

Faces & Places

ASTROPARTICLE PHYSICS

Largest Cherenkov telescope sees first light

The largest Cherenkov telescope ever built has come into operation at the High Energy Stereoscopic System (HESS) in Namibia. HESS II joins the four smaller (12 m) telescopes that have been operating at the HESS observatory since 2004, a site dedicated to observing the most violent and extreme phenomena of the universe in very high-energy gamma-rays.

The new telescope has a mirror 28 m in diameter – equal in area to two tennis courts – and weighs almost 600 tonnes. It saw its first light in the early morning of 26 July, producing images of the particle cascades that are generated in the atmosphere by cosmic gamma rays and cosmic rays. With four times as many pixels for an area of sky compared with the smaller HESS I telescopes, HESS II can resolve unprecedented detail in the cascade images. It will explore the gamma-ray sky at energies in the range of tens of giga-electron-volts in the poorly explored transition region between current space-based instruments and ground-based telescopes.

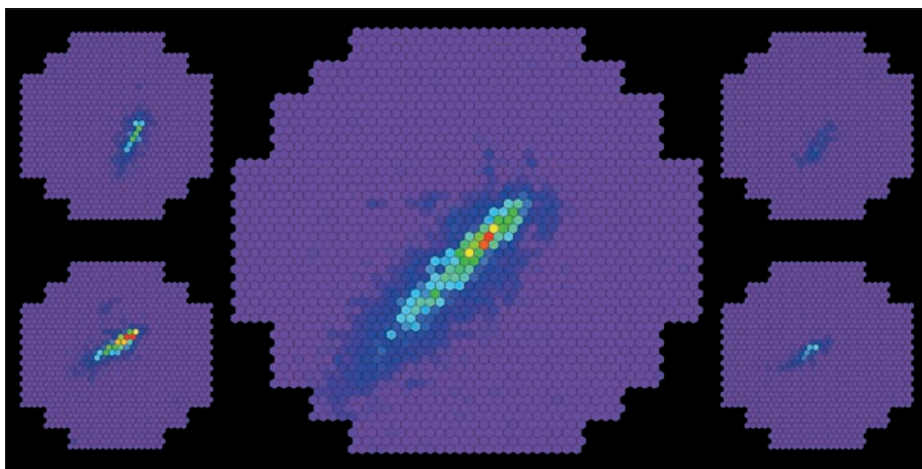
When gamma rays interact high in the atmosphere, they generate a cascade of secondary particles that emit faint blue Cherenkov light as they traverse the atmosphere. This light can be recorded by ultrafast photodetectors, forming a “camera” at the focal planes of telescopes on the ground. The HESS II camera – weighing almost 3 tonnes – is 36 m above the primary mirror in the focal plane. Despite its size, the new telescope will slew twice as quickly as the smaller telescopes to respond immediately to fast and transient phenomena anywhere in the sky, such as gamma-ray bursts.

The most extreme gamma-ray emitters – active galactic nuclei – shine in gamma rays with an apparent energy output equivalent to 100 times the luminosity of the entire Milky Way, yet the radiation appears to emerge from a volume much smaller than that of the Solar System. It also turns on and off in a matter of minutes – a strong signature of supermassive black holes. Some of the objects seen with the four HESS I telescopes have no known counterpart at other wavelengths; they may represent a new type of celestial object that HESS II will help to characterize.

The HESS observatory has been in operation for a decade by a collaboration of



The HESS II telescope. (Image credit: HESS collaboration/Frikkie van Greunen.)



Images of particle cascades viewed simultaneously by the HESS II telescope (centre) and by the four HESS I telescopes (shown at a reduced size). Colour encodes light intensity. The images illustrate the dramatically improved intensity and resolution with which HESS II views the particle cascades. (Image credit: HESS collaboration.)

more than 170 scientists from 32 scientific institutions in Namibia and South Africa, Armenia, Australia, Austria, the Czech Republic, France, Germany, Ireland, the UK, Poland and Sweden. The telescope structure and drive system for HESS II were designed by engineers in Germany and South Africa and produced in Namibia and Germany. The 875 hexagonal mirror facets that make up the huge reflector were manufactured

in Armenia and individually characterized in Germany. The mirror-alignment system is the result of co-operation by German and Polish institutes. The camera, with its integrated electronics, was designed and built in France. The construction of the new HESS II telescope was driven and financed largely by German and French institutions, with significant contributions from Austria, Poland, South Africa and Sweden.

