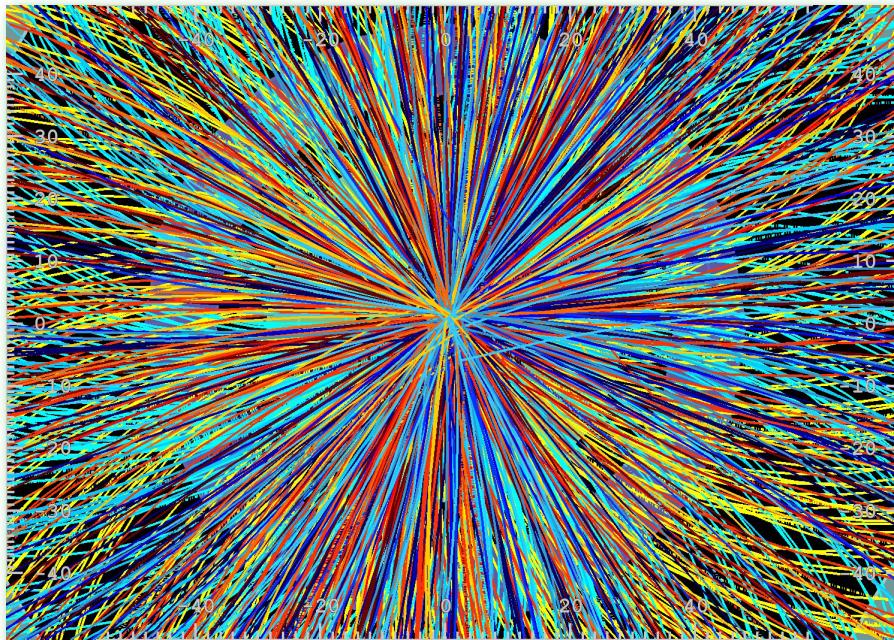




## LHC experiments present new results at Quark Matter 2011 Conference



Events recorded by the ALICE experiment from the first lead ion collisions (Nov-Dec 2010).

"These results from the LHC lead ion programme are already starting bring new understanding of the primordial universe," said CERN Director General Rolf Heuer. "The subtleties they are already seeing are very impressive."

In its infancy, just microseconds after the Big Bang, the universe consisted of a plasma of quarks and gluons (QGP), the fundamental building blocks of matter. By colliding heavy ions, physicists can turn back time and recreate the conditions that existed back then, allowing us to understand the evolution of the early universe.

**The three LHC experiments that study lead ion collisions all presented their latest results today at the annual Quark Matter conference, held this year in Annecy, France. The results are based on analysis of data collected during the last two weeks of the 2010 LHC run, when the LHC switched from protons to lead-ions. All experiments report highly subtle measurements, bringing heavy-ion physics into a new era of high precision studies.**

The LHC heavy-ion programme builds on experiments conducted over a decade ago at CERN's Super Proton Synchrotron (SPS) accelerator, which saw hints that the plasma could be created and studied in the laboratory. Then, in 1999, the baton passed to the Relativistic Heavy-Ion Collider (RHIC) at the US Brookhaven National laboratory, which firmly established that QGP could be created on a minuscule scale. This year's Quark Matter conference is the first in the series to feature results from the LHC.

(Continued on page 2)

Nos 21 & 22 – 25 May & 1 June 2011



A word from the DG

### Dare to excel: making Europe a star in the research firmament

Last week, I was invited to give a talk at SwissCore, the Swiss contact office for European research, innovation and education in Brussels. They gave me the title 'Dare to Excel', and asked me to address the challenges of the European Commission's upcoming next framework programme.

(Continued on page 2)

### In this issue

#### News

- LHC experiments present new results at Quark Matter 2011 Conference 1
- A word from the DG 1
- LHC Report: Boost in bunches to bring record luminosity 3
- Experiments at the Large Hadron Collider – How are discoveries made? 4
- Origin of life experts might find inspiration at CERN 5
- Three tasks for physicists in the name of health 6
- The antimatter factory is ready for another successful year 7
- George Smoot talks to the Bulletin 9
- A mini-exhibition with maximum content 10
- TIARA: Connecting accelerators 10
- New researchers join HIE-ISOLDE 11
- 5, 4, 3, 2, 1... lift-off! 11
- Scientists present their design for Einstein Telescope 12
- Classified 13
- CERN relay race 14
- News from the Library 14

#### Official news

- Take note 15
- Academic training 16
- Safety Training Course 16
- External meeting 16
- Seminars 17

#### Published by:

The European Organization for Nuclear Research - CERN  
1211 Geneva 23, Switzerland - Tel. + 41 22 767 35 86

Printed by: CERN Printshop

© 2010 CERN - ISSN: Printed version: 2077-950X  
Electronic version: 2077-9518



# LHC experiments present new results at Quark Matter 2011 Conference

(Continued from page 1)

Results from the ALICE experiment have provided evidence that the matter created in lead ion collisions is the densest ever observed, over 100000 times hotter than the interior of the sun and denser than neutron stars. These conditions allow the properties of the plasma to be studied with unprecedented detail. ALICE has confirmed the RHIC experiments' finding that QGP behaves almost like an ideal fluid with minimal viscosity. ALICE's presentation also discussed the behaviour of energetic particles in the QGP medium.

"We are very excited about the plethora of observables challenging many of the theoretical interpretations," said ALICE spokesperson Paolo Giubellino. "The extraordinary capability of our detector to provide detailed information about the thousands of particles created in each collision proves to be essential for the understanding of the QGP."

The ATLAS collaboration has performed a comprehensive study of heavy-ion collisions. The experiment's analysis includes

global properties, such as the number and distributions of charged particles emerging from the plasma, which elucidate the collision dynamics and transport properties of the medium, as well as so called hard-probes of the medium, which include measurements on the production of W and Z bosons, charmonium and particle jets.

"The first LHC heavy-ion run was a great success for ATLAS," said co-convenor of the collaboration's heavy-ion group, Peter Steinberg of Brookhaven. "Combining global measurements and hard probes in LHC heavy-ion collisions is leading to greater insight into both the nature of the hot, dense medium and the QCD processes that lead to jet quenching."

