

United Nations
Educational, Scientific and
Cultural Organization



International
Astronomical
Union

Partners for the International Year of Astronomy 2009

Astronomy

We've often been asked:

What is astronomy actually?

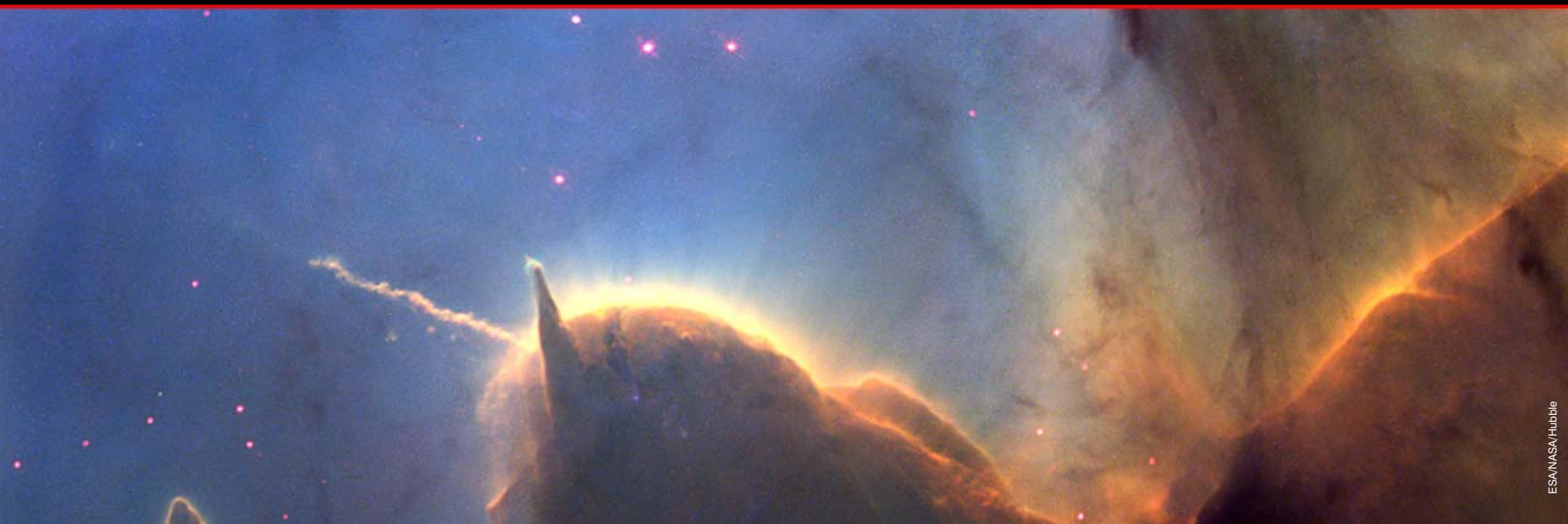
And what it is good for?

These are good questions and worthy of an answer.



Astronomy is the study of all celestial objects. It is the study of almost every property of the Universe from stars, planets and comets to the largest cosmological structures and phenomena; across the entire electromagnetic spectrum and more.

It is the study of all that has been, all there is and all that there ever will be. From the effects of the smallest atoms to the appearance of the Universe on the largest scales.