Faces & Places

CONFERENCE

Munich welcomes Strings 2012

The world's largest and most important annual conference on string theory, Strings, took place this year on 23–28 July at the Ludwig Maximilians University in Munich. Around 400 physicists from more than 35 countries gathered at Strings 2012 in Bavaria's capital to discuss recent developments, results and the future of string theory. The scientific programme was divided between seven research areas and lecture series. The sessions on each scientific field started with a plenary talk as an overview, with several technical lectures completing the programme for each scientific area.

In string theory, matter and fundamental forces arise from the vibrational modes of one-dimensional strings. String theorists seek to unite all physical forces in a universal theory, which includes the unification of the five different versions of string theory as proposed by Edward Witten. Following this successful unification, a theory of everything seems closer than ever. However, all string theories predict the existence of extra dimensions of space, which do not impinge directly on the everyday world but could have repercussions for the physics of the universe. If string theories are unable to define uniquely the exact nature of the hidden dimensions, then the question arises whether a “multiverse” exists (*CERN Courier* December 2007 p13).

Following the latest results of the Higgs search at the LHC, the conference saw much discussion about possible impacts on physics beyond the Standard Model. Will there be more to reveal at the LHC, such as the supersymmetric particles that have been postulated? Supersymmetry predicts that each of the known elementary particles has an as yet undiscovered partner. If supersymmetric particles can be detected by the LHC, then their properties could help pin down which concept of the hidden dimensions in string theory best describes the universe. Nobel laureate David Gross highlighted the importance of possible discoveries at the LHC during his excellent outlook talk, in which he presented his vision for string theory.

Another significant and much discussed topic was the progress in formulating a holographic description of the laws of quantum physics. This scientific endeavour generalizes the basic holographic principle, which allows the generation of a 3D image



The poster for Strings 2012 shows *Kämpfende Formen* (“Fighting Forms”) by Franz Marc (1914), an important German expressionist artist. The picture can be seen at Pinakothek der Moderne, the museum of modern art in Munich. (Image credit: layout design by Marco Baumgartl.)

or hologram from a 2D surface. Juan Maldacena, founder of the holographic description in the context of string theory and a plenary speaker at Strings 2012, has invoked this principle to link Albert Einstein's theory of gravity with quantum physics. These ideas have led not only to deeper insights into the nature of quantum gravity, they are also being applied fruitfully in other fields, such as solid-state physics. Indeed, it turns out that gravitational solutions that describe black holes can also account for the properties of certain metals and superconductors. In his talk, Hermann Nicolai of the Max Planck Institute for Gravitational Physics in Potsdam presented alternative formulations of quantum gravity and discussed related open issues.

Other fervent discussion topics on the scientific schedule included the use of higher-spin theories as a refined test for anti-deSitter/conformal field theory correspondence by relating higher spin theories in the bulk to infinite dimensional W -algebras on the boundary. Black-hole complementarity versus firewalls, as well as subjects on quantum gravity in de Sitter space were also talking points.

String theory has become one of the most active and exciting research areas in modern theoretical physics and has aroused much interest not only among scientists but also with the media and the public. All of the speakers mentioned above attended the exclusive Strings 2012 press conference on 24 July. A high number of print and broadcast media representatives attended



Edward Witten introduced string theory and its fundamental concepts in his public lecture to an audience of 750. (Image credit: A Grisch/Max-Planck Institute for Physics.)

and took the opportunity to ask the scientists many questions.

Two public lectures were presented in association with the conference in the Main Aula at Ludwig Maximilians University. Rolf Heuer, CERN's director-general, gave an impressive lecture about particle physics, the LHC and the status of the Higgs search. The audience was also privileged to hear from Witten himself, who gave a remarkable talk about string theory and its fundamental concepts.