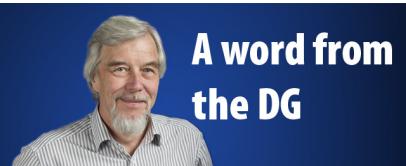
Jet quenching is the phenomenon, first reported by ATLAS last year, whereby so-called jets of particles formed in the collision are broken up as they cross the turbulent region of plasma.

CMS has seen a number of new phenomena including the production of W and Z

bosons. Novel studies have been produced on jet quenching and to characterize the behavior of matter that reproduces the extreme conditions just after the universe's birth. The most striking observation from CMS is that weakly bound states of the b-quark are heavily suppressed in lead-lead collisions. This phenomenon is important for understanding the properties of the QGP.

"We are entering a new era of high precision studies of strongly interacting matter at the highest energies ever," said CMS spokesperson Guido Tonelli. "By deploying the full potential of the CMS detector we are producing unambiguous signatures of this new state of matter and unravelling many of its properties."

CERN Press Office



(Continued from page 1)

## Dare to excel: making Europe a star in the research firmament

I took my lead from Aristotle, who said that excellence is achieved by what we repeatedly do. It is not a single act, but a habit won by consistency and dedication. With seven framework programmes to its credit so far, I think Aristotle would have approved of the EC's track record so far. But excellence is no friend of complacency, and the EC is right to strive for improvement.

In my opinion, the EC plays a vital role in supporting European science. Its role should be to supplement and build on national programmes, not to replace them, and this is something that the framework programmes have done well. One area in which the EC can improve is, perhaps surprisingly, by allowing some projects to fail without becoming stigmatised; not necessarily the large flagship projects, but imaginative projects in their early stages. Such an approach would encourage more innovative thinking, ultimately leading to greater returns.

Most vitally of all, however, EC funding, like all public funding, should ensure the sustainability of basic science over the long term, and thereby underpin the virtuous circle of innovation that links basic and applied science.

Another area where the next framework programme can make a real difference is in becoming more inspirational for a wide public. In an increasingly science-dependent age, society is becoming dangerously apathetic, and sometimes hostile, to science. It's important for science to become more fully integrated into society, and through the framework programmes, the European Union can play an important role in achieving that ambition.

As a starting point, I suggested that rebranding the framework programmes with a more motivational title might be a good place to start. My suggestion? Supporting Technology And Research in Europe: STAR Europe.

I was quite pleased with that idea, until someone pointed out that the Commission had already had the same idea and run a competition for a new name as part of a broad consultation on what should be in the next programme. Apparently, I've missed the deadline, but what's important is that through its open engagement with the community for feedback, criticism and input to the next framework programme, the EC is already daring to excel in science, technology and innovation.

Rolf Heuer

# LHC Report: Boost in bunches to bring record luminosity

The MD periods improve our understanding of the machine, with the aim of increasing its short- and long-term performance. This one also included tests of the machine's configurations for special physics runs and a future high luminosity LHC.

It was an intense program and overall it went very well, with most measurements carried out successfully. Highlights included: commissioning a dedicated machine setup for TOTEM and ALFA; successfully colliding high intensity bunches with small transverse beam size, demonstrating the LHC's ability to push present parameters; and an encouraging

**Having hit a luminosity of around  $8.4 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$  with 768 bunches per beam, the LHC went into a 5-day machine development (MD) program on Wednesday 4 May. Operators are now working at increasing the number of particle bunches in the machine towards a 2011 maximum of around 1380 bunches. Another record-breaking peak luminosity was recorded Monday 23 May.**

first look at a potential solution for the High Luminosity LHC (HiLumi-LHC).

This MD period led into a 4-day technical stop with the cryogenics, quench protection and other systems receiving some TLC (tender loving care). Quench tests were also performed to probe the potential for an increase in beam energy in the coming years. The technical stop was followed by a recovery period where a key priority was the careful validation of the machine protection system. On Sunday 15 May, a full

set of luminosity (or Van der Meer) scans were performed. These are designed to allow the experiments to calibrate the measured luminosity - important input into analysis of the collected data.

Stable beams with 912 bunches were recorded on Sunday 22 May. This brought the peak luminosity to  $1 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$  on Monday, a new record. Over the coming days, the LHC team aims to push the number of bunches towards a 2011 maximum of around 1380 bunches.

*Mike Lamont for the LHC team*

# Experiments at the Large Hadron Collider - How are discoveries made?

This is because new particles are hardly ever detected directly. Depending on the design of the experiment, there can be several centimetres

between the collision point and the first layer of detector electronics. This is a vast distance on the scale of a subatomic particle. Particles created in the collisions interact and indeed decay before ever reaching the detector. If created in an LHC collision, the Higgs boson, for example, is expected to last for a mere trillionth of a trillionth of a second ( $10^{-24}$  s), before decaying into other particles – not long enough to move anywhere perceptible, let alone reach the detector. Moreover its decay products may themselves also decay before being detected.

It is only through a complete analysis of the tangle of particles created in collisions that physicists can begin to suppose the existence of something new. Over time, with repeated observations of the same effect, suppositions become more certain. The larger the data set, the more confidence we can have about the results. However, new

**With the LHC up and running, some might imagine physicists just waiting for a Higgs boson to pop up in one of the four experiments, before publishing a paper and moving on to solve science's next Big Mystery. However this picture is very far from the reality of experimental particle physics today, where results are based on statistics, statistics and yet more statistics.**

particles are not created in every collision. Far from it! Finding a Higgs will be like finding a needle in a million haystacks.

Making a discovery often consists of collecting a lot of data and combining them in a plot (one of the most common plots is production rate against mass) before carefully subtracting the contributions expected from known processes. This is because known particles can often produce similar decay products, or signatures in the detector, to new particles. Once all known processes are accounted for, if a signal remains, it might be down to something new.

Often you will hear a sigma value attached to a particular announcement. This gives a measure of how certain physicists are that the result is real and not just a statistical fluke. A two-sigma result has a 2.3% chance that it is not true. A three-sigma result has a 0.15% chance that it is not true. Beyond the three-sigma level, physicists start sitting up and taking notice, but a result can't yet be termed a new discovery. For that to happen, a five-sigma certainty is needed, or a mere one in 3.4 million chance that a sighting is due to chance.