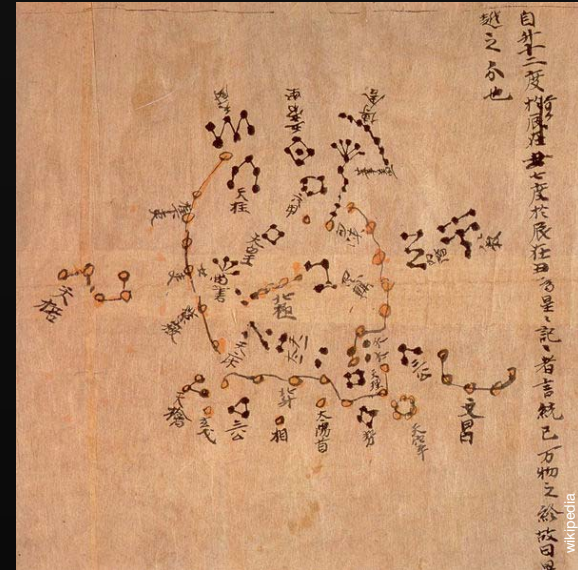


Astronomy in the ancient world

Astronomy is the oldest of the natural sciences, dating back to antiquity, with its origins in the religious, mythological, and astrological practices of the ancient civilisations.

Early astronomy involved observing the regular patterns of the motions of visible celestial objects, especially the Sun, Moon, stars and naked eye observations of the planets.

The changing position of the Sun along the horizon or the changing appearances of stars in the course of the year was used to establish agricultural or ritual calendars.



