neighbour.

The two men are immortalized on the Moon: there is a lunar crater, Galilaei, celebrating Galileo's discoveries. Another crater, Alhazen, celebrates Ibn Haitham's.

Ambitious projects such as the IYA2009 could inspire the "next big thing" in astronomy. Soon the entire night sky will be continuously scanned by space as well as Earth-based telescopes, across many wavebands, churning out terabytes of data. The next 40 years, let alone the next 400, could well see another revolution in astronomy.

Hatim Salih
is a Sudanese researcher in quantum computing and a member of the York Astronomical Society (United Kingdom).



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Looking at the Moon with his newly made telescope, Galileo discerned mountains, craters, and what he thought were seas.

LOOKING FOR WATER ON THE MOON


© NASA

Launch of LCROSS and LRO on 18 June 2009.

The Lunar Reconnaissance Orbiter (LRO), and its sister mission LCROSS, launched by National Aeronautics and Space Administration (NASA) last June, are the first in a series of unmanned missions scouting for the return of astronauts to the Moon. Tantalizingly, in 1998, NASA's Lunar Prospector found an excess of hydrogen in the frigid, permanently shadowed craters at the Moon's poles, indicating the possibility of water ice.

"The only way you're going to know if it's water ice is by sticking your finger in it," says Alan Binder of NASA. That's exactly why LCROSS won't be around for long. Having hitched a ride with LRO, LCROSS is currently in an unusual orbit around both the Earth and Moon, and is set to impact the lunar south pole on 9 October 2009. But why the wait?

One reason is to give LRO time to remote-sense the lunar south pole, where ancient comets and asteroids might have deposited water. Data from LRO will help decide which exact crater to excavate. Another reason is to drag LCROSS's impactor, called Centaur, in space long enough to rid it of residual fuel (containing both hydrogen and oxygen), which could contaminate results. Yet another reason is to time the impact so that observatories in Hawaii (USA), with their sophisticated water detecting capabilities, can tune in. "The goal is to muster as many eyes and instruments as possible," says LCROSS Principal Investigator Tony Colaprete.

In fact anyone in Hawaii, up to the Mississippi region, with a 10 to 12 inch diameter telescope or larger, should be able to witness the event! If everything goes according to script, Centaur will hit the lunar south pole with an energy equivalent to what you get from 100 million 60 Watt light bulbs in a second, kicking lunar debris that has not been exposed to sunlight for billions of years, more than 2 kilometers up, enough to clear the crater's rim. LCROSS will then fly through the ejecta cloud looking for watery spectroscopic signatures in the dust-dimmed sunlight, before plunging into the Moon's south pole four minutes later.

Discovery of bits of ice hidden at the lunar poles could be invaluable for any sustained human presence in space. For one thing, transporting water from Earth into space is highly costly. And the fact that the Moon's gravity is only one sixth of Earthly gravity means that you need smaller rockets to launch space missions from the Moon that go the same distance. The implications of LCROSS could therefore be, quite literally, far reaching. If future astronauts could extract lunar water for human consumption and for making rocket fuel, perhaps the 'one giant leap' of setting foot on Mars will become, sooner than we imagine, 'one small step' away.

H. S.

A STORY AS OLD AS THE WORLD

The movements of the Sun and the phases of the Moon have synchronized human activities, particularly rituals and agriculture, for thousands of years. At its inception, astronomy was primarily used to measure time. Calendars have played an essential role in people's lives. We revisit the astronomy of ancient China, the Mayans and the medieval Islamic world with the astronomers Zhao Gang, Julieta Fierro and George Saliba.

From interviews at the launch of the International Year of Astronomy at UNESCO (January 2009), by Weiny Cauhape, Lucía Iglesias Kuntz and Katerina Markelova.

Cuneiform tablet containing ancient observations of the planet Venus (7th century BC).

The two Chinese characters for the word universe ( ) denote the union of time and space" explains Zhao Gang, deputy director of the Chinese observatory. He continues "it is indeed difficult for man to conceive the infinity of space-time and, moreover, it has not yet been scientifically proven."

"Our ancestors believed in the idea of harmony between man and the sky", he says, explaining that before starting any important activity they would first consult the stars. "Livestock and agriculture were in effect the two pillars of Chinese society during Antiquity. That is why agricultural calendars were a central concern for astronomers, along with manufacturing astronomical instruments and the observation of astronomical phenomenon."

"Even our lunar calendar used today is founded on the scientific method applied by Luo Xiahong (140-87 B.C), author of Tai Chu, the first written Chinese calendar", highlights Zhao Gang. Luo Xiahong is equally well known for having calculated the precise frequency of solar and lunar eclipses over a period of 135 months and for also having perfected the spherical astrolabe, which during Chinese antiquity was the main tool for predicting the positions of the stars.

Another famed calendar was reated by Guo Shoujing (1231-1316). Developed under the Yuan dynasty, the astronomer calculated that the Earth's revolution around the Sun takes 365.2425 days. This extremely accurate calendar was created 300 years before the Gregorian calendar which uses the same calculation and is universally accepted today.

It is estimated that from the 24th century B.C an official at the court of emperor Yao was specifically instructed to observe the sky and astronomical phenomenon as well as tell the time. But the most ancient written information comes from ruins of the Yin dynasty (during the 14th to 11th centuries B.C). From these sites inscriptions on tortoise shells and bones tell us about the Sun and Moon, planets, comets, stars and meteor showers.

The most ancient astronomical book known today comes from the Era of Warring States. The work entitled "Gan Shi Catalogue of Stars" (5th-4th centuries B.C) lists no fewer than 800 stars, including 121 with exact known positions.

A particularly interesting document from Chinese astronomical history is the "Map of Dunhuang", which contains over 1300 stars (see photo). Created in the 7th century on a roll of Chinese paper about 4 metres in length, it is considered one of the oldest celestial atlases in the world.