And although a three-sigma result may already sound pretty certain to you, don't forget physicists are making huge numbers of different plots. If you plot 1000 different distributions, the chances become about one in a thou-

sand (0.1%) that you'll see something odd in one of them, without it being due to a new particle.

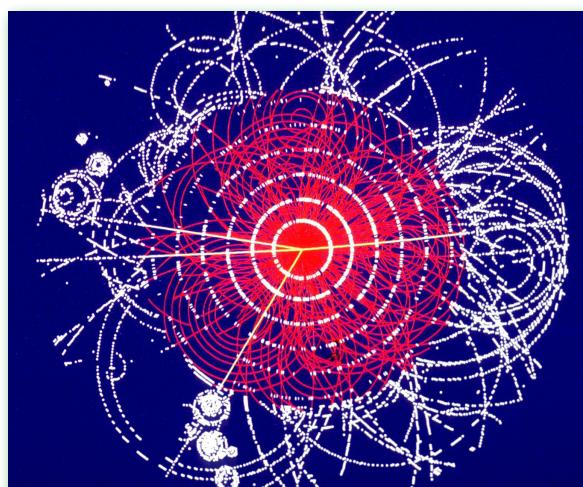
Luminosity is key - the more protons in the LHC and the higher the collision rate, the more data are collected and analysed by the experiments and the lower the error. But this only works up to a point. The sigma value alone does not give the whole story. The contributions from known particles that are subtracted from the plots are not always known exactly. This is a potential source of systematic error that is not reflected in the sigma value.

In addition, the choices made by the physicists running the experiment, such as the criteria for which data to store and analyse, can contribute to errors in the analysis. These choices are based on our current understanding of physics, which gives pointers to what we expect to find, but they are not infallible. There can also be effects due to the way a particular experiment is designed.

Hence the importance of comparisons with results from different teams. CERN's communication protocol ensures that before the lab makes an announcement of a new discovery, the leaders of the other LHC experiments have also had a chance to compare results to their own measurements and give their reactions.

This doesn't mean it's wrong to get excited about the first indications of new physics. It is just important to put them into context. They should be taken with a pinch of salt until they have been both tested over time and subjected to peer review. With the LHC performing so well, there is great excitement all over CERN and huge anticipation of the results that are on their way. Roll on the summer conference season and its abundance of new peer-reviewed papers.

Emma Sanders



Simulated Higgs decaying into four muons in the ATLAS detector.

## **Origin of life experts might find inspiration at CERN**

**A**ccording to workshop chair Stuart Kauffman, an American theoretical biologist, currently Finland Distinguished Professor (FiDiPro) at the Tampere University of Technology: "The Origin of Life problem began with Louis Pasteur, who refused to believe in the 'spontaneous generation principle' of life. All life, he said, comes from life. This left Pasteur in a conundrum: how did life start in the first place?" As a renowned expert in complexity of biological systems and organisms, Kauffman is one of the best minds studying this still unanswered question.

Yet the focus of the workshop was not exactly the emergence of protolife, but the organisational difficulties that seem to affect the field's progress. "If we do not organise our field we are in danger of drifting into scattered, uncoordinated groups that make little progress," says Kauffman. "By coordinating our efforts, we believe we can make more rapid strides." Along with a group of international Origin of Life scientists, Kauffman has begun addressing this organisational issue. They need a growing team of scientists who can collaborate while conducting appropriately diverse research, thus avoiding being trapped by any single idea.

**“How did life appear on Earth?”** That was the unanswered question on attendees’ minds at a single-day workshop held at CERN, 20 May. The brainstorming session featured experts from the biology field and CERN physicists. Although the million-dollar question wasn’t answered, the group explored the possibility of organising a large-scale research project that could do just that.

At CERN, scientists from more than 100 different countries work together and produce results that are then shared with the world. Although the specific activities are very different, the biochemists are hoping that some of CERN's organisational success will rub off on them. "We are happy to share how we plan large-scale experiments and how we work together with our colleagues in other research fields," says Markus

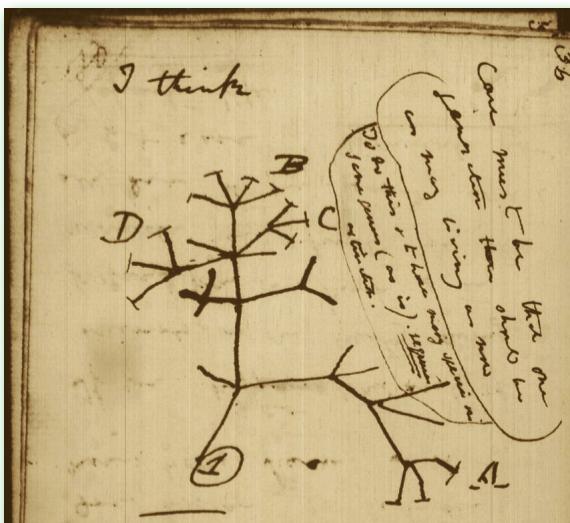
Nordberg, ATLAS resources co-ordinator and co-organiser of the Origin of Life brainstorming workshop. "We hope to inspire their approach to finding the large-scale resources that the fundamental scientific questions require."

"Technically, the time is ripe for an international group to coordinate, tackle and solve the problem of the emergence of protolife," concludes Kauffman. "With its successful organisational model, CERN has showed us how a distributed collaboration can produce coherent efforts. The whole event was extremely inspiring for our community." Famous organic chemist Albert Eschenmoser once remarked: "the best minds in chemistry should now enter the Origin of Life field." With these "best minds" already on board, and a bit of inspiration from CERN, the group could be close to solving Pasteur's riddle.

You will find further details about the Origins of Life Workshop at:

[http://indico.cern.ch/  
conferenceDisplay.  
py?confId=130130](http://indico.cern.ch/conferenceDisplay.py?confId=130130)

Katarina Anthony & Anaïs Schaeffer



Darwin's vision of "descent with modification" from his "B" notebook.