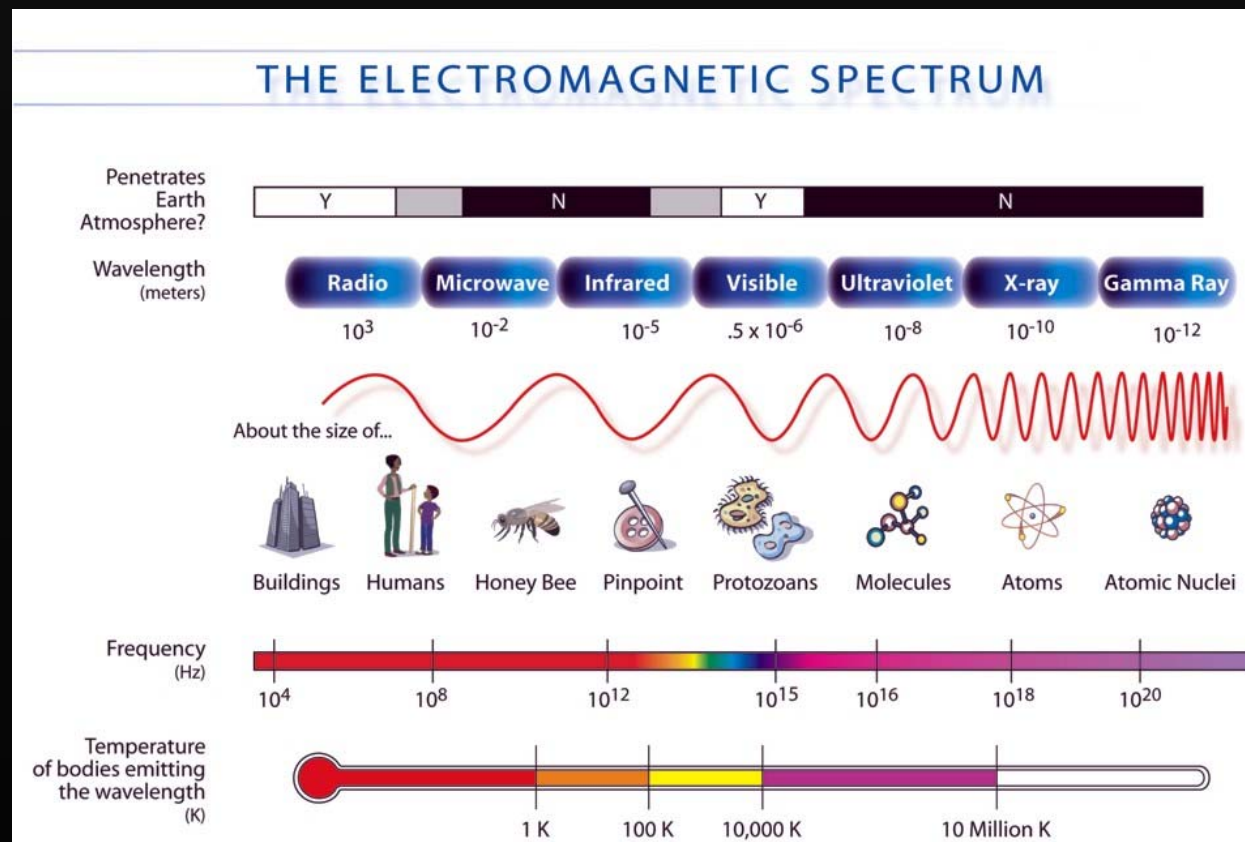


Astronomical Research Today

- Astronomical objects are far and faint...
- We only have access to limited information about their nature
- We need large and powerful instruments: resolution and sensitivity
- Astronomers combine different types of observations and in different wavelengths

Astronomical Research Today

Astronomers observe electromagnetic waves from all parts of the spectrum. Every type of visible and invisible light reveals a different piece of the great cosmic puzzle.



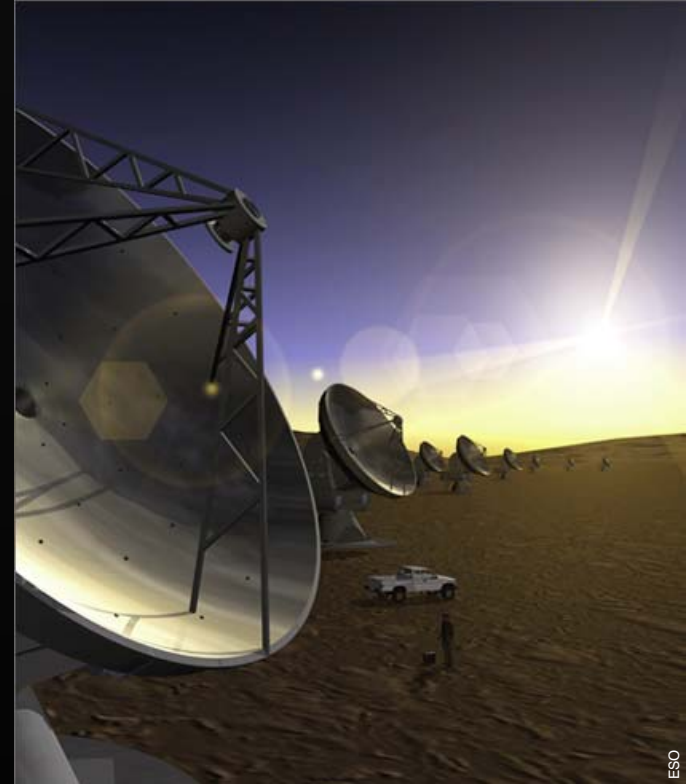
Astronomical Research Today

Astronomers around the world study the workings of the Universe.

Today, this is being done through a combination of many disciplines and sub-fields using many different approaches;

- Ground-based telescopes
- Space based observatories
- Robotic probes
- Theoretical calculations and simulations

Astronomers study the Universe not only to further our understanding of the cosmos, but to advance other fields of science and technology too.



Astronomical Research Today

Astronomy consists of a series of disciplines including:

Solar astronomy:

Studies of our own star, the Sun

Planetary science:

Studies of the bodies in our own Solar System and those in orbit around other stars

Stellar astronomy:

The study of stars and stellar evolution

Galactic astronomy:

The study of our own Milky Way and its evolution

Extragalactic astronomy:

The study of objects outside of our Milky Way

Cosmology:

The study of the Universe as a whole.