Uniting the heavens and the earth

"The Mayan civilisation spread over an enormous territory including south-east Mexico and parts of Central America. Their year was organised according to rainy and dry seasons and therefore the calendar had fundamental importance for organising civil life, building monuments and agriculture", explains the Mexican astronomer Julieta Fierro Gossman, winner of the UNESCO Kalinga Prize for the Popularisation of Science (1995).

Onstage with a suitcase full of masks, sticks and cards – props for her performance – the expert in Mayan astronomy used stories and images to illuminate this fascinating culture, and concluded by handing out paper butterflies. A regular figure on television and radio, as well as at universities and schools both in

© British Library

China: The map of the heavens of Dunhuang is the most ancient map of the stars found to date.

Mexico and abroad, Fierro spreads the message that science can be brought to everyone, provided they lift their eyes to the sky.

"The main Mayan buildings were built with a view to measure time" Fierro reflects, before highlighting the story of Chichen Itza (a UNESCO World Heritage Site). This site was designed so that during the equinox the Sun cast a shadow onto the pyramid resembling a serpent descending the staircase – this symbolised Kukulkán, god of resurrection and reincarnation, also known as "feathered serpent". "This effect was achieved by first building small models of their monuments" allowing them to calculate exactly how and where to build.

"The sophisticated level of Mayan astronomy, which still astounds scientists today, can also be seen in the codices, made from bark, and stele, engraved stone to stone, that survived the Spanish conquest. Yet, the different measuring devices they used weren't as complicated as astrolabes - they used merely two sticks. One had to be horizontal and the other placed at the altitude of the celestial objects – this way they could draw the different paths of the Sun, Moon, Venus and Mars and know when special events such as eclipses would happen" Fierro explains. The design of the temple at Bonampak for example, shows that they observed the Milky Way, which they called "Wakah Chan" and is portrayed in the beautiful frescos within the temple. It is embodied as a deity in the form of a snake which according to their beliefs united the heavens and the Earth.

The Mayans used both the astronomical calendar (or solar, 365 days), similar to that found in other cultures, and another religious calendar with a 260 day year, reflecting the time taken to bear a child. These two calendars coincided every 52 solar years. This was marked by a grand ceremony in which every house fire was put out and then relit to signify renewal.

The missing link

Contrary to popular belief Islamic astronomy is not the docile pupil of Greek astronomy. While the heavenly science may have been in slumber in Europe between Antiquity and the Renaissance, it had extraordinary momentum in the Islamic world during the Middle Ages, reflects George Saliba, professor of Islamic and Arab science at Columbia University in New York (United States). This is particularly true of the Caliphate of Baghdad, who under the reign of al-Mamun gathered the wise men from the empire and encouraged them to translate ancient Greek, Indian and Persian texts into Arabic.

According to Saliba, simply being a good linguist wasn't sufficient for being a good translator. You also had to be equipped with a strong scientific background. So much so that some translators even corrected the masters - the great Ptolemy was refuted more than once.

When, for example, in 829 al-Hajjaj translated the celebrated Almageste, the "great book" of mathematics and astronomy, he took the opportunity to recalculate the duration of the lunar month and included the correct figure. Ptolemy had published an incorrect calculation, taken from the Babylonians, without having verified it.

In 1375 Ibn Al-Shati also improved Ptolemy's highly complex "Earth-Moon-Sun" model. The model is based on Arab knowledge and is almost identical to that proposed by Copernicus in 1543, the difference being that the Earth and not the Sun was the centre of the universe. Saliba wonders whether Copernicus's model was not even directly inspired by the works of Ibn Al-Shati. Especially given that their diagrams both represent the three celestial

© British Museum

A brass astrolabe (Ispahan, Iran, 1712).

bodies and use the same symbols in the same places, only with Arabic characters in one and Latin in the other. Could this be the missing link between the Ptolemaic system and Copernicus's heliocentric system?

One thing is certain: thanks to their technology, Islamic astronomers perfected observations of the sky and through their meticulous calculations they fine tuned the mathematics of astronomy. We cannot deny, as Saliba states, that "they redefined nearly all the parameters at the foundation of Greek astronomy."

TOWARDS A MAP OF THE UNIVERSE

On May 14, 2009 the Planck satellite was launched into space aboard the Ariane 5 rocket from the Kourou aeronautical base in French Guyana. This European Space Agency (ESA) mission will help us to improve our understanding of the universe. A 2006 Nobel Laureate in physics, Professor George Fitzgerald Smoot, explains more.

George Fitzgerald Smoot was awarded the Nobel Prize in Physics along with John C. Mather for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation. Their discovery follows a quarter of a century after the initial discovery of Cosmic Microwave Background radiation (CMB) by Arno A. Penzias and Robert W. Wilson. Mr. Smoot began his scientific career by obtaining dual bachelor's degrees in Mathematics and Physics from the Massachusetts Institute of Technology *(MIT). It was there, after obtaining a doctorate in particle physics, he first began to turn his attention towards cosmology. He subsequently started working for the* Lawrence Berkeley National Laboratory *in the early 1970s where he collaborated with Luis Walter Alvarez, a 1968 Nobel Laureate in Physics.*

Professor Smoot took part in the UNESCO sponsored international symposium, "The Invisible Universe", *held at UNESCO in Paris from June 29 to July 3. During his visit he gave an interview to French science journalist Dominique Chouchan.*

You were one of the principal architects of COBE, the first satellite to observe the CMB in 1989. What are your thoughts, 20 years later, on the Planck mission?

I recall that as soon as we had made the COBE discoveries and made the announcement, I was already thinking about what was next. I had colleagues Nazzareno Mandolesi and Marco Bersanelli from Italy visiting for a month. We met together and outlined possible missions. We eventually proposed what became COBRAS (COsmic Background Radiation Anisotropy Satellite). At the same time the French people here, mostly from Orsay, but some others as well, proposed SAMBA (Satellite for Measurement of Background Anisotropies).