# Three tasks for physicists in the name of health

The three actions that were discussed in the first Physics for Health workshop were very specific and included: a new research facility for biomedical uses, the launch of a new study for a compact and low-cost accelerator for hadron therapy, and the creation of a European distributed user facility for the production of innovative radioisotopes. "CERN has a lot of expertise in all of these fields and it is seen as a 'neutral' ground by the various communities involved," explains Steve Myers, CERN Director for Accelerators and member of Physics for Health Organizing Committee. "Our role is not to build the future machines for medical applications but to coordinate and prompt feasibility studies for future developments. We want to be a centre that helps catalyse collaborations and co-ordination, and we hope that institutions, such as the EU, will support us with these new initiatives."

Some of the existing CERN facilities could indeed be partially adapted to be used for medical applications. "We are studying the possibility of using LEIR since it is well suited to be converted into a facility providing a range of ions and energies both for radiobiology and detector developments, and it is only used for LHC operation for part of the year," says Manjit Dosanjh, in charge of life-science related projects at CERN within the Knowledge Transfer group. "Although particles – in particular protons and carbon ions – have been successfully used in cancer treatment over many years, the medical community is still lacking systematic studies on the biological impact that different particles at different energies have on cells and other biological material. We are also missing information on the additional role of drugs and oxygen with particles that could possibly improve the effectiveness of the treatment. With the new slow ejection channel and beamline from LEIR, we could set up dedicated experiments in a relatively short time. We are currently aiming at starting the first ones by the end of this year." Initially, only a few types of ions will be delivered by LEIR for radiobiology experiments. But in the longer term, and given interest and support from the communities involved, CERN could also think of building a more versatile front-end to the accelerator and produce a wider variety of beams.

In addition to exploring possible new projectiles to zap cancer cells, the scientific community needs to work on reducing the costs of the machines that will accelerate

The first "Physics for Health" workshop was organized at CERN in February 2010. It successfully showed the big potential that particle accelerators and detectors have in serving as instruments for early diagnosis and effective treatment of tumours. The conference participants expressed the wish that CERN be involved in three innovative projects. One year later, it's time to touch base on the assignments and prepare for a new edition of the conference, which will be held in Geneva in February 2012.

them. The second task CERN was assigned after the first Physics for Health workshop was the launch and co-ordination of a study to design the future accelerator to be used in hadrontherapy. "The new study will be called PIMMS2 and it's the follow-up of PIMMS, the Proton Ion Medical Machine Study led by CERN between 1995 and 1999," explains Daniel Brandt, in charge of the project. "The new study will aim at designing an accelerator complex (accelerator, transfer lines and gantries), which will have to be compact, use a reliable technology, and fulfil the most recent medical requirements. The overall cost to build it will also have to be relatively low." Phase one of the project has already started and a call for proposals was recently sent to the scientific community. "We are already starting to receive inputs on this. The pool of European experts we are setting up will decide on the type of the future machine by February 2012, in time to present our results at the next edition of Physics for Health," adds Brandt. The step after that is the actual design of the new facility, eventually delivering the Conceptual Design Report by end-2013.

Radioisotopes are playing an increasingly important role not just in cancer diagnosis, but also in treatment. Companies, hospitals and research centres are carrying out many research projects on this field. Dewi Lewis, a renowned isotope expert, will coordinate the third task from Physics for Health, which aims at creating a European network of institutes and companies involved in radioisotopes research. "Our aim is to define a common research programme that could be carried out in a co-ordinated way to achieve the best results in the production of innovative radioisotopes," explains Steve Myers.

The first Physics for Health workshop opened a new era of collaboration between physicists and medical doctors, laying the foundations for better mutual understanding and dedicated common efforts for the good of health. The follow-up of the workshop will be the ICTR-PHE 2012 conference, which will be held in Geneva, 27 February - 2 March, 2012. The conference is the result of the merging of the ICTR medical conference – whose objective is to



update the radiation oncology community on the most recent advances in translational research – and the Physics for Health in Europe workshop. "The reason for bringing the two conferences together is to catalyse stimulating exchanges and interactions between experts in various fields, from biology and physics to clinical medicine. These novel synergies will be the 'red thread' that ICTR-PHE 2012 will follow during these 5 days," concludes Manjit Dosanjh, one of the ICTR-PHE 2012 chairs. The second chair of the joint conference is Professor Jacques Bernier, whom the Bulletin will interview later in the year in order to give voice to the medical community. "Medicine is increasingly dependent on cutting-edge technology developments. It is therefore timely that the medical and research communities come together to work on common projects," he comments.

The abstract submission deadline for participating in ICTR-PHE 2012 is October 3, 2011. All information can be found on the conference website:

<http://ictr-phe12.web.cern.ch/ICTR-PHE12/>

CERN Bulletin

# The antimatter factory is ready for another successful year

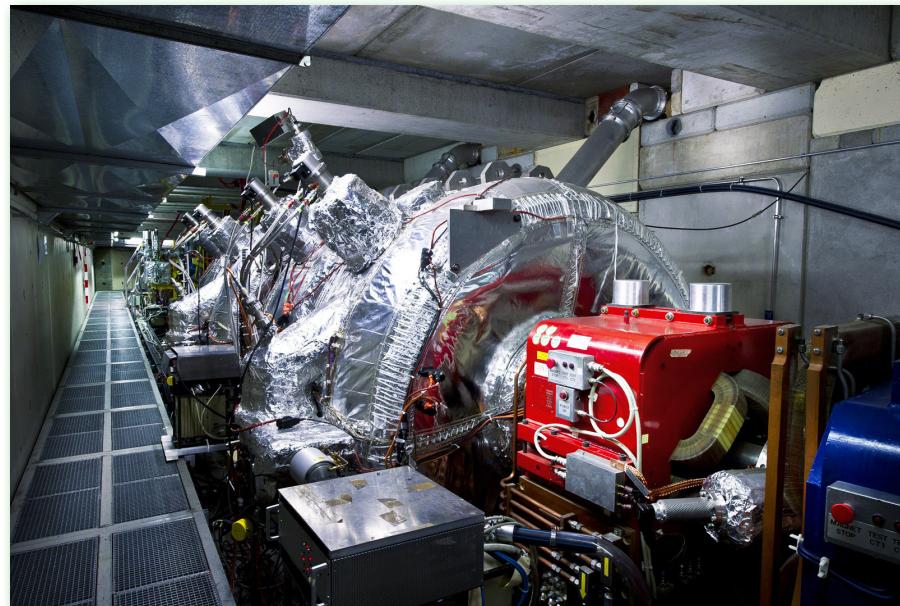
CERN's Antimatter Decelerator (AD) is a unique antimatter factory that produces low-energy anti-protons for creating anti-atoms. The AD delivers its precious ingredients to

several experiments that use them to study antimatter properties from many different angles. The 2011 run is about to start, and the experiments are ready to enter a new data-taking period. Their scientific goals for this year include applying spectroscopy techniques for the first time to probe the inner workings of antihydrogen atoms;

**CERN's contribution to antimatter research is interspersed with important breakthroughs: from the creation of the very first anti-atoms in 1995 to the production of large quantities in 2002 and the invention in 2010 of the technique that freezes them down to allow precise studies of their properties. This week, antimatter experiments are on the starting blocks for a new run that promises to be just as exciting.**

evaluating the biological effects of antiprotons on living cells; and reaching a very high precision in the study of the antiproton.