Astronomical Research Today

And some interdisciplinary studies:

Astrobiology:

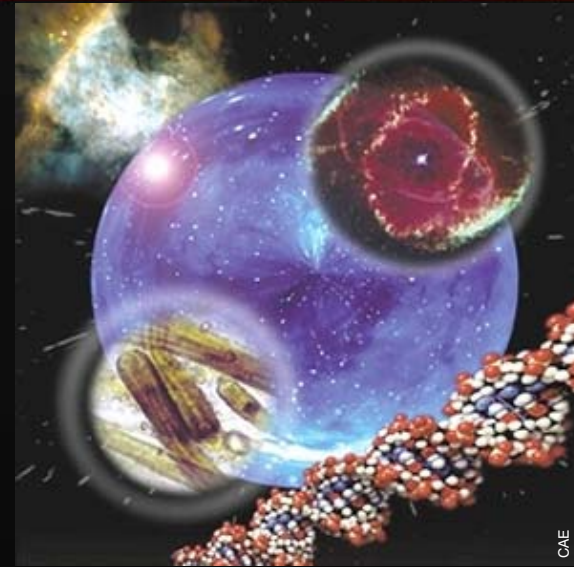
The study of the advent and evolution of biological systems in the Universe

Archaeoastronomy:

The study of ancient or traditional astronomies in their cultural context, utilising archaeological and anthropological evidence

Astrochemistry:

The study of the chemical constitution of objects in space



**There are two main streams of
research in astronomy
(as well as other natural sciences)**



**Fundamental Research
&
Applied Research**



Fundamental Research

Fundamental Research is where new ideas and methods that later become commonplace begin—as 19-century curiosity about electricity led to the electric light, and the world wide web has allowed international teams of researcher to communicate more easily.

No amount of applied research on the candle would have brought us the electric light; no amount of research and development on the telephone would have brought about the web.

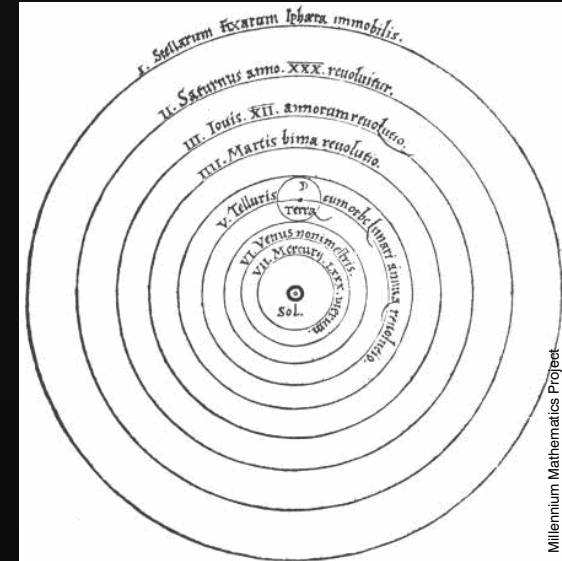
Science needs space for curiosity and imagination.

Fundamental Research

Fundamental research is the basis of the scientific method. It is motivated by an astronomer's curiosity or intuition without any 'end product' in mind.

Examples include:

- Galileo Galilei's study of the jovian moons that helped us understand our Solar System in context.
- Edwin Hubble's studies of the recession of distant galaxies that demonstrated that the Universe is expanding.



Fundamental Research

Fundamental research is a stand-alone process that is done because it is deemed valuable by society and civilisation. It often occurs on very long timescales and satisfies a deeply rooted curiosity in humans.



Applied Research

Applied research is research for a specific, often commercial or client-driven, purpose.

Astronomy seemingly has small impact on our daily lives. But...



Astronomy Impacts our Daily Lives

Advances in astronomical and space science technology, brought about by applied research, can often have a greatly beneficial effect on humankind after 50, 100 or even more years.

Today millions of people worldwide – often unknowingly – are affected by the short- and long-term advances made in astronomy and space science.