Later on they merged and eventually it became COBRAS-SAMBA and then it became Planck. Once we made the discovery that the radiation was sure and that there were these fluctuations in the early universe to map, then the fluctuations became this tool where you could discover the geometry and constituents of space and check to see if the laws of physics re-main constant over time and valid over all of space time. What was needed was to make a much more precise set of maps using these fluctuations.

Therefore, one of the objectives of the Planck mission is to make these more precise maps of the early universe?

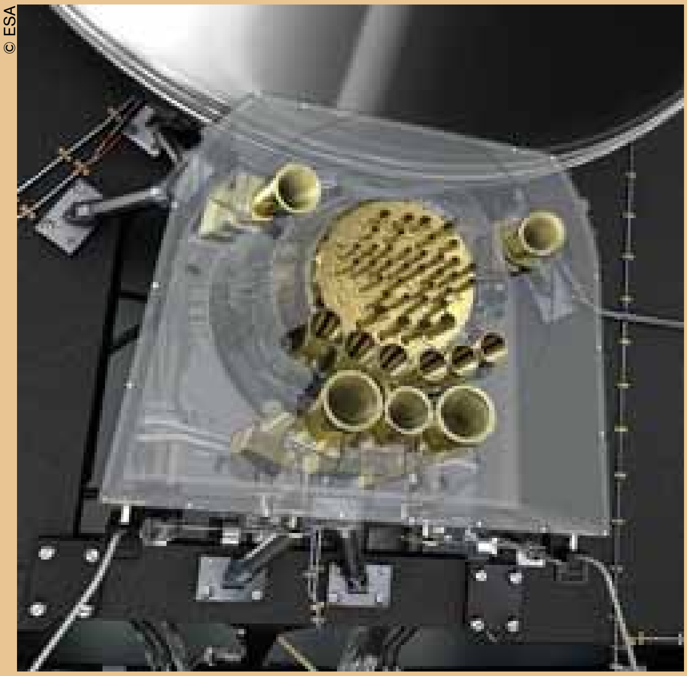
Its objective is to make a beautiful map to measure very precisely the embryo universe by using the light from the beginning of the universe. In order to accomplish this task the detectors and the cooling system had to be very high-tech and the way to send the data back is also very complicated.

In order to explain the importance of measuring with such precision the radiation and its fluctuations, I will use an analogy. If you have two bells that you hear are struck, you can tell which one is bigger. If they are made of the same material, the bigger one will be the lower frequency because the wavelength is longer. If you have two bells, one made of iron and one made of brass, and you strike them both, you can tell the constituents of the bell by the harmonics you hear. It's the same for the early universe, it's a precise analogy. The sound speed is affected by what the early universe is made out of and by measuring precisely you can tell what the universe is made out of.

When will astrophysicists receive the first data from Planck?

We're already getting some data, but it takes at least 6 months before you have seen even the sky and it takes 14 months before you have seen the whole sky enough times so that you have a complete sky map. Nothing will be released to the public for some time because it's going to take a while to analyze the data and the team is so large (400 scientists) and they have a lot of comments to make. So, I think it will be 2 to 3 years.

THE PLANCK MISSION AT A GLANCE



On board the Planck satellite.

Did the universe begin with a Big Bang? This question remains a source of controversy. However, for the supporters of this theory, which are the majority in the astronomical community, the observation of relic radiation (the electromagnetic radiation present in the universe at a time when matter and radiation existed separately), and in particular the measure of its fluctuations, should allow us to see around 380,000 years after the famous Big Bang.

These low frequency microwaves, also referred to as Cosmic Microwave Background Radiation (CMB), are a remnant of the hotter anterior period. Its fluctuations, or its heterogeneities according to observations (anisotropies), provide a key to understanding the formation of visible matter (stars, galaxies, etc.).

The Planck Mission of the European Space Agency follows in the footsteps of the COBE (COsmic Background Observer) satellite launched by NASA in 1989 and the WMAP (Wilkinson Microwave Anisotropy Probe) also launched by NASA in 2001. The two detectors aboard the Planck satellite have been designed to be 50 times more sensitive in detecting fluctuations in relic radiation than that of its predecessor WMAP, which had already been 30 times more sensitive than the original instruments aboard the COBE satellite. They cover complementary ranges of frequencies: one of the detectors is under the direction of Jean-Loup Puget, Director of the IAS (Institut d'Astrophysique Spatiale) located in Orsay, France, the other is headed by Nazzareno Mandolesi of the Istituto di Tecnologie e Studio delle Radiazioni Extraterrestri in Bologna, Italy.

D. C.

Will the results from Planck definitively confirm the Big Bang Theory?

The thing about science is that you never prove anything, you only support it. It's like the theory of evolution. Do you know how strong the evidence is for evolution? You can map DNA, and so forth. It's a theory. But it is very, very accurate and has very many cross-checks. For the universe, 20 years ago we used to not have as much evidence, now we're getting much more. The predictions so far have been check, check, check. The fact that I am still talking about the Big Bang Theory and putting checkmarks down tells you so far, so good. But the fact that there are so many checks means that now we have it really, really narrowed down.

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Drawing of the constellations in the Southern hemisphere by Joannes Janssonius(1661).

When pondering to such length the secrets of space and time, do you feel more like a scientist, a poet, a philosopher, or all three?

Sometimes I have to become more of an artist and philosopher because that's what people relate to and not to the technical details. All they care about is the real structure of space and time and what's possible and what's not possible. What we know today probably tells you that time travel is not possible. Is that philosophy or is that science? Well, it's a mixture. It's like people who cook. Are they chemists or are they artists? Well, a good cook is both. And so a really good scientist will be a scientist, artist and a philosopher.