Here are some detailed descriptions of the experiments and the results they expect in 2011.



The Antiproton Decelerator (AD).

## ACE

The ACE experiment studies the biological effects of antiprotons on living cells. The potential use of antiprotons in cancer therapy was first discussed in the mid 1980s. Monte Carlo calculations showed that the energy deposited by antiprotons near the end of the range is twice as high as for protons, for identical energy deposition at the entrance to the target. This is caused by the secondary particles produced in the annihilation event, when an antiproton comes to rest. Some of these secondaries are low energy fragments and recoil ions resulting from a break-up of the target atoms and molecules. These have a high linear energy transfer (LET) and are therefore expected to have an enhanced biological effect, which would boost the energy enhancement. ACE's goal is to quantify this effect and study the biological effective dose of antiprotons annihilating biological targets.

In the ACE experimental set-up, living cells are embedded in a gelatine matrix and irradiated with antiprotons from the AD. After irradiation, cells are extracted from defined positions along the beam path, dissolved from the gelatine matrix and incubated so that they can be studied. The effective biological dose of antiprotons is extracted and compared with that of other particles, such as protons and carbon ions.

Early experiments with 46 MeV antiprotons showed a total enhancement factor of 4. Based on this encouraging result we have conducted a sequence of experiments using 126 MeV antiprotons, yielding a clinically relevant penetration depth of 10 cm in water. In contrast to carbon ion beams the ACE collaboration has observed a distinctively different dependency of biological effect with depth, which could be beneficial

for certain deep-seated cancers surrounded by critical organs. Experiments planned for the near future aim at increasing the statistical significance of these findings and will allow ACE to perform virtual treatments of specific types of tumour in different locations using protons, carbon ions and antiprotons to identify those cancers where antiprotons could make a significant difference to the clinical outcome.

In parallel, the ACE team has been studying effects on cells situated outside the direct beam, which could indicate potential damage to cell DNA that could cause secondary malignancies due to the treatment. The group has also developed methods for absolute dosimetry of mixed radiation fields as generated by antiproton annihilations, and has studied methods to directly measure LET, an important indicator of increased biological efficiency. The possibility of real-time imaging of the dose distribution has been demonstrated in pilot experiments. These measurements will continue and are expected to yield a solid scientific basis for evaluating antiprotons as candidates for cancer therapy.

Detailed information about the ACE experiment can be found at:

<http://users-phys.au.dk/hknudsen/introduction.html>

## AEGIS

The newest experiment at the AD, AEGIS (Antihydrogen Experiment: Gravity, Interferometry and Spectroscopy) aims to measure the gravitational interaction between matter and antimatter for the first time. The design involves forming a pulsed beam of cold antihydrogen atoms that will fly horizontally at a few hundred meters per second over about one meter through a classical atom interferometer. This so-called Moiré deflectometer allows us to measure the minute drop the atoms undergo over their parabolic trajectory, producing a shadow mask-like pattern on the high-resolution antihydrogen detector, a large-surface silicon microstrip detector. Such a beam - once it has been made - will also open the door to spectroscopic measurements of antihydrogen atoms in flight, but its formation requires a number of daunting challenges to be overcome, including the cooling of antiprotons to sub-Kelvin temperatures, forming positronium atoms (an electron and its antimatter particle – the positron – orbiting around their centre of mass) in large quantities, exciting them into a highly excited state via two laser pulses, bringing them into contact with the cold antiprotons, and finally accelerating

(Continued on page 8)

# The antimatter factory is ready for another successful year

(Continued from page 7)

the formed antihydrogen atoms into the interferometer.

The experiment is currently being built and installed in the AD, sharing the last remaining experimental area with the ACE experiment, and should be fully operational in 2012.

Detailed information about the AEgis experiment can be found at:

<http://aegis.web.cern.ch/aegis/home.html>

## ALPHA

After a memorable run in 2010 that featured the first trapping of antimatter atoms, the ALPHA collaboration at the Antiproton Decelerator is anxious to get started again in 2011. The current ALPHA device allows the study of interactions between trapped anti-atoms and microwaves. This will be the experimental emphasis in 2011.

The microwaves can be used to probe the hyperfine structure of antihydrogen - a first step down the path of precisely testing the CPT theorem, which requires that hydrogen and antihydrogen have identical spectra. The latest results from 2010 indicate that trapped antihydrogen could survive in ALPHA for a much, much longer time than the 172 ms reported in the proof-of-principle article on trapping. This suggests that it may be possible to perform such measurements on just a few trapped atoms. The collaboration will, however, devote a lot of time to improving the fraction of trapable antihydrogen atoms from the current best level of about 2 out of 10,000 produced atoms. In parallel, ALPHA's scientists are designing and building an upgraded apparatus that will also allow laser access to the trapped anti-atoms, starting in 2012.

Detailed information about the ALPHA experiment can be found at:

<http://alpha.web.cern.ch/alpha/>

## ASACUSA

ASACUSA (Atomic Spectroscopy And Collisions Using Slow Antiprotons) is a Japanese-European collaboration studying diverse aspects of antiproton physics. The most topical activity in 2011 will be the continuation of work to produce a beam of antihydrogen atoms in their ground state,

at the extremely low energy of one or two milli-electron volts (meV). This will be used to measure the so-called 'Maser frequency' of antihydrogen. According to the CPT theorem this should be identical to the value for hydrogen. Studies of various promising trap designs for this purpose will be continued, including the Cusp trap (a pair of Helmholtz coils wound in opposite directions) and a radio-frequency RF Paul trap (which can confine both antiprotons and positrons simultaneously). The success of the Cusp trap in synthesizing antihydrogen shared first place with the ALPHA collaboration in Physics World's top ten breakthroughs of 2010.