“German precision collides with Bavarian hospitality, an obvious success,” is how Lars Brink of Chalmers University and the international advisory committee described Strings 2012 at the conference dinner, in appreciation of the well organized meeting. Dieter Lust, chair of the local organizing committee, was for his part pleased to welcome so many outstanding scientists to Munich

● Strings 2012 was organized jointly by the Ludwig Maximilians University Munich, the Max-Planck Institute for Physics, the Arnold Sommerfeld Centre for Theoretical Physics and the Excellence Cluster Universe at the Technical University Munich.

MEETING

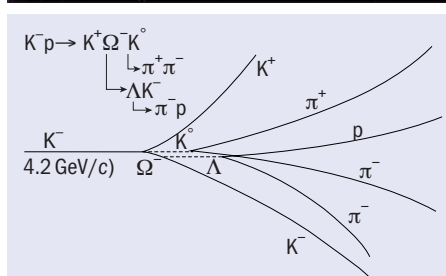
The 9th Vienna Central European Seminar on Particle Physics and Quantum Field Theory is to be held at the University of Vienna on 30 November – 2 December. This year's subject is “Dark matter, dark energy, black holes and quantum aspects of the universe”. Speakers include Sir Roger Penrose, who will also give a public lecture. For details, see www.univie.ac.at/vienna.seminar/2012.

PAST EVENTS

A look back at a beautiful Ω^-

In July 1962, at the 11th “Rochester” Conference (now better known as the International Conference on High-Energy Physics), Murray Gell-Mann presented the scheme based on SU(3) symmetry that he and Yuval Ne’eman had developed to describe the proliferation of new particles. This needed one particle, the Ω^- , to complete an SU(3) decuplet of baryon resonances. The famous first example was discovered at Brookhaven National Laboratory in 1964, followed a year later by a few at CERN (*CERN Courier* November 2008 p12). Almost a decade later, fewer than 30 Ω^- events had been seen from only a handful of experiments.

Early in the 1970s, the Amsterdam-CERN-Nijmegen-Oxford collaboration proposed the first large-scale exposure of the CERN 2 m hydrogen bubble chamber to a 4.2 GeV/c K^- beam. With 3 million pictures, the goal was to measure all events with visible strange-particle decay to improve significantly on existing data. The production of the Ω^- was just possible kinematically, so Richard Hemingway, a member of the



An Ω^- decay in CERN's 2 m hydrogen bubble chamber, found in 1974 in the experiment by the Amsterdam-CERN-Nijmegen-Oxford collaboration.

CERN team, encouraged the scanning team to look out for its characteristic signature in film taken in 1973. Some time in 1974, one of them succeeded, finding the event shown here – possibly the best ever taken of the Ω^- , with all of the produced particles clearly visible and identified by their bubble density. The experiment ultimately found 40 examples and provided good measurements of the mass and lifetime.

Further reading

R J Hemingway *et al.* 1978 *Nuclear Physics* **B142** 205.

VISIT



The French prime minister, **Jean-Marc Ayrault**, left, and French minister of higher education and research, **Geneviève Fioraso**, centre, were welcomed to CERN on 30 July and accompanied in the LHC tunnel by CERN's director-general, **Rolf Heuer**. During their visit they toured the CMS underground experimental area and viewed the *Universe of Particles* exhibition in the Globe of Science and Innovation before participating in a round-table discussion with members of the French and international scientific communities working at CERN.



Dinesh Kumar Srivastava, an eminent nuclear physicist, took over as director of the Variable Energy Cyclotron Centre (VECC) in Kolkata on 1 July, succeeding Rakesh Kumar Bhandari. VECC has a long association with CERN and is a collaborating institute of the ALICE experiment at the LHC. The centre carries out frontier research and development both in accelerator science and technology and in theoretical and experimental nuclear science, as well as in other areas such as material science, and computer science. (Image credit: VECC.)

Faces & Places

NEW PRODUCTS

Highland Technology Inc has announced the T240 single-channel externally triggered complementary-output pulse generator for driving electrical/optical modulators. The T240 features delay/pulse width in two ranges, from 100 ps FWHM up to 25 ns, and a programmable trigger threshold. It is controlled via USB, RS232 or trimpots and is powered by USB or standard 5 V micro-USB power supply. The T240 is also useful for RF applications including fast-pulse modulation and harmonic generation. For further details, tel +1 415 551 1700, fax +1 415 551 5129, e-mail info@highlandtechnology.com or see www.highlandtechnology.com.