But you remember the Greek word for science is "natural philosophy". It's only because science has been so extraordinarily successful that philosophy is now the domain about what we don't know and science is the domain about what we do know. There are just so many incredible and beautiful places on earth. It's hard when you go into the forest and you see all these interconnected species to not see the hand of God. But when you step back and you see evolution, then it becomes very natural. But it doesn't mean it's still not beautiful. If you see a rainbow and you know how the rainbow works, it still doesn't mean it's not beautiful. I was once asked "Are you reducing man to a jiggling string of corks? Isn't that dehumanizing? Doesn't that take away the soul?" I said, "Not necessarily. Sometimes there is even more beauty in understanding how the machine works."

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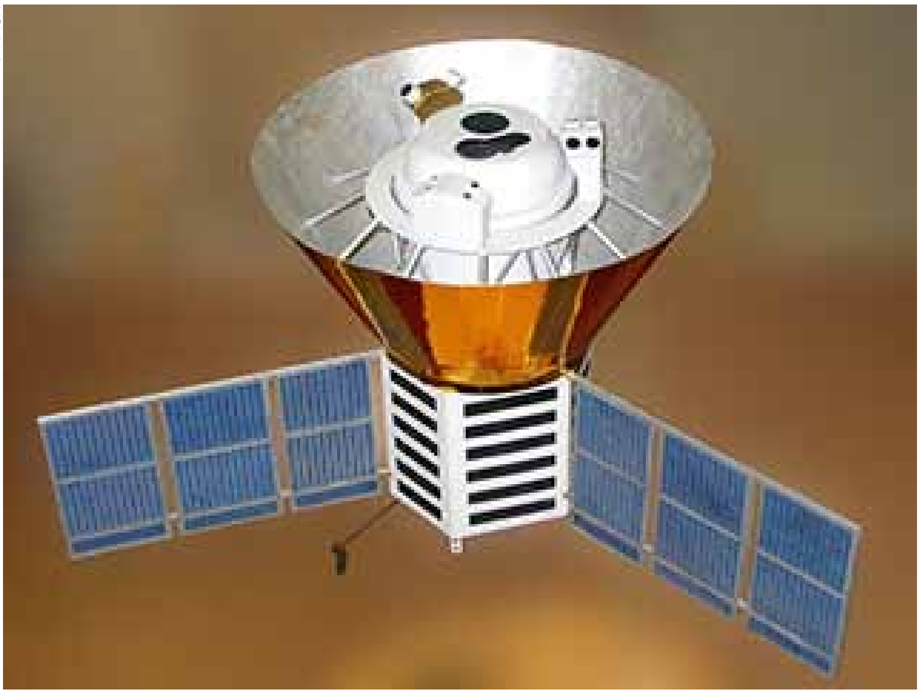


COBE was the first satellite to observe cosmic radiation in 1989.

Does the discovery of extrasolar planets mean the discovery of extraterrestrial life? During a UNESCO conference marking the International Year of Astronomy three world renowned scientists, Lord Martin John Rees (United Kingdom), Jonathan P. Gardner (United States) and Françoise Combes (France), tackled the question from different perspectives.

EXTRATERRESTRIAL LIFE: SURPRISES IN STORE?

Lord Martin John Rees at UNESCO for the launch of the International Year of Astronomy (January 2009).

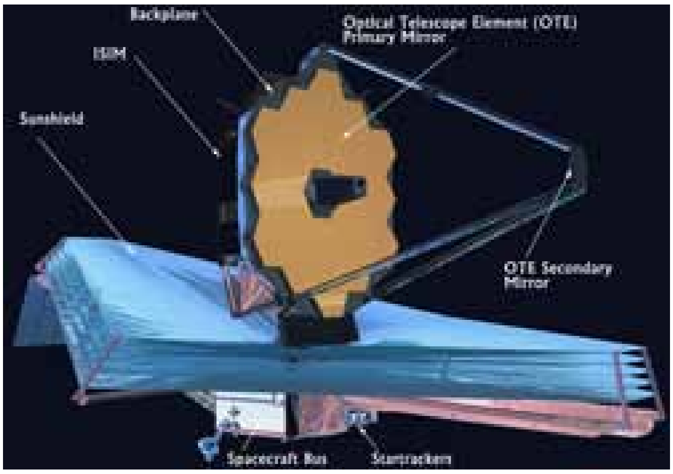
The search for extraterrestrial life is a fascinating aspect of the work of Martin John Rees, Baron of Ludlow, whose current research deals with cosmic structure formation, especially the early generation of stars and galaxies that formed relatively shortly after the "Big Bang". The Astronomer Royal, President of the Royal Society, Master of Trinity College and Professor of Cosmology and Astrophysics at the University of Cambridge believes we will soon answer the question "Are there other forms of life in the universe?", as he told Cathy Nolan (UNESCO).

Maybe they're out there. We can't say because we don't know how life began on earth, so we don't know how probable it is. And of course even if simple life is common, we don't know whether it always evolves into complex life, so there could be another planet where there are just bugs, or ants, nothing else.

I think it's stupid to have convictions about a topic where we have no idea. I think we should not be surprised either way. It could be that we are the only life in the galaxy. It could be that there's a lot out there. But it's a very important question and probably this century we will settle it.

It's important, but I wouldn't want

everyone to work on it, because it may be impossible. If you're a scientist, I think it's best to work most of the time on a topic where you are sure to make some progress. Mainly, it is certain that we will discover lots more planets around stars, even if we don't know if there's life on them. That's a very important subject. And we'll understand galaxies more, we'll find even more distant galaxies and do better calculations. We'll understand much better what happened (at the very beginning to create life on Earth), that's the main thing. As a bonus, we may find some real surprises!



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The future James Webb Space telescope.

Galileo's telescope measured only a few centimeters in diameter - that of some modern telescopes reaches up to 10 meters. What discoveries do they hold in store for us? According to NASA's project manager Jonathan P. Gardner, the launch of the space telescope James Webb in 2013 may herald an entirely new phase in aerospace research.

In just the last 10 or 20 years, using large new telescopes on the ground and Hubble and other telescopes in space, we have made a tremendous number of discoveries that have revolutionized what we know about the universe. With upcoming missions like James Webb, the next 10 or 20 years promises to be just as exciting!

