NEWSLetter
Excellence Cluster Universe

Issue 4 October 2008

Dear Readers,

"Rome wasn't built in a day" - this saying also applies to the Large Hadron Collider at CERN. The "big bang machine" is at a standstill as a faulty electrical connection caused a helium leak. Of course the incident is a bitter disappointment after the smooth start of the LHC on 10 September. However, in science the road to success is often paved with setbacks. Also, one has to bear in mind that the LHC is an unprecedented project: It is the biggest apparatus ever built by mankind. With temperatures of -271 centigrade Celsius, it is also the coldest place in the universe, making trouble shooting and repair much more complicated than for any other machine. After all, a restart in early spring 2009 would mean a relatively short delay compared to development time of more than 20 years - and a holdup of 10 years: Initially, the start of the LHC was planned for 1998. Let's hope the best for spring 2009!

Barbara Wankerl, Public Outreach Coordinator

PICTURE OF THE MONTH

Late identification of a supernova

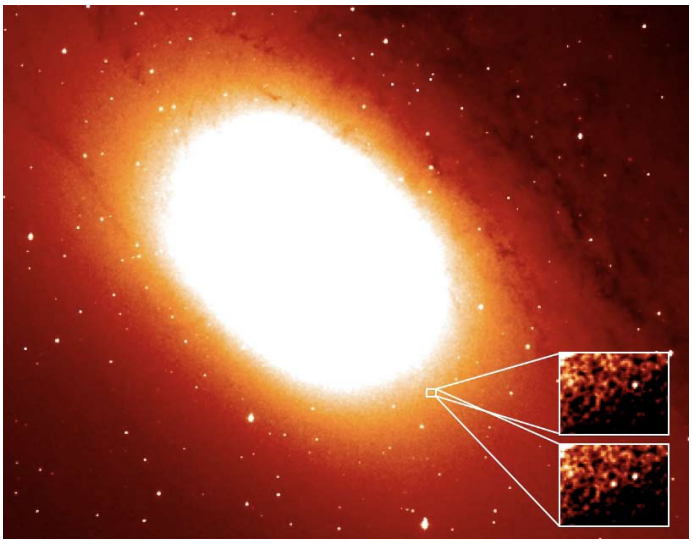
Over a decade after it exploded, one of the nearest supernovae in the last 25 years has been identified. The data show that SN 1996cr is among the brightest supernovae ever seen in radio and X-rays. It also bears many striking similarities to the famous supernova SN 1987A, which occurred in a neighboring galaxy only 160,000 light-years from Earth.

HIGHLIGHT

MACHO discovered in the Andromeda Galaxy

Only 4.5 percent of the Universe consists of matter which is known to us. Apart from this kind of matter, which is called "baryonic matter", there are further components known as dark matter and dark energy. Dark matter contributes to 23 percent of the energy density of the universe. In astronomy, dark matter indeed plays a significant role in the formation of galaxies; to this day, however, scientists are still puzzling over the nature of this matter.

Beside particles like the so-called WIMPs (Weakly Interacting Massive Particles), objects named MACHOs (MAssive Compact Halo Objects), whose properties are under intensive investigation, are also considered as candidates for the invisible matter. A team at the Excellence Cluster Universe has now detected one of these objects in our neighboring galaxy of Andromeda and has used an improved method (Astrophysical Journal, 10 September 2008, Vol. 684, p. 1093).



MACHO - Microlensing event GL1 in M31

Dark matter shows up in the rotation curves of spiral galaxies. Without these components, the outer regions of these galaxies would rotate more slowly around the center than the inner region. As this is not the case, the scientists conclude that the disk and the bulge of spiral galaxies are embedded in an invisible halo made of dark matter. For this reason, researchers comb through the primary halo regions for possible MACHOs. The goal is to classify these objects more precisely and thus to clarify whether the wanted dark matter is hidden in them. The simplest explanation for MACHOs is matter consisting of white dwarfs or neutron stars – that is, stellar remnants of baryonic origin.

As MACHOs emit (virtually) no light, the scientists use an indirect verification procedure. This is based on a phenomenon termed "gravitational lensing": Massive objects can deflect light rays, for example, light from a star, so that the size and distance of the object can be inferred from the angle of deflection. The effect of the deflection of light due to gravitation can also be observed on our sun. The angle of deflection caused by the MACHOs, however, is conspicuously smaller than the resolution capacity of the best telescope. Therefore, MACHOs can only be detected by an amplified brightness of the background object – an effect called microlensing.

