PRESS RELEASE 4

Center for Social Communication/ CBPF

[For immediate release]

What: Researchers from IceCube will present data on the recent detection of the two most energetic neutrinos known to-date.

When: From 02-09 July this year.

Where : SulAmérica Convention Center.

Why: To present the latest scientific results in the physics area.

RIO WILL HAVE ICECUBE, A 'CUBE' OF ICE WITH VOLUME TEN TIMES GREATER THAN THE SUGARLOAF

The ICRC (International Cosmic-Ray Conference) - which occurs the first time in South America - will present the latest data from IceCube, an international experiment whose light sensors form a network 1km^3 - 10 times the size of the Sugarloaf Mountain - in the underground of Antarctica, that recently detected the two most energetic neutrinos known to-date - and perhaps the first two of astrophysical origin.

Rio de Janeiro, May 2013 - The ICRC (International Cosmic-Ray Conference) - which will take place in the city of Rio de Janeiro for its first edition in South America - will have the presence of members of the IceCube. They will detail the detection of the two most energetic neutrinos known to date, in addition to presenting more recent data on this international experiment, located in the South Pole.

Most neutrinos that reach the Earth come from the Sun or are created in the Earth's atmosphere by cosmic rays **(see**'Glossary'). It is known, however, that the energies of these

particles is low. The very energetic neutrinos captured by Ice Cube now, are therefore strong candidates for being the first of an astrophysical origin, ie. coming from somewhere far from the solar system - perhaps even beyond the Milky Way. So we stand before the first detection of the history of an astrophysical neutrino. Studying them is like making an 'X-ray' of the universe from the Earth.

Both particles captured have energies a hundred times higher than those of protons accelerated at the LHC (Large Hadron Collider), the most powerful particle accelerator in the planet, located at the European Center for Nuclear Research, in Geneva (Switzerland), and where the Higgs boson (the particle responsible for generating the mass of other particles) was recently discovered.

Each of the two neutrinos was about 1 petaelectronvolt (or 1 quadrillion electron-volts). Electron-volt is a unit commonly used by physicists to measure the energy of atomic and subatomic particles. Compared to energies from our daily lives, it is extremely small. However, we must remember that these entities have Lilliputian dimensions that are approximately a trillion times smaller than a grain of sand. Particles with this energy level - at the house of petaelectron-volts - are considered very energetic.

The IceCube, which cost about $ 270 million, consists of 5,160 spherical light sensors connected by cables that resemble a pearl necklace with 1 km long - in all, there are 86 such necklaces vertically 'buried' in the Antarctica ice, at depths of about 1.5 km. The final set resembles a gigantic cube with a volume of approximately 1 km^3

At such depths, the ice - without the presence of gases, driven out by the immense pressure deep in the underground - is as transparent as the earth's atmosphere. And it allows the light generated by the passage of neutrinos through the ice to reach the sensors with virtually no loss of energy.

To learn more about the IceCube: http://icecube.wisc.edu/

Scientists from around the world - The 33rd edition of the ICRC, is held from 2-9 July this year, at the SulAmérica Convention Center in the city of Rio de Janeiro.

This is the first time the event will take place in South America.

It is estimated that about 1000 scientists worldwide - among which are renowned international experts - will come to Brazil for the seven-day conference.

The first edition of the ICRC - as this meeting is best known by the international community of physicists - occurred shortly after the end of the Second World War, and since

then has happened every two years. The last two meetings were in Beijing (China) in 2011, and Lodz (Poland) in 2009.

Mysteries of Nature - The ICRC is traditionally dedicated to topics related to the physics of cosmic rays and high energy astrophysics and particles. But it also attracts scientists working on topics related to gamma rays and neutrinos - for technical terms, see **"Glossary"** at the end of this release.

This year, for the first time in Brazil, there will be involvement of the community studying the mysterious dark matter. For this reason, the ICRC adopted the subtitle 'The Conference of Astroparticle Physics.'

Over 300 scientific lectures are planned to take place - in plenary and parallel sessions - as well as lectures for the general public.

Organization - The Brazilian edition of the ICRC is being organized by the Brazilian Center for Physics Research (CBPF) - an institut of the Ministry of Science, Technology and Innovation (MCTI) - the Federal University of Rio de Janeiro and the Brazilian Physics Society, sponsored by the National Council for Scientific and Technological Development (CNPq), the Coordination for Improvement of Higher Education Personnel (CAPES) with the support from the Research Foundations of Rio de Janeiro (FAPERJ) and São Paulo (FAPESP).

Prize-- In the ICRC are traditionally presented the prizes of the IUPAP (International Union of Pure and Applied Physics) for research in cosmic ray physics and particle astrophysics.

Tradition - Last year, we celebrated the 100th anniversary of the discovery of the origin of the cosmic rays. The experiments that led to the conclusion about the extraterrestrial origin of this radiation yielded the Austrian physicist Victor Hess (1883-1964) the Nobel Prize in Physics in 1936.

Brazil has a long tradition in related areas to the meeting with researchers involved in several international scientific collaborations dedicated the study of the most energetic particles in the universe, such as the Pierre Auger Observatory in Argentina (www.auger.org), the European laboratory CERN (European Organization for Nuclear Research) in Switzerland

(www.cern.ch), and CTA (the Cherenkov Telescope Array) (www.cta-observatory.org), the most important experiment in high energy astrophysics of the next decade, and whose operations should begin by 2018 - with a great chance of the observatory being installed in South America.

The cosmic ray physics has as one of its pioneers in Brazil, the physicist César Lattes (1924-2005), founder of CBPF in 1949 and one of the discoverers, in the late 1940s, of the so-called pi-meson, a particle that serves as 'glue' of protons and neutrons, keeping the atomic nucleus cohesive.

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GLOSSARY

Cosmic rays - are atomic nuclei - some extremely energetic, the most energetic particles known by science - that bombard the Earth all the time from space. When they collide with atoms in the atmosphere, they create a 'shower' of particles - sometimes billions - that reach the the ground. The less energetic ones come from the Sun, the medium energy ones are generated when massive stars explode at the end of their lives. The ultra-energetic cosmic rays probably are created in black holes that occupy the core of some galaxies.

Dark Matter - We know only 5% of the constitution of the universe. There is evidence that the remaining 95% are divided into: i) dark matter (about 25%) and ii) dark energy (70%). Dark matter can only be detected by the gravitational pull it exerts on other heavenly bodies, because it

does not emit any type of light - hence the term 'dark'. Its nature is still a mystery to science. O the other hand, dark energy plays a similar role to an 'anti-gravity' and we suspect it is responsible for making the universe expand at an accelerated rate.

Gamma-ray bursts - are the most energetic events of nature since the birth of the universe, called *Big Bang.* One of these explosions can emit energy in the form of extremely light energy (gamma rays), equivalent to that obtained by the total evaporation, in seconds, of the weight of a thousand planets like Earth.

Neutrinos - They are the most elusive particles known to science. Can pass through a wall of lead with about 10 trillion km thick without colliding with atoms. Are created in abundance in the universe: the stars, cosmic rays on Earth, nuclear plants, the natural radioactivity of our planet and even the human body - each of us, because of radioactive elements in our bodies, emit about 10 million neutrinos per hour. Every second, trillions of neutrinos pass through our bodies - and therefore the Earth - almost without interacting with matter.

[End of release]