Recently, a couple of planets were detected through direct imaging, which is very exciting. Most of the planets discovered to date are big ones like Jupiter. A small, rocky planet like the Earth is a lot harder to detect. Future telescopes will be able to find smaller planets and tell us a lot more about them.

The next big step will be the James Webb Space Telescope, which is Hubble's successor. After it is launched in 2013, it will be able to study the atmospheres of transiting rocky planets.

What astronomers really want to do is to find "biomarkers" such as ozone and methane in the atmosphere of an Earth-like planet that is warm enough to have liquid water on its surface. That would be a good indication that the planet has life: bacteria, plants, and maybe animals. We don't know if Webb can do that. We'll try.

In 1995 two Swiss astronomers, Michel Mayor and Didier Queloz, made one of the most remarkable discoveries of the century. They detected a celestial object orbiting a star that was not our Sun. It became known as 51 Peg b – the first extrasolar planet. Suddenly, the search for extraterrestrial life seemed more promising. "Not so fast!" warns Françoise Combes, an astronomer at the Paris Observatory and member of the French Academy of Sciences. "There could be thousands of solar systems neighbouring the Sun, but that does not mean we can see them." She tells the UNESCO Courier's Katerina Markelova about some of the questions at the centre of current research into exo-planets.

If we were anywhere else in our galaxy, on a distant celestial object, we would never have been able to detect Earth with the observation facilities available to us at present. Our instruments are simply not sensitive enough to see small telluric [rocky] planets like ours. Of the 353 exo-planets, or extrasolar plants, that have been

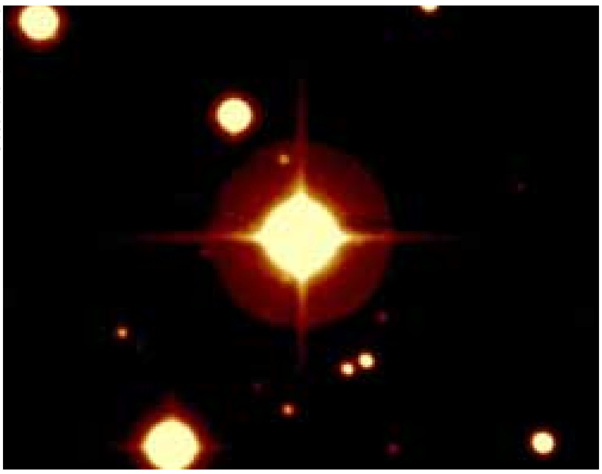
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Image taken by the CFH telescope (Canada-France-Hawaii) of the star around which CoRoT-Exo-7b orbits.

discovered so far, the majority are "hot Jupiters", large gaseous planets that orbit very close to their stars. The time it takes them to make a complete orbit is therefore very short. Planets that are further out can take hundreds of years to travel the full distance around their stars. It would take several human lifetimes to see them.

A series of methods can be used to detect exo-planets. There is the transit method: when the planet passes in front of its star, it obscures it slightly. Some 59 planets have been discovered this way, to date. Seven other planets have been discovered using so-called 'gravitational lensing', where light rays from a star are deviated by the gravitational field of a massive celestial object on the same visual axis as the star. But most exo-planets have been detected using the Doppler effect, which allows us to measure the disturbance of the speed of the star as its planet passes close by.

In 2006 the French National Centre for Space Studies (CNES) put the Corot (Convection, Rotation and Planetary Transit) satellite into space with the mission of finding exo-planets similar to Earth. This February, Corot discovered what was then the smallest exo-planet ever observed - Corot-Exo-7b. Its diameter is barely1.8 times that of Earth, its period of revolution is just 20 hours and it has a temperature of between 1000 and 1500°C. Its density has not been determined precisely, but it is without doubt a rocky object like Earth.

The European Space Agency (ESA) is currently studying the possibility of launching the Darwin satellite, which will mostly be used by 'exo-biologists', as it is designed to detect traces of water and oxygen in the atmosphere of exo-planets.

© Auger Observatory

The Observatory's office building.

PIERRE AUGER OBSERVATORY

On 14 November 2008, the Pierre Auger Observatory was inaugurated in Malargue, Argentina. The Observatory is exploring the mysteries of the highest energy cosmic rays – charged particles showering the Earth at energies 10 million times higher than the world's highest-energy particle accelerator. Launched more than a decade ago under the auspices of UNESCO, the observatory is a network of 1600 sensors spread over 3000 km^2 in Argentina.

The Auger Observatory is a 'hybrid detector', employing two independent methods to detect and study high-energy cosmic rays. One technique detects high energy particles through their interaction with water placed in surface detector tanks. The other technique tracks the development of air showers by observing ultraviolet light emitted high in the Earth's atmosphere.

It was at UNESCO Headquarters in 1995 that the international collaboration in support of the project formally got off the ground after Argentina's offer to host the southern Pierre Auger Observatory was gratefully accepted by all parties. On 13 October 1998, the finance board of the Pierre Auger project met at UNESCO Headquarters to work on the agreement underpinning the organization, management and funding of the project. The meeting was graced by the visit of then President of Argentina, Carlos Menem, who announced that construction of the Pierre Auger Observatory could begin early the following year. The project formally came into being in March 1999 with the signing of an agreement, two months before construction of the detector began in Argentina.

The project is named after former UNESCO Science Director Pierre Auger (1948-1958), who died in 1993. He is perhaps best-remembered for UNESCO's key role in the founding of the European Organization for Nuclear Research (CERN) near Geneva, which launched the Large Hadron Collider [gigantic particle accelerator used by physicists to study the smallest known particles].on 21 October last year.

Pierre Auger's scientific speciality was experimental physics, in the fields of atomic (photo electric effect), nuclear (slow neutrons) and cosmic ray physics (atmospheric air showers). After his service with UNESCO, he served as Director of the Cosmic Physics Service at the French National Centre for Scientific Research (1959-1962) and as Director-General of the European Space Research Organization (1962-1967).