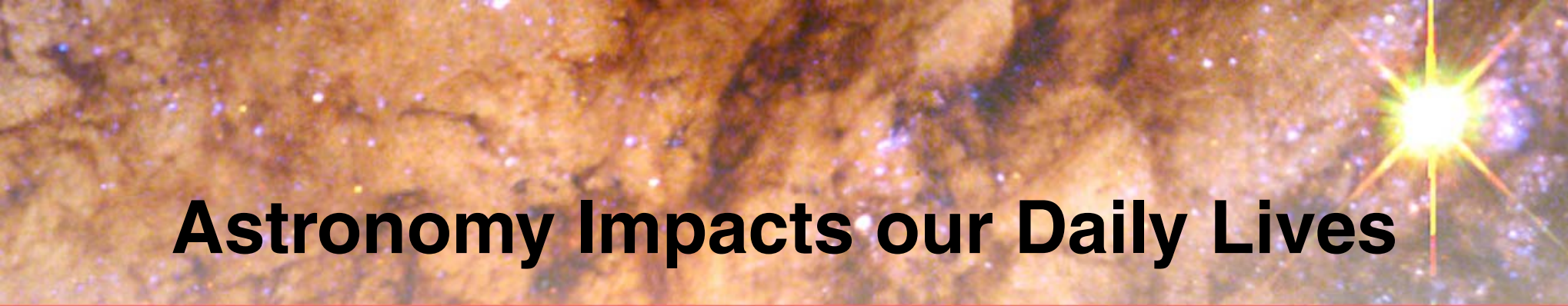
Technology Transfer

Some astronomical results, or derivatives of astronomical research, can be transferred to technological advances (so-called Technology Transfer). For instance:

- The development of CCD detectors
- Image processing techniques
- Satellite Communication Techniques
- Development of Robotics

Astronomy benefits from and drives technology



A vibrant, colorful nebula with a bright star in the upper right corner. The nebula features a mix of orange, red, and purple hues, with a bright yellow star in the upper right corner. The text "Astronomy Impacts our Daily Lives" is centered in a bold, black font.

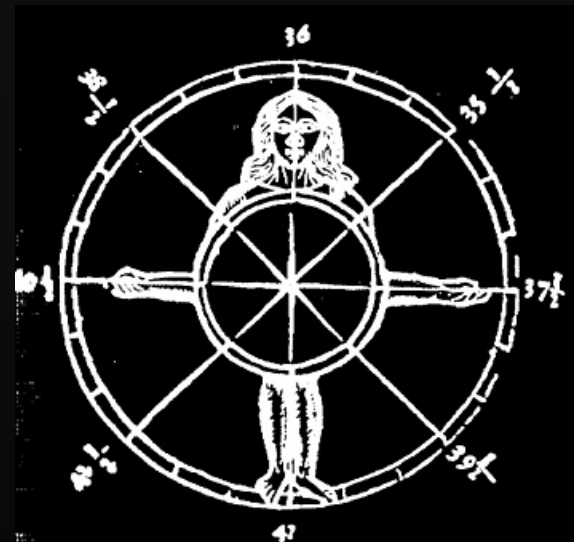
Astronomy Impacts our Daily Lives

Astronomy is also useful for:

Agriculture: The seasons are main markers in the agricultural calendar and for centuries astronomical observations determined when to sow and when to harvest.

Nautical Navigation: Knowledge of the tides induced by the Sun and the Moon is very important to the all ocean-going traffic. In earlier times measurements of the position of the Sun, Moon, stars and planets in the sky were the only way of knowing a ship's position at sea. This skill is still taught as a way to survive in case of instrument failure.

And more ...



Astronomy Impacts our Daily Lives

Architecture: Awareness of the Sun's daily path across the sky is crucial for the design of new buildings, to achieve proper light and temperature conditions.

Crime investigation: The Sun's daily path, phases of the Moon, eclipses, meteors and other sky events help police investigations.

Possible survival of humankind: The search for Near Earth Asteroids and studies to understand them may one day help us deal with a dangerous meteorite.