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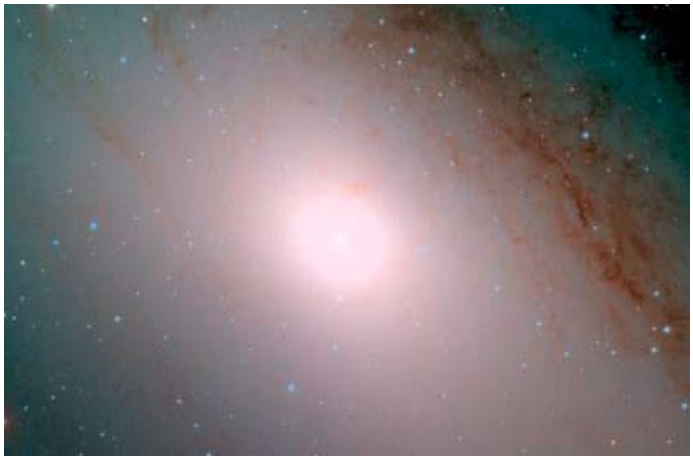
⇨ Arno Riffeser, Stella Seitz and Ralf Bender of the University Observatory of Munich evaluated a microlensing event named WeCAPP-GL1 in the Andromeda galaxy (M31). In contrast to their earlier work, the researchers account for the size of the background object. With this procedure, the scientists can distinguish bright microlensing events caused by MACHOs from those caused by stars. Due to their large mass, stars can also deflect light – an effect called self-lensing.

However, why are the scientists looking for MACHOs in the M31 galaxy, 2.5 light-years away, and not in the Milky Way? The advantage of monitoring the Andromeda galaxy comes from the fact that the scientists can simultaneously measure significantly more events per image. However, due to the little apparent brightness and the high stellar density, the requirements of the data analysis are significantly higher. The procedure tried and tested here should clearly improve the quality of future surveys.

In their current work, Riffeser and his colleagues analyzed the data, which were already taken in 2000 by the Observatories on Mount Wendelstein in Bavaria and Calar Alto in Spain. At that time, the scientists analyzed 4 million light curves in total. The results so far indicate that the matter in the halo of the Andromeda galaxy could indeed be partly composed of MACHOs – future observations will further pin this down.



The Andromeda Galaxy (M31)

The researchers of the University Observatory of Munich expect „illuminative" knowledge (in the truest sense of the word) from an Andromeda survey over three years at Haleakala-Observatory in Hawaii. With the Pan-STARRS telescope, 1.2 billion light curves can be studied simultaneously. Moreover, the scientists expect to gain further insight from the opening of the new 2-Meter-telescope on Wendelstein, which will presumably come on line in 2010. Here, gravitational lenses causing very short microlensing event durations and thus small lensing masses can be studied more intensively.

EVENTS

Open House at Garching

On 18 October it will be that time again: From 11 am to 6 pm, the Research Center Garching will open its laboratories and lecture halls to the public. The Excellence Cluster will be presenting its program in the Physics Department of the TUM. There, visitors will learn how stars and galaxies come into existence. A photo experiment where everyone can participate will show what happens if you end up near a black hole. In Lecture Hall 2, Cluster scientists will explain their current research.

Program of the Universe Cluster: *www.universe-cluster.de*
Complete program of the day: *www.forschung-garching.de*

Cosmology at the Beach - Winter School in Mexico

From 12 to 16 January 2009 there will be a winter school in Baja California, Mexico, intended for scientists at the PhD and postdoctoral level. The event is a joint venture of the Excellence Cluster Universe, the Berkeley Center of Cosmological Physics and the Instituto Avanzado de Cosmología, Mexico. A wide range of topics in cosmology will be taught at the conference, e.g. Dark Energy, Dark Matter and CMB Secondary Anisotropy. The lecturers of the school are eminent scholars in their fields, who include Carlos Frenk, Wayne Hu, Eric Linder, Simon White and George Smoot.

More information on the website of the Cosmology at the Beach School:
www.universe-cluster.de/catb2009

Interdisciplinary Workshop on Hydrodynamics

Apart from the "wow" effect they produce, a new BMW car and a stellar supernova seem to have little in common. On closer examination, they share a few fundamental physical laws, described as hydrodynamics. Phenomena such as turbulence and flow instabilities play an important role in both research and product development: e.g. in astrophysics and meteorology as well as in car and aircraft design. To illuminate the topic from different perspectives, the Universe Cluster is organizing a workshop from 17 to 19 November, 2008. Experts from research institutions and companies like the BMW Group will meet for an interdisciplinary exchange of knowledge and methods. The workshop will take place at the Max-Planck-Institut für Plasmaphysik (IPP) in Garching.

The workshop is free of charge and doesn't require registration.
www.universe-cluster.de/hydro2008

PEOPLE

Three new Junior Research Group Leaders at the Cluster

On 1 October, three new Junior Research Group (JRG) Leaders joined the Cluster: Professor Dr. Ilka Brunner, Professor Dr. Sebastian Jäger, and Professor Dr. Jochen Weller. They will work in the areas of theoretical particle physics and observational astrophysics.