ASACUSA also aims to improve the precision of its measurement of the antiproton-electron mass ratio by continuing its laser spectroscopy measurements on antiprotonic helium. Going beyond the one part in a hundred million precision the collaboration recently achieved will also require ever-lower energy antiprotons, and will form an important part of the efforts in 2011. The precision of this measurement may then surpass that for the 'ordinary' proton, in which case we will 'know' the antiproton better than we know the proton.

Other items on the ASACUSA agenda for 2011 include systematic microwave spectroscopy of antiprotonic Helium-3, annihilation cross-section measurements of antiprotons on various metallic elements at 100 KeV, and differential cross-section measurements of antiprotons in hydrogen and helium using a reaction microscope.

Detailed information about the ASACUSA experiment can be found at:

<http://asacusa.web.cern.ch/ASACUSA/>

## ATRAP

ATRAP's goal is precise spectroscopic comparisons of antihydrogen and hydrogen. The proposed method is to use antihydrogen atoms that are cold enough to be stored in a magnetic trap. The goal and method, proposed long ago while ATRAP was developing the required cold antiproton method at CERN's LEAR, are now being vigorously pursued by multiple collaborations at CERN's AD.

In 2009 ATRAP reported producing the first antihydrogen atoms at the minimum of a

very strong magnetic field – the trapping field configuration proposed for storing and studying cold antihydrogen atoms. No trapped antihydrogen atoms were detected at a reported detection sensitivity of 20 atoms per trial (required to distinguish atom annihilations from the cosmic ray background).

The collaboration spent 2010 developing methods to increase the number of cold atoms rather than increasing its detection sensitivity, since more atoms per trial seemed important for achieving the spectroscopy envisioned at ATRAP. The result is that it is now possible to use 1000 times more antiprotons at a 3 times lower temperature than was ever used previously for making antihydrogen atoms.

In the first of two steps, ATRAP reported accumulating enough cold antiprotons to allow the first observation of a centrifugal separation of plasmas of trapped antiprotons and electrons. Second, a sequence of "embedded electron cooling" and "adiabatic cooling" methods was shown to further cool such antiprotons, yielding five million antiprotons at a temperature of 3 K or below. Whether this is the antiproton temperature or an upper limit on the temperature measurement technique remains to be established.

ATRAP hopes to use the much larger and much colder plasmas of antiprotons to produce enough trapped antihydrogen atoms for precise spectroscopy.

Detailed information about the ATRAP experiment can be found at:

<http://hussle.harvard.edu/~atrap/>

CERN Bulletin

# George Smoot talks to the Bulletin

You started your scientific career as a particle physicist, but soon you moved to astrophysics and in particular the Big Bang theory and cosmology. What motivated your interest in the Big Bang theory?

After I graduated from MIT, I went to Berkeley to work with particle physicist Luis Alvarez. He knew I was interested in many areas and said, "tell me what you would like to do and we'll try and work on that". I saw astrophysics as a new field, with a lot of new and exciting opportunities. I started doing experiments looking for antimatter, which eventually led to the idea of ASTROMAG and later to AMS. Studying antimatter, we found that it was in less than one part in 10,000. I thought: "There's no antimatter around us and in the nearby stars, so I should think about looking at other science to pursue. We know the Big Bang happened, and we know it was very energetic and related to particle physics. It should tell us much more about fundamental physics."

From AMS you moved on to build extremely complex telescopes and detectors, from balloon-borne to spy-plane-borne detectors, located in extreme places, from space to the South Pole. Can you summarise the steps and discoveries that led to your Nobel Prize?

It all began by trying to find the best approach to look at the relic radiation from the big bang. We started by putting a prototype detector on a mountain. When that worked, we wanted to get it much higher up, in either an airplane or a balloon. I had done a bunch of experiments with balloons and knew that equipment could easily get damaged in them, so I wanted to use an airplane. We found that the U-2 spy plane was perfect for our experiment, as it flew very high and evenly. The only problem was that it was designed to look down, so we had to convince NASA and Lockheed to build a hatch that looked up. Once we'd done that, we developed the technology for the flight-high-quality radio receivers, good antennas and techniques of switching and interchanging - most of which was refined from previous concepts. The next step was to make a cooled version of it to get more sensitivity, and then make a refined version of that to fly on the COBE satellite, and an

**Antimatter, dark matter, dark energy, the nature of space and time... The Nobel Laureate George Smoot answers Paola Catapano's questions about his career and the many issues about the Universe that are still open.**

even further refined version for the WMAP satellite.

So, there was a whole sequence of developments that made the measurements better and better. I don't see it as just one achievement. Once we'd succeeded in taking measurements, we learnt how to improve them for new projects. That's one of the things that Alvarez taught us. He'd say, "Don't just repeat the measurements unless you know how to improve them in a way that leads to new science; otherwise, see if there's something else you should be doing".

Now we're starting the development of the next generation of detectors. Nowadays, just a few detectors are not enough. We want to make, say, a thousand detectors. And not only do we have to make them, but we also have to make them work in a focal plane.

*Let's go back to COBE. Since the start of your scientific ventures, you've been looking for "anisotropies", that is, you were trying to prove that the Universe is not homogeneous. Can you explain why this is important?*

Actually, we were looking for three things with the COBE satellite. We had come to the conclusion, from measurements from our balloon and ground-based experiments, that the fluctuations in the Universe were very small - too small for galaxies to form if the Universe was only made of ordinary matter. Dark matter hadn't really taken off as a concept then, so the question was how could galaxies possibly have formed? That depended on whether or not Cosmic Background Radiation really was relic radia-

tion from the Big Bang, and if the Big Bang was as simple as we thought it was. So the first COBE experiment studied this radiation, using a far-infrared spectrum photometer, designed for precise measurements. We discovered that the spectrum had the right shape to conclude that this was the first radiation - it was a relic of the big bang. This was the first COBE discovery.



