TRANSCRIPT VNR GAMMA RAY

Commentary
01 00 01
Awarded on the initiative of the European Commission, the 2002 Descartes Prize went to a research project that has helped to solve the mystery of gamma ray bursts in the universe.

Commentary;
01 00 15
We are at the Anton Pannekoek Astrophysics Institute in Amsterdam where we will meet the project's two main figures: Edward Van Den Heuvel and Luigi Piro.

Luigi Piro:
01 00 27
Our research would not have been possible without international collaboration. Using "BeppoSAX" we located and studied gamma bursts in gamma rays and X rays, and thanks to a series of earthbound observatories we obtained important results.

Ed Van Den Heuvel:
01 00 44
So, therefore, you must follow up the observations from space from astronomy posts from all over the world, European but also International. You cannot do this work other but in European cooperation, and even in cooperation with the entire world.

Commentary:
01 01 01
This research brought together teams from the Astrophysics Institute and the University of Amsterdam, the Ferrare Astrophysics Institute and the Sapienza University in Rome, English teams from Cambridge and Danish, Spanish, German and American teams.

Commentary:
01 01 26 The aim of the project was to discover the source and nature of the most violent explosions in the universe: gamma ray bursts.
The story began accidentally at the end of the 60s with satellites whose primary purpose was not strictly scientific.

Ed Van Den Heuvel:
01 01 45
In 1967, both the American and the Russians put spy satellites into space to see if anyone was taking nuclear tests in the earth's atmosphere. These satellites essentially only contained a simple Geiger counter, such as I have here, and this Geiger counter can only observe radiations that come from all

directions, that is, it cannot tell exactly what direction that radiation is coming from.
But by having a number of satellites together moving around the earth, you can after all observe what direction that radiation comes from.
We did not discover those explosions on earth, but discovered flashes of gamma radiation, which were coming from the entire universe.

Ed Van den Heuvel:
01 02 36
For gamma rays and hard x-rays radiation, you cannot create an optic, no lenses or mirrors, and the technique that was applied here in the BeppoSAX is the so-called pin-hole camera technique.

John Heise:
01 02 55 The equivalent of the camera obscura, a front side with the holes, a plate with the holes, and a back side that is the equivalent of the photographic plate that registers the x rays and the gamma rays.
The principle is rather simple, we can demonstrate it with this small cardboard model that I have here.
01 03 24
This represents the hole of the camera obscura, this is the sensitive surface, and this is the gamma flash. The gamma flash gives a light splash on the sensitive surface depending on the direction. To obtain a very accurate position, you need to make a very small hole, and the problem is then that you have a very light, weak picture. That problem was resolved by making a lot of little holes. As a matter of fact, in reality we made a mask with twenty thousand holes.

Luigi Piro :
01 04 24
We launched "BeppoSAX" on 30 April 1996 and after a number of attempts to capture these gamma ray bursts, we finally succeeded on 28 February 1997. This is how we did it:
The wide field camera identifies the location of the event with a high degree of precision. Here we see the image of a gamma ray taken at different times: before the burst there is nothing, here we see the event for the few seconds during which it appears, then it disappears.
We need to observe the phenomenon in much greater depth, so we aim our satellite with narrow-angle instruments which are much more sensitive, they are like a telephoto lens, a zoom lens for X rays.
01 05 14
These are the two wide-angle cameras, the "uefilcameras" which locate the event. The green instrument is the one that gives us the gamma ray burst monitor, and these telescopes over here are the much deeper narrow-angle instruments.
So, rotating the satellite in the direction of the gamma ray as quickly as possible, on 28 February 1997, eight hours after the burst, we discovered an X-ray source which had never been observed before.
01 05 48

When we checked again three days after the event, we saw that the source had declined, that it had weakened by a factor of 20.
This led us to conclude that the source really was associated with the gamma burst, and therefore that the gamma bursts continued to emit their energy, over hours, days and months in X rays. We call these "after-glow X". However, as we shall see, this phenomenon also occurs in other wavelengths such as optical, radio, and infrared.

Ralph Wijers:
01 06 31
The locations given by the wide field camera were not only good enough for the BeppoSAX to search for an afterglow but also for optical telescopes. In Las Palmas, Spain, the Netherlands, Georgia, India, Australia, Hawaii, the Rocky Mountains in the United States, the Andes in South America and Chili, we found an optic afterglow a number of times.
This gave a very precise position, even better than the x rays, and every time we went to look at the location, we found a far removed Milky Way system. Here you see pictures of those Milky Way Systems taken with the Hubble Space Telescope, which is also cooperating with us, and since we now know by means of these pictures that they are located in very remote Milky Way Systems, yet are very clear to us, it means that they must be incredibly energetic, and must give an enormous amount of light.

Ed Van Den Heuvel:
01 07 30
We discovered that the birthplaces of gamma ray bursts were located in Milky Way Systems at enormous distances between five and ten billion light years distance from us, and involved explosions in which the quantity of energy released is equivalent to that emitted by the sun over a thousand billion years. And this very probably, is linked to the explosion of black stars at the end of that life where the inner core of the star collapses into a black hole.

Commentary
01 08 01
Each year, the Descartes Prize won by this research project, rewards scientific excellence on the initiative of the European Commission.