ID Quantique has launched a new time-to-digital converter, the id800-TDC, with eight channels. This system is used to transfer the time-tags of events to a PC with picosecond precision and at high rates. It can also count single and multiple channel-coincident events at higher rates internally and convey those to a PC. A graphical user interface is supplied for Windows and Linux, with software examples are available for C/C++ and Labview. For more information, contact Michaël Désert, tel +41 22 301 8371, fax +41 22 301 8379, e-mail info@idquantique.com or visit www.idquantique.com.

Micromech has introduced the Parker Hannifin NX1, a robust brushless servomotor for applications including machine tools, X-Y tables and a variety of special-purpose machinery. This development extends torque output down to 0.45 Nm. The NX1 series is now the smallest product in Parker's existing range of brushless permanent-magnet synchronous servomotors, which offer a choice of torque outputs from 0.45 to 64 Nm, with power ratings from 0.2 to 13.7 kW at operating speeds of up to 7500 rpm. For further details, contact Alan Spinks, tel +44 1376 333 333 or e-mail alan@micromech.co.uk.

Photonic Science has announced the new high-sensitivity full HDTV low-noise cooled sCMOS camera, which delivers read-out noise as low as 1.2 electrons at 100 MHz overall scanning frequency. It is targeted at users with low light-level requirements, seeking real-time acquisition with high dynamic range > 20,000:1. The camera actively compensates for fixed-pattern noise, non-uniform response and gain balance on a parallel bus read-out

architecture. For more information, contact Diane Brau, tel +33 476 935 720, fax +33 476 935 722, e-mail Diane@photonic-science.com or see www.photonic-science.com.

Telonic Instruments has launched a new low-cost, high-quality digital-spectrum analyser, the DSA815, manufactured by Rigol. The latest in a range of fast compact and lightweight spectrum analysers, the DSA815 can distinguish small signals to a frequency difference of only 100 Hz. The IF filter also enables smaller bandwidth settings. The DSA815 is available in a 9 kHz to 1.5 GHz frequency range, with a typical 135 dBm displayed average noise level for accurate measurements. For further details, contact Bob or Doug Lovell, tel +44 118 978 6911 or visit www.rigol-uk.co.uk.

Wavelength Electronics has redesigned the PLD10000 laser diode driver with a new compact heat sink and fan shroud, and improved internal heat-dissipation capability. This technology has also been leveraged into a high-current driver, the PLD12500, that can drive up to 12.5 A. Mounted on printed circuit boards, both can drive lasers with compliance voltage as high as 27.5 V and both include laser-safety features designed to enhance system reliability. For more information, tel +1 406 587 4910, fax +1 406 587 4911, e-mail sales@teamwavelength.com or see www.teamwavelength.com.



Jan Hladký, an experimental physicist at the Institute of Physics of the Czech Academy of Sciences, has made many sculptures over the years based on recycled materials from particle-physics labs (CERN Courier June 2011 p46). His latest work is a celebration of the new boson discovered at CERN (CERN Courier September 2012 p46). The lower black glass plate (80 cm × 50 cm) represents the black mass of the universe. It is covered by a semi-black glass plate with a decoration (circles) that represents a field (the Higgs field?). An excited field particle appears as crystal glass, its decay through various channels symbolized by the ring with metal fingers. This includes two-gamma decay (the two fingers on the left), lepton decays (the few disordered fingers) and channels that are so far undiscovered (the undisturbed fingers). The large copper ring indicates zero spin – which, of course, is still to be confirmed. (Image credit: Renata Louvarova.)



Bryan Webber, emeritus professor at the University of Cambridge, was awarded the degree of Doctor Honoris Causa at Lund University on 25 May. Webber has made a number of seminal contributions to particle-physics phenomenology. Among other honours, he received the 2008 Dirac Medal from the UK Institute of Physics and the 2012 J J Sakurai Prize from the American Physical Society. (Image credit: Lund University.)