We then undertook a second experiment, looking for fluctuations in the Microwave Background Radiation that would lead to the formation of galaxies. After improving our measurements, we found that the fluctuations make up only one part in 100,000 - a very tiny amount.

The Universe is as smooth as a billiard ball and incredibly uniform, but those small variations are enough if you have dark matter. Dark matter does not interact electromagnetically with light, so it does not get blown apart by light pressure from radiation that dominated the early Universe.

Understanding the origin of these fluctuations was the goal of the third experiment, accomplished using WMAP and PLANCK. The fluctuations meant that we had to have some other kind of phenomenon making the fluctuations. A piece of new physics that made it possible for the Universe to be both big and flat, while also allowing the fluctuations to form galaxies. With these experiments, we gained further insight into the fluctuations and their spectrum; we can tell how much dark matter there is, how much ordinary matter there is, and other processes.

But how does it all fit together? What do our results mean to high-energy physics? What do they tell us about the fundamental nature of space and time? That's what I'm looking at now. My career has been one very exciting trip and it just keeps on going.

CERN Bulletin

This text was adapted by Katarina Anthony for the Bulletin and is based on a longer interview that Paola Catapano conducted with George Smoot for RAI TV.

# A mini-exhibition with maximum content

The purpose of CERN's new mini-exhibition is to be more interactive and easier to install. Due to its size, the main travelling exhibition cannot be moved around quickly, which is why

it stays in the same country for 4 to 6 months. But this means a long waiting list for the other Member States. To solve this problem, the Education Group has designed a new exhibition, which is smaller and thus easier to install.

Smaller maybe, but no less rich in content, as the new exhibition conveys exactly the same messages as its larger counterpart.

**The University of Budapest has been hosting a CERN mini-exhibition since 8 May. While smaller than the main travelling exhibition it has a number of major advantages: its compact design alleviates transport difficulties and makes it easier to find suitable venues in the Member States. Its content can be updated almost instantaneously and it will become even more interactive and high-tech as time goes by.**

However, in the slimmed-down version the explanatory texts are no longer printed but appear on LCD screens. The texts used in the main exhibition are printed in English and translated into the language of the host country and, as a result, the panels cannot be re-used in the next host country. "With the LCD screens it is simple to update the content with new translations, as needed," explains the Head of the Education Group, Rolf Landua.

The new travelling exhibition features a projection room where visitors watch the film recounting the birth of the Universe, also on show at the permanent exhibition "Universe of Particles" in the Globe of Science and Innovation. This room can subsequently be used to screen other films. "The exhibition will become more and more high-tech over time, with new features ever more in tune with the messages we wish to convey. We have a whole team of students continuously dreaming up ideas for new displays that can gradually be added to the exhibition," says Rolf Landua.

Romania, Poland and Greece are next in line to host the exhibition.

*Laëtitia Pedroso*

## TIARA: Connecting accelerators

Partly funded by the European Commission under its Seventh Framework Programme (FP7), the TIARA project is being coordinated by the CEA (Commissariat à l'Énergie Atomique et aux Energies Alternatives). "The aim of the project is to arrive at an organisational structure that will provide coordination for R&D efforts and associated infrastructures in the field of particle accelerators in Europe," explains the CEA's Céline Tanguy, project coordinator assistant. "The new structure, which we hope will be a durable one, will be set up at the end of the project's preparatory phase."

Particle accelerator research spans a variety of different fields, from the design of accelerators to their numerous applications. Ultimately, TIARA will make it possible to address the needs of all these different fields at the European scale—and one day, who knows, perhaps at a worldwide scale. "For now, we are concentrating on setting up TIARA at the European level. Extending it to the worldwide level might be conceivable, but it would be much more complex, and it

**The preparatory phase of the TIARA (Test Infrastructure and Accelerator Research Area) project has begun. In January, members from 11 research institutes in 8 European countries began a three-year collaboration intended to enhance, improve and structure R&D efforts in the area of accelerator science and technology in Europe.**

would definitely take more time," cautions C. Tanguy.

The TIARA preparatory phase is divided into nine work packages. Five of them are dedicated to administrative and organisational issues such as management, governance, management of R&D infrastructure, education and training, and collaboration with industry. The four others cover the technical side of the project, addressing the upgrade or creation of R&D infrastructure for the development of tuning methods and instrumentation for measuring very low emittances, ionisation cooling, high gradient acceleration and high-energy accelerator components. CERN's Yannis Papaphilippou explains: "I coordinate Work Package 6, which has the objective of identifying elements of the Swiss Light Source at the Paul Scherrer Institute that will need to be upgraded to turn it into a test-bed for reaching ultra-low vertical



emittances." These emittances are needed in order to squeeze maximum performance out of future electron-positron colliders, but also for storage rings that make use of the synchrotron radiation emitted by electrons.

In practice, says Céline Tanguy, "TIARA will make it possible to ensure a better match between R&D needs and accelerator science and technology infrastructure. Coordinating infrastructure availability across the whole of Europe should ensure that the process is optimised and takes everyone's interests into account."

*Anais Schaeffer*

\* CEA and CNRS in France; CIEMAT in Spain; DESY and GSI in Germany; INFN in Italy; PSI in Switzerland; STFC in the United Kingdom; Uppsala University in Sweden; IFJ-PAN in Poland; and CERN.

# New researchers join HIE-ISOLDE

CATHI is a 4-year Marie Curie-funded Initial Training Network aimed at preparing researchers in the application of advanced accelerator technology. The €4.97 million initiative provides support for 20 researchers: 16 Early Stage Researchers and 4 Experienced Researchers (positions are similar to CERN's junior and senior fellowships).

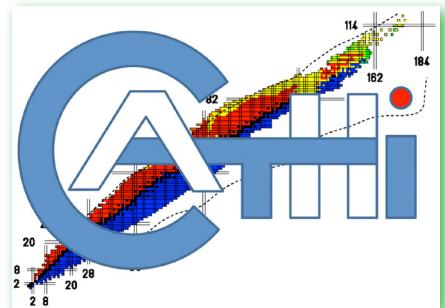
The main objective of the CATHI project is to give researchers the highest level of specialist training. Researchers will develop expert, technical R&D skills by working on HIE-ISOLDE, the ongoing upgrade of the ISOLDE facility, one of Europe's leading radioactive ion beam facilities. In addition to their work at CERN, they will also be provided with the resources to carry out their training in other participating institutes. These "associate partners" will host the researchers for on-site training sessions. The young researchers will also attend relevant summer school courses and conferences.

