EUROPEAN COMMISSION
Community research

Nominee for the EU Descartes Prize 2005
Field of research: Physics

Finding the astrophysical Holy Grail

Pulsars are rapidly spinning neutron stars, often described as 'cosmic clocks', whose observation offers unparalleled opportunities to study some of the most extreme physical conditions in the universe. By pooling resources and sharing their results, European scientists propelled themselves to the forefront of this stellar field of research. In 2003, they made a discovery that has been hailed as one of the greatest advances in astrophysics.

Observing pulsars offers the unique opportunity to study some of the most extreme physical conditions in the universe. Monitoring apparent variations in pulse-rates makes it possible to test theories of relativity, follow their precise motion in space, explore the solid-state physics of super-dense matter and more. Since the equipment needed to study these stars can be costly to build and to run, scientists across Europe came together to found the European Pulsar Network (EPN). In collaboration with the Australian Telescope National Facility, EPN members combined instrumentation and software efforts, coordinated observing programmes, developed a common data format and set up a universal database for all observational feedback. With the partnership in place, the team began searching for pulsars that were invisible to their earlier low-frequency surveys. Over five years, the researchers located over 850 pulsars, more than the total number found in all surveys spanning the previous 30 years. In addition, the team's deep search of globular clusters (gravitationally bound concentrations of approximately 100 000 very old stars, of which our galaxy has around 200) produced more significant findings, which have prompted investigations by many groups around the world.

The height of the researchers' activities is undoubtedly the discovery of the first double pulsar. The existence of such a system is remarkable because its two components needed to have survived twin supernova explosions. Among other exciting implications, this discovery revitalises the possibility of detecting gravitational waves, which are ripples in space-time predicted by Einstein. The double pulsar is also a unique laboratory for studying electrodynamics and plasma physics under the most extreme conditions.

"Our work increases mankind's knowledge of some of the fundamental physical laws that govern the universe," states Prof. Andrew Lyne, from the Jodrell Bank Observatory of Manchester University in the UK. "These results are not only of relevance to today's scientific professionals. They also help to interest young people in astronomy, physics and basic research, forming an important foundation for a society increasingly based on science and technology."

Project title: PULSE
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