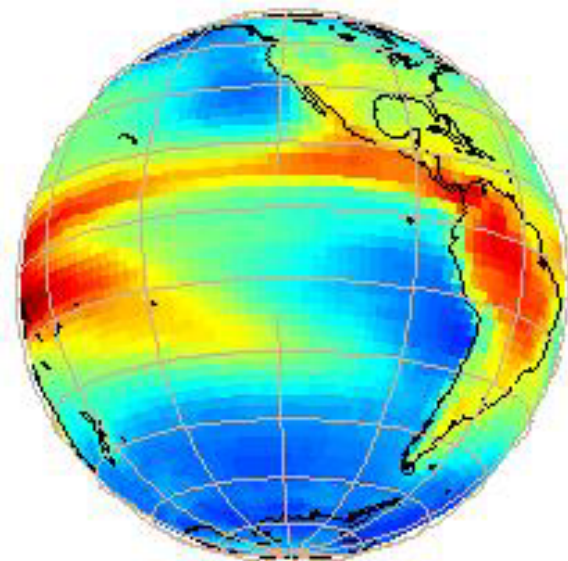
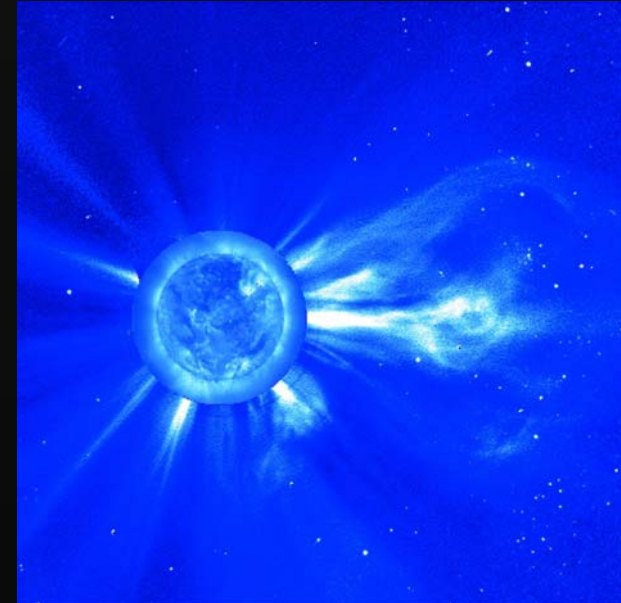
And more ...



Astronomy Impacts our Daily Lives

Climate research: Manmade climate changes are at the top of scientific and political agendas, but need to be disentangled from certain astronomical phenomena that have long-term influences on Earth's climate on our Earth.

- The variability of the amount of solar radiation changes the total energy input to the Earth's atmosphere.
- The variability of the solar ultraviolet emission affects the ozone layer and the temperature on Earth.
- High energy particle effects the ozone layer.
- Cosmic rays may affect cloud coverage.

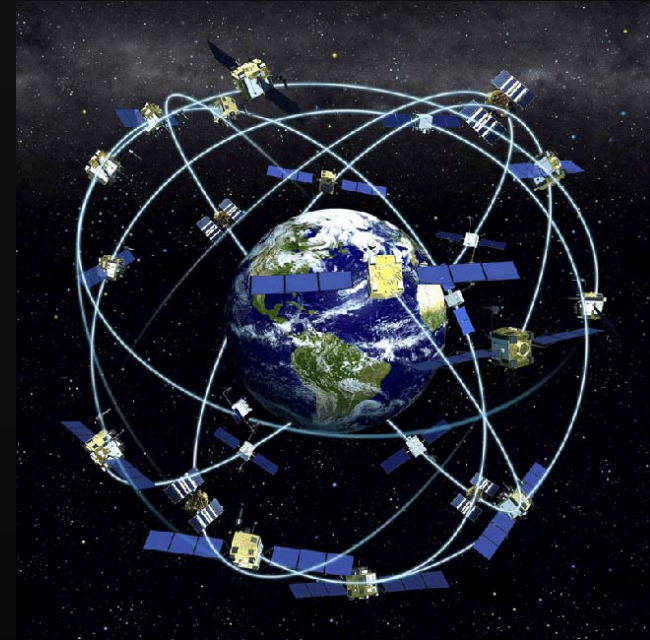


Astronomy Impacts our Daily Lives

Thanks to **accurate astrometry** (positional astronomy) our satellites can fly through space knowing where they are.