The Pierre Auger Collaboration involves about 350 scientists from Argentina, Australia, Bolivia, Brazil, the Czech Republic, France, Gemany, Italy, Mexico, Netherlands, Poland, Portugal, Slovenia, Spain, UK, USA and Vietnam. Nobel Laureate in Physics, James W. Cronin, of the University of Chicago, conceived the Pierre Auger Observatory, together with Alan Watson of the University of Leeds.

The first research results from the Pierre Auger Observatory have given fresh insights into the properties of the highest energy particles in the Universe. These findings are summarized in a paper published in Science in November 2007.

Now begins the project's second phase, which includes plans for a northern hemisphere site in Colorado (USA) and enhancements to the site in the southern hemisphere.

World of Science,
Vol. 7, No. 2, April–June 2009

We have no reason to think that the planets in our solar system represent every type of planet in existence, according to the Swiss astrophysicist Michel Mayor, who discovered the first extrasolar planet with Didier Queloz in 1995. Last April, his team at the Geneva Observatory discovered the smallest exoplanet known today.

ASTRONOMY : THE THREE TIERS OF RESEARCH

© John Whatmough

An image of 51 Peg b, the first exo-planet discovered by Michel Mayor and Didier Queloz in 1995.

Interview by Marie-Christine Pinault-Desmoulins (UNESCO).

The great scientific discoveries are often the result of chance. Was this the case for the first planet discovered outside of our solar system?

No, it wasn't a stroke of luck if that's what you mean. It was the outcome of a long process of research and the development of instruments to accurately measure the speed of stars. The spectrograph called ELODIE at the Provence Observatory [France] allowed us to detect the first exoplanet and was designed precisely in order to look for planets outside of out solar system.

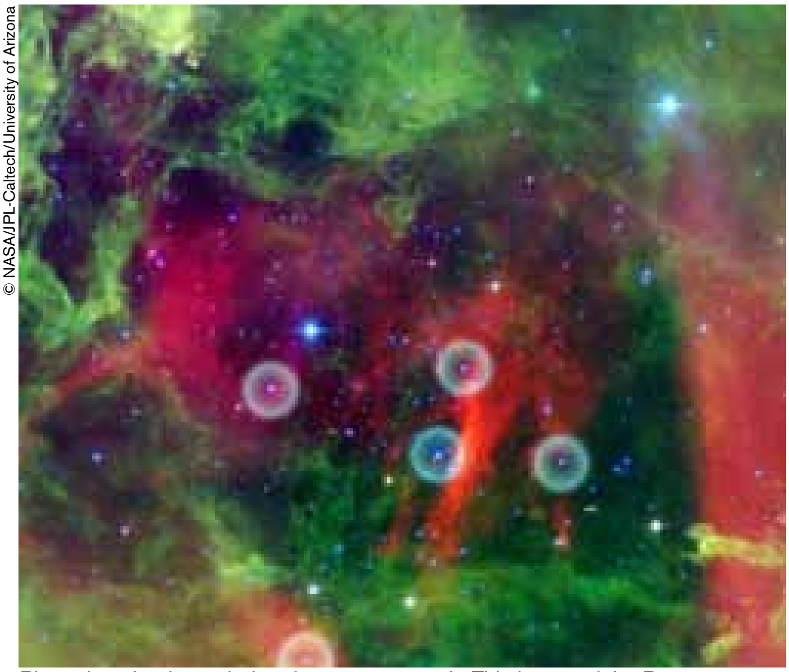
Where we were lucky was in discovering some planets that revolved around their orbit very quickly. The orbital period of 51 Pegasi b is only 4.2 days. To give you an idea, by contrast the orbital period of Jupiter is 4332.71 days - approximately 10 years. It is without doubt that objects with a shorter orbital period are easier to discover and observe. In a few nights you can make observations that in other cases would take you 10 or 20 years.

What is your most important current research?

In the short run, I would say that the research follows three main themes: comparative planetology, the detection of lighter planets and planetary imaging.

The first field combines data from satellites and ground instruments to determine the average density of planets. These studies aim to know the physics of planets. This is very important since we have no reason to believe that the planets in our solar system represent every type of planet. In theoretical terms we can predict that, for example, there are planets made of melted ice. This would be the case with Neptune. If it approached the sun its surface would be covered with oceans. But this sort of ocean would have nothing to do with the type of ocean we have here on earth because it wouldn't have a rocky bottom

Regarding the search for lighter planets, you must know that until recently we've been able to detect extra solar planets that are as small as four times the mass of Earth. That's already almost 100 times lighter than Jupiter! In our jargon, we call



Planet imaging is a priority of current research. This image of the Rosette Nebula, situated 4500 light years from earth, was taken by the infrared spatial telescope Spitzer.

Michel Mayor, who discovered the first extra solar planet, participated in the launch of the International Year of Astronomy (UNESCO, January 2009).

them "Super-Earths". But thanks to new instruments we have discovered a telluric exoplanet only two times the mass of earth. [Note, the Geneva Observatory announced the discovery of Gliese 581 E on the 21 April.]

These discoveries are made by indirect measures. At the same time, planetary imaging that allows us to see the exoplanets directly is taking off. At the end of last year, we had great success in obtaining images of some very large young planets. But please note this doesn't mean we will now be flooded with images, because the vast majority of exoplanets cannot be seen easily: either they are already cold, or they are too close to their stars.

Currently, the Geneva Observatory is in the process of developing, in collaboration with partners, a tool called SPHERE for direct imaging of exoplanets, which will allow us to see these tiny planets. It should be operational in 2011. More than 200 people have been working on it for over 5 years.

Is there much international collaboration in the field of astrophysics?

Currently the most common collaboration is person to person. There isn't any real international collaboration. It must be said that in certain areas it isn't necessary or even desirable: competition is positive. However, the search for life in the universe necessitates international collaboration. This field requires considerable resources and it is probable that the existing organizations aren't adequate for promoting this type of mission effectively.