Ilka Brunner

Before joining the Cluster, Ilka Brunner was made a "EURYI award holder" (European Young Investigator) at the Institute for Theoretical Physics at ETH Zurich. At the Universe Cluster she will lead the JRG on "Extra Dimensions in Particle Physics and Cosmology". Ilka Brunner's main research interests include D-branes in Calabi-Yau Compactifications and "Orientifolds", which provide a description of unoriented strings.

Sebastian Jäger

Sebastian Jäger, leader of the JRG "New Physics beyond the Standard model", is already familiar with the Cluster's environment. He received his PhD from TUM and for the past two years has worked as a Postdoc at LMU's Arnold Sommerfeld Center and as a Fellow at CERN. At the Cluster, Jäger will continue and extend his research on the limitations of the Standard Model, including how virtual effects of new particles beyond it may manifest themselves in experiments at the CERN LHC and elsewhere.

Jochen Weller

Last but not least: Jochen Weller. He has spent the past four years as a lecturer at the Department of Physics and Astronomy at University College London. Weller will be the leader of the JRG "Observational Astrophysics" and will focus, among other matters, on the research issues involved in Dark Energy, Modified Gravity, Galaxy Clusters and the Cosmic Microwave Background

Two new Fellows join the Cluster

The Cluster welcomes two new Research Fellows: Dr. Robert Dunn and Dr. Boris Grube. Robert Dunn received his PhD at the Institute of Astronomy, Cambridge, on the interplay between supermassive black holes and clusters of galaxies. Subsequently, he became a Postdoctoral Research Assistant in the Astronomy Group with Professor Rob Fender at the University of Southampton, where he started to work on stellar mass black holes in X-ray binaries. His main research interests focus on the interaction that black holes have with their environment, as well as how their environment affects the black holes. With his investigations he hopes to further the understanding of black holes in general, which is of great importance with regard to their influence on galaxy and large scale structure formation.

After obtaining his PhD from the Technische Universität München, Boris Grube worked as a Postdoctoral researcher at Pusan National University, Korea and was a member of the STAR collaboration at the Brookhaven National Laboratory, USA. At the Cluster, he will concentrate on the field of hadron physics focusing mainly on the measurement of the hadronic and gluonic excitation spectrum using hadron beams at the CERN COMPASS experiment.

Welcome to the Cluster!

Junior Research Group Leader: Prof. Dr. Ilka Brunner (since 1 October 08) ++ Prof. Dr. Sebastian Jäger (since 1 October 08) ++ Prof. Dr. Jochen Weller (since 1 October 08)

Research Fellows: Dr. Boris Grube (since 1 October 08) ++ Dr. Robert Dunn (since 1 October 08)

Guests: Dr. Martin Crocce (Inst. Space Science, Barcelona, 9 - 17 October 08) ++ Prof. Eberhard Klempt (Universität Bonn, Germany, October 08) ++ Dr. Dmitry Ryabchikow (JHEP, Moscow, October - December 08) ++ Prof. Ikaros Bigi (NSH Notre-Dame, USA , 1 - 30 November 08) ++ Prof. Ralph DeVoe (Stanford University, USA, 1 - 23 November 08) ++ Dr. David Lai (UCO Lick, USA, 3 - 16 November 08)) ++ Dr. Florian Heitsch (University of Michigan, USA, 15 - 21 November 08) ++ Dr. Takahashi Fuminobu (University of Tokyo, Japan, 17 November - 5 December 08) ++ Prof. Joe Silk (Oxford University, UK, 4 - 9 November 08)

Postdocs: Dr. Marco Baumgartl (1 October 08) ++ Dr. Minoru Nagai (1 October 08)

LINKS

The bizarre sides of technology, science, love and life as such - drawn in a rudimentary stickman way. On XKCD.com almost-physicist Randall Munroe even shows us "The Observable Universe from top to bottom on a log scale". Lots of fun and truth in it!

http://xkcd.com

While we are still enjoying the last warm days, the shops have already heralded Christmas time: Early adopters now can buy candies and cookies of the season. Time to think about presents for our dearest ones! How about a cute Higgs boson or a neutrino as a plush toy? Absolutely irresistible!

http://www.particlezoo.net/shop.html

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Technische Universität München, Boltzmannstr. 2, D-85748 Garching, Fon: +49.89.35831-7100, Fax: +49.89.3299-4002, E-mail: info@universe-cluster.de, www.universe-cluster.de
Directors: Prof. Dr. Stephan Paul (TUM), Prof. Dr. Andreas Burkert (LMU)
Head of Administration: Dr. Katja Ketterle, Dr. Andreas Müller

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