Understanding General Relativity enables us to fly planes, launch satellites or build GPS receivers.

Weather forecasting: Thanks to advances in satellite technology we have more accurate weather forecasting.



The 10 Biggest Discoveries in Astronomy

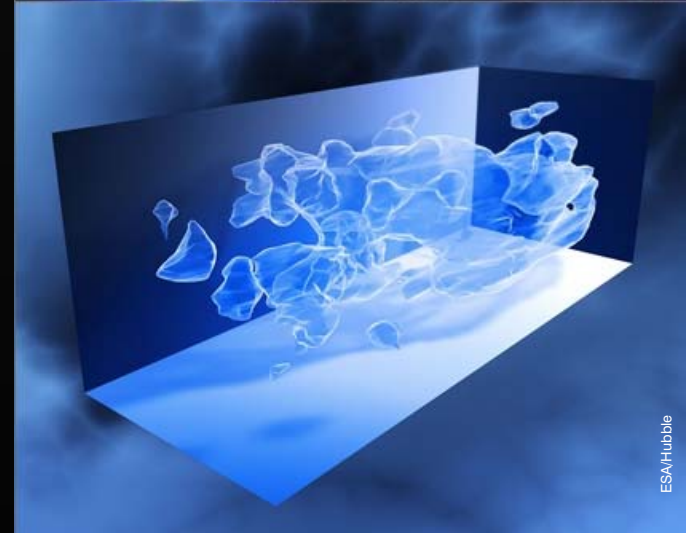
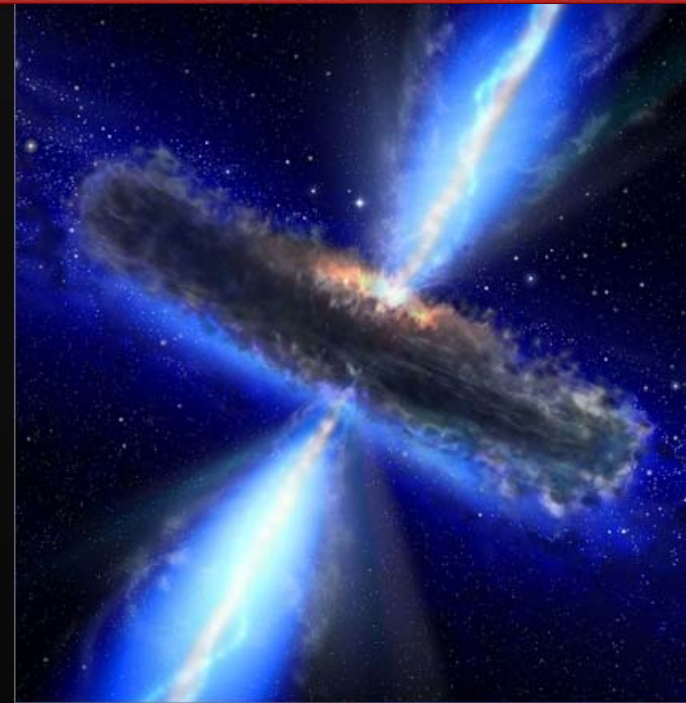
1. The Milky Way is not the only galaxy in the Universe.
2. The Universe is expanding.
3. The generation of stellar energy.
4. There are only two common types of stars – dwarfs and giants.
5. We now understand the composition of the ordinary matter in the Universe.



The 10 Biggest Discoveries in Astronomy

6. Exotic objects – from pulsars and black holes to white dwarfs.
7. The Microwave Background Radiation.
8. Dark Matter.
9. Extrasolar planetary systems.
10. Solar neutrinos and helioseismology.

From The Top Ten Astronomical 'breakthroughs' of the 20th century
(David W. Hughes, Richard de Grijs) CAP Journal, Issue 1, October 2007



www.astronomy2009.org

IYA 2009 Secretariat

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