This ambitious mission has largely been put on hold for budgetary reasons, both from ESA (European Space Agency) and NASA (National Aeronautic and Space Administration of the United States). Some researchers dream of a type of institution which could coordinate these studies on a global scale, but for the moment this is wishful thinking.

"Gross National Happiness" through literacy

"The Thief of Words" (2008)
by Jaume Plensa (Barcelona, Spain), one of the most important international sculptors.

Innovative literacy projects in Afghanistan, Burkina Faso, India and the Philippines are the winners of this year's UNESCO International Literacy Prizes, while a programme in Bhutan received an Honourable Mention.

Since 1967 UNESCO has awarded annual International Literacy Prizes to outstanding efforts in the field of literacy and non-formal education. The current prizes are the UNESCO King Sejong Prize (supported by the Republic of Korea) and the UNESCO Confucius Prize for Literacy (supported by the People's Republic of China).

Throughout the years, these prizes have rewarded over 450 literacy projects and programmes undertaken by governments and NGOs around the world. The theme for this year's Prizes was "Literacy and Empowerment."

The **Pashai Language Development Project** is a community-owned initiative that has defied war, cultural hostility to female education and a lack of an existing writing system for the dialect concerned, to provide education to about 1,000 participants a year. Founded in 1999 by SERVE Afghanistan, a British NGO, in response to community requests for an adult education program, the project is a winner of this year's UNESCO Confucius Prize for Literacy. The organisation expanded its work in 2006 with support from the provincial government to include classes for girls and now provides literacy, livelihood, public health and nutrition education to the Pashai minority, some of whom were completely excluded from the existing education systems. Participants learn to use written material in their local language as well as in Pashto, one of the country's two official languages, the other being Dari.

Tin Tua is an NGO in eastern Burkina Faso working to educate communities that have some of the lowest literacy rates in the world. In the Gulimancema language Tin Tua means "let's help ourselves develop", a principle their Literacy Programme has been putting into action since 1986 across 750 villages and hamlets. They now reach 40,000 learners annually and in recognition of their work they are a winner of this year's UNESCO King Sejong Literacy Prize. Their participatory approach engages communities, using any of five local languages and offering numerical and literacy lessons as well as practical lessons about farming, gender, health, hygiene and human rights. Their innovative approach has made striking changes to the daily life of villagers, from enabling farmers to manage food production better at the village level, by taking measures to stock cereals in order to avoid speculation in times of famine for example, to training health workers, notably in the field of maternal health. Staff also say that girls who follow the programme are less likely to accept forced or early marriage. Tin Tua is now sharing its experience with organisations in Benin, Togo, and Niger.

Khabar Lahariya was a project doomed to failure: a newspaper written, produced and sold by poor, "low-caste," rural and barely literate women, in a local language in the region Uttar Pradesh, northern India. Seven years later, however, the newspaper which means "news waves" in English, has a fortnightly readership of over 25,000 and has just been awarded a UNESCO King Sejong Literacy Prize. The newspaper was started by Nirantar, a women's organisation founded in 1993 with the aim of promoting literacy and education for women's empowerment. In 2002 the organisation began selecting women from marginalised backgrounds and training them as journalists. Two years on, Nirantar and Khabar Lahariya began collec-

A wall on the metro in Lisbon (Portugal).

Khabar Lahariya is an Indian newspaper, written and sold by poor women.

tively offering journalism courses for neo-literate and semi-literate women. The result has been the only women's media collective in the country, a newspaper from, about and for the village that has raised the voice of villagers. Its easily replicated example of transformative education is a model for women fighting caste, gender, traditional role models and lack of education. The independent journalist and women's activist Farah Naqvi, who has recently written a book "Waves in the Hinterland, the journey of a newspaper" about their story, states that Khabar Lahariya has "not only redefined the very male notion of citizenship but turned the very notion of women in India on its head."

The Municipal Literacy Coordinating Council of the Municipality of Agoo, La Union, Philippines has developed a holistic education system that aims to encompass all within their community. From basic literacy and numeracy, to computer skills, farming techniques and indigenous crafts – the entire local population has the chance to become literateor upgrade their skills. It is this vision and ethos that has earned them a 2009 UNESCO Confucius Prize for Literacy. The very old, marginalized and neediest in all 49 villages in the area are served by travelling teachers and mobile libraries that ensure the unreached are reached. The programme is also distinguished by its unique funding arrangement, with the government, NGOs, the private sector and international donors all contributing.

The Continuing Education Programme of the Ministry of Education of Bhutan was launched in 1992 and has since reached over 135,000 learners, 70% of whom are women, and established 700 non-formal education centres. Its approach is community driven, flexible and participatory with courses ranging from literacy and numeracy to health, hygiene, forestry, family planning, agriculture and the environment. This year's recipient of the Honourable Mention of the UNESCO Confucius Prize for Literacy emphasises education as an integral part of the country's guiding principle, "Gross National Happiness", which aims to improve the life of all its citizens.

The experience of last year's winners highlights the positive impact that being awarded a UNESCO International Literacy Prize makes. Since the Adult and Non Formal Education Association (ANFEAE) in Ethiopia won a 2008 UNESCO Confucius Prize for Literacy, their voice is being clearly heard by the Ethiopian Ministry of Education. They are acting as government advisors to implement adult education and are helping to guide national adult education curriculum. Similarly, the KwaNibela Project, Operation Upgrade of South Africa, which also won a 2008 UNESCO Confucius Prize for Literacy, has gone from strength to strength since the award. Their raised profile with the government has built confidence in donors - some have actually contacted them asking for funding proposals. They are being consulted more frequently by the Ministry of Education, and have also helped the Namibian government review their literacy curriculum.