SCHOOL

CAS course in Slovakia focuses on ion sources

Each spring, the CERN Accelerator School (CAS) offers a course on a speciality of accelerator physics. This year it was the turn of ion sources to feature in a course that was organized jointly by CAS and the Slovak University of Technology and held in Senec, Slovakia, on 29 May – 8 June.

Following some lectures that recapitulated background accelerator physics and the fundamental processes of atomic and plasma physics, the course went on to cover a range of topics related to ion sources and highlighted the latest developments in the field. Realistic case studies and topical seminars completed the programme. In addition, the participants were able to enjoy a one-day excursion that included a guided tour of Bratislava.

The school attracted 69 participants representing 25 nationalities. Their feedback was extremely positive, reflecting the high standard of the lectures. The case studies were pursued with great enthusiasm and



Marta Cimbáková, left, representing the ministry of education, science, research and sport of the Slovak Republic, with Marius Pavlovic of the Slovak University of Technology, the local organizer of the school. (Image credit: Peter Janata.)

produced some excellent results.

A welcome event at the Hotel Senec included speeches by CERN's Roger

Bailey, head of CAS, Marta Cimbáková, representing the ministry of education, science, research and sport of the Slovak Republic, Peter Ballo, a vice-dean of the faculty of electrical engineering and information technology of the Slovak University of Technology in Bratislava, Michal Petráš, director-general of the Hotel Senec, and Vladivoj Řezník, representing Slovenské Elektrárne As.

The next specialized CAS course will be on "Superconductivity for Accelerators" and will take place in Erice, Italy, on 24 April – 4 May 2013 (see www.cern.ch/schools/CAS).

● The CERN Accelerator School is grateful to the following sponsors: the City of Senec, EBG MedAustron Wiener Neustadt, GSI Helmholtzzentrum Darmstadt, ministry of education, science, research and sport of the Slovak Republic via project KEGA 019STU-4/2012, Nadačný fond Slovenských Elektrární v Nadácii Pontis, ZŤS VVÚ KOŠICE As.

ET Enterprises

electron tubes

New Photomultiplier HV Base

Using photomultipliers is now even easier with a new range of compact, low noise, HV Bases from ET Enterprises.

Incorporating socket, voltage divider and HV supply, they are suitable for use with a wide range of photomultipliers operating in analogue, pulse counting or photon counting modes.

- range of input voltage (5V to 15V)
- output voltage adjustable from 100V to 2000V
- very low power
- high stability

Visit our new website for further information.

ET Enterprises is now your single source for 'Electron Tubes' and ADIT photomultipliers, including many Photonis replacements.

Use our new interactive website to search our complete range of products or follow the contact links to discuss your application.

ET Enterprises Limited, Riverside Way,
Uxbridge, UB8 2YF, UK
Phone: +44 (0)1895 200880
Fax: +44 (0)1895 270873
sales@et-enterprises.com
www.et-enterprises.com

ADIT Electron Tubes, 300 Crane Street,
Sweetwater, Texas 79556, USA
Phone: (325) 235 1418
Fax: (325) 235 2872
sales@electron tubes.com
www.electrontubes.com



www.ventacid.hu



Prompt supplier needed? A Market Leader Hungarian Manufacturer

Founded in the year 2000 **Ventacid Hungary Ltd** is working on the field of the environmental protection. As part of the french Europe Environnement Group **VENTACID** provides turn-key air treatment systems and plastic tanks even in ATEX-proof version. The company is **certified** for manufacturing plastic welded installations and tanks containing **dangerous liquids** having suitable technical and personal conditions documented procedure specifications and operates a quality management system with reference to **ISO 9001:2008**.

As the **most important Hungarian** manufacturer of plastic welded installations **VENTACID** made significant investments in the recent years: 2,500 m² indoor production hall as well as modern plastic welding machines some of them **unique in Hungary**. Due to its machines and well trained specialists VENTACID managed to join the European technical construction-commercial processes. The company's annual revenues from domestic and export now reaches one and a half million euros.

Following **CERN Procurement services' approval**, the firm is registered into CERN database.

Contact: dir. Laszlo ORBAN email: orban@ventacid.hu