David Jackman,
UNESCO Courier

ON LIVING WITH LESS, FROM THREE POINTS OF VIEW

How to protect the poor from a crisis caused by a few of the rich? This was the main question raised at the UNESCO Future Forum held last March. The debate is summarized by one of the moderators, Alison Smale, in a presentation of three different perspectives on the crisis and its effects.

Opening of the Future Forum at UNESCO (2 March 2009).

The message arrived one recent weekend with a glossy thud: a 300-plus-page edition of Madame Figaro, the French daily's weekly ode to women and beauty, dedicated to the first Paris ready-to-wear fashion shows since the advent of ''la crise'' in the luxury industry.

Madame Figaro, like all such magazines, had been somewhat crisis-starved of ads and thus pagination of late, but fashion week - and fashion houses determined that the shows will go on - bulked it up again. Nonetheless, "fashionistas" could not miss the main point: times are tough, or at least much tougher, as evidenced in the 10 detailed tips for ''recessionistas'' » about maintaining cool and chic even on diminished budgets (mostly this seems to involve trawling Web sites that will offer you slightly used couture on the cheap).

To get readers in the right mood, the French designer Jean-Charles de Castelbajac kicked off the editorial offerings with musings on what he called ''the democratization of beauty,'' or ''low cost luxury.''

''We are moving irredeemably,'' he proclaimed, ''to this new El Dorado.''

''Today,'' wrote Castelbajac, ''fashion, luxury and creation must reinvent themselves.'' A young generation of designers, he insisted, has this transformation in hand. ''Nothing will be the same again, and that's for the best. Our renaissance will equal the measure of our conscience,'' he added, because ''we carry within us a treasure beyond value: imagination.''

French ingenuity at pleasing the senses - whether through food, wine, fine clothes or graceful buildings - has survived and indeed thrived for many centuries, and Castelbajac, himself a veteran of invention, can doubtless bank on it safely once more.

Impact of the crisis on the developing world

Across town, a few days earlier, sounded a cri de coeur that was just as timeless and true: the indignation of international aid workers, labor officials and others about the ever quickening, ever harsher impact of the global crisis on the developing world.

UNESCO had summoned a day-long conference on this theme, and the conclusions of one panel (at which I moderated) were sobering. Kevin Watkins, director of UNESCO's Global Monitoring Report on Education for All, summed up the task: ''What to do to protect some of the poorest from a crisis created by some of the richest.''

In his presentation, Watkins coined an acronym new to the alphabet soup of international institutions: ITYBL. In The Year Before Lehman, i.e. 2007, he noted, aid to poorer countries was already falling. Now that foreign investment in the developing world has slowed to a trickle, trade has shrunk, commodity prices have fallen, and remittances sent home by immigrants in richer countries are declining sharply, Watkins asked how poor and middle-income countries could avoid a drastic fall in already meager or subsistence living standards.

He estimated that the poorest 70 countries needed about $400 billion a year - or about 1 percent of the total gross domestic product of the 30 (mostly rich) countries in the Paris-based Organization for Economic Cooperation and Development. In the lingua franca of his world, that's what it would take to maintain hope of realizing the eight MDGs, or Millennium Development Goals, to which 189 countries committed in 2000. Several now look truly unrealizable by the target date of 2015.

If anyone had any doubt that broken promises like this leave a great deal more than a bitter taste, he had only to hear the passion of another speaker, Aminata Traore, a West African activist and former minister of culture and tourism for Mali. Hers was a howl of outrage at the many ills bestowed on Africa by the outside world, and particularly colonial powers. She was loudly applauded. And this was before the G-20 meeting in London, which while pledging to do more for the poorest -- a pledge followed by an energetic push for the poor from U.N. Secretary General Ban Ki Moon in a meeting of all U.N. agencies, the World Bank and the International Monetary Fund in Paris the following weekend -- sets the developed world up for yet another test that it may flunk in the eyes of the poorest.

At the UNESCO gathering, José Manuel Salazar, a Costa Rican who heads the employment sector at the International Labor Organization, was also blunt about the effects of crisis on Africa. "It is very clear that the crisis will reverse the modest gains," he said. "The effects will outlast the crisis."

The impact of the crisis on developing countries has made few headlines in the Western news media compared to the attention heaped upon the swindler Bernard Madoff, the high-flying investment bankers of Wall Street, London and Hong Kong, or the trans-Atlantic dispute over what to do first to get out of the nosedive: spend, or regulate.

One interesting aspect of that chatter was the fall in global markets after Moody's Investor Service wrote in February that the indebtedness of Eastern Europe, and particularly its weak banks, would drag down their owners, mostly large banks in Western Europe.

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A man from Jaipur (India), the crisis particularly hurts the poor.

Europe after the crisis

The crisis has exposed many rifts and weaknesses in the European political structure so painstakingly assembled since World War II. But the countries that most recently benefited - the ex-Communist nations which regained liberty in the 1990s - are not uniformly glum, nor are all going hat in hand to the European Union, the International Monetary Fund or other institutions for help.

And so to a third scene of the world in crisis, Warsaw. A 24-hour visit in March -- around the 10th anniversary of the first opening of the West's most exclusive club, the entry of Poland, the Czech Republic and Hungary into NATO - found a country calmly determined to relay that it is not, thank you, in crisis.

From the president on down, acknowledgement of the crisis was plain, but gloom was not, as in New York or London these days, setting the tone of the conversation.

Indeed, Pavel Swieboda, a former diplomat who now heads a think tank, the Center for European Strategy, jauntily revealed over breakfast that he was off to the first of a series of discussions under the title "Europe After the Crisis."

And, yes, maybe the anniversary and the satisfaction of the political elite at having spent 10 years in NATO and almost five in the European Union tinted the mood. But it was surely refreshing to hear people who 20 years ago were waging politics underground extolling not the joys or woes brought by money, but, at a packed Warsaw University forum, the many ways in which to guard very jealously its best guarantor – democracy.

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A disused office in the wake of the bankruptcy of a company.

Alison Smale,
Executive Editor,
International Herald Tribune

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