The project has involved industry at an early stage, with the industrial sector making up

The HIE-ISOLDE team is expecting a few new faces around the lab, as the new EU-funded project CATHI (Cryogenics, Accelerators and Targets for HIE-ISOLDE) gets into full swing as part of the Seventh Framework Programme. The project will recruit researchers from around the world to be trained at CERN and will hold its kick-off meeting here on 23 May.

5 of the 13 associate partners. "With multi-billion euro projects on the horizon – the European Spallation Source and CERN's own SPL, to name but a few – industry will need to improve upon their current expertise," says Yorick Blumenfeld, spokesperson of the ISOLDE Collaboration. "By providing researchers with greater experience and training, CATHI will enhance European manpower in highly technical areas."

Yacine Kadi, HIE-ISOLDE project leader, led the development of the CATHI proposal, with support from the Marie Curie Steering Group, the EU Office in DG, and the Fellows and Associates Service in HR. "To make a successful application for Marie Curie funding, a group needs more than just a good idea," says Kadi. "Although project experts will be the only ones capable of completing the technical part of an application, there are also administrative and social issues that will have to be addressed. The Marie Curie



support network at CERN helped us excel in that part of the application."

CATHI ranked first out of the hundreds of Marie Curie proposals submitted to Brussels in late 2009, scoring an impressive 97%. The project was one of the few proposals that received its requested funding in full – a rarity demonstrative of the quality of the training that CATHI will provide to the recruited Fellows.

The new blood has already made its way into the ISOLDE facility, with 4 early-stage researchers selected and more on the way. We can no doubt expect to hear more from HIE-ISOLDE before its 2014 completion.

Katarina Anthony

## 5, 4, 3, 2, 1... lift-off!

The protracted efforts of 56 institutes across the world, including CERN, have finally come to fruition with the launch of the Space Shuttle Endeavour transporting the AMS Alpha Magnetic Spectrometer to the International Space Station (ISS). The launch was originally scheduled for 29 April but had to be pushed back to Monday 16 May for technical reasons. The data collected by AMS will be analysed in particular in the experiment's brand new control centre currently under construction at CERN (Building 946) and due for completion by June. Stay tuned to the CERN Bulletin for news of any discoveries.



A selection of images taken by Micheal Struik at Kennedy Space Centre on the day of the launch.



Watch the CERN webcast of the Endeavour Shuttle launch and the CERN Video News at:

<http://cdsweb.cern.ch/record/1351130>

Laëtitia Pedroso

# Scientists present their design for Einstein Telescope

A new era in astronomy will come a step closer when scientists from across Europe presented their design study today for an advanced observatory capable of making precision measurements of gravitational waves – minute ripples in the fabric of spacetime – predicted to emanate from cosmic catastrophes such as merging black holes and collapsing stars and supernovae. It also offers the potential to probe the earliest moments of the Universe just after the Big Bang, which are currently inaccessible.

The ET Observatory (ET) is a so-called third-generation gravitational-wave (GW) detector, which will be 100 times more sensitive than current instruments. Like the first two generations of GW detectors, it is based on the measurement of tiny changes (far less than the size of an atomic nucleus) in the lengths of two connected arms several kilometres long, caused by a passing gravity wave. Laser beams passing down the arms record their periodic stretching and shrinking as interference patterns in a central photo-detector.

The first generation of these interferometric detectors built a few years ago (GEO600, LIGO, Virgo and TAMA) successfully demonstrated the proof-of-principle and constrained the gravitational wave emission from several sources. The next generation (Advanced LIGO and Advanced Virgo), which are being constructed now, should make the first direct detection of gravitational waves possible – for example, from a pair of orbiting black holes or neutron stars spiralling into each other. Such a discovery would inaugurate the new field of GW astronomy. However, these detectors will not be sensitive enough for precise astronomical studies of the GW sources.

"The community of scientists interested in exploring GW phenomena therefore decided to investigate building a new generation of even more sensitive observatories. After a three-year study, involving more than 200 scientists in Europe and across the world, we are pleased to present the design study for the Einstein Telescope, which paves the way for unveiling a hidden side of the Universe," says Harald Lück, deputy scientific coordinator of the ET Design Study.

The design study, which will be presented at the European Gravitational Observatory in Pisa, Italy, outlines ET's scientific targets, the detector layout and technology, as well as the timescale and estimated costs. A superb sensitivity will be achieved by building ET underground, at a depth of

**Plans shape up for a revolutionary new observatory that will explore black holes and the Big Bang. This detector will 'see' the Universe in gravitational waves.**

about 100 to 200 metres, to reduce the effect of the residual seismic motion. This will enable higher sensitivities to be achieved at low frequencies, between 1 and 100 hertz (Hz). With ET, the entire range of GW frequencies that can be measured on Earth – between about 1 Hz and 10 kHz – should be detected. "An observatory achieving that level of sensitivity will turn GW detection into a routine astronomical tool. ET will lead a scientific revolution", says Michele Punturo, the scientific coordinator of the design study. An important aim is to provide GW information that complements observational data from telescopes detecting electromagnetic radiation (from radio waves through to gamma rays) and other instruments detecting high-energy particles from space (astroparticle physics).

## A multi-detector

The strategy behind the ET project is to build an observatory that overcomes the limitations of current detector sites by hosting more than one GW detector. It will consist of three nested detectors, each composed of two interferometers with arms 10 kilometres long. One interferometer will detect low-frequency gravitational wave signals (2 to 40 Hz), while the other will detect the high-frequency components. The configuration is designed to allow the observatory to evolve by accommodating successive upgrades or replacement components that can take advantage of future developments in interferometry and also respond to a variety of science objectives.

## The European dimension

The European Commission supported the design study within the Seventh Framework Program (FP7-Capacities) by allocating three million euros. "With this grant, the European Commission recognised the importance of gravitational wave science as developed in Europe, its value for fundamental and technological research, provided a common framework for the European scientists involved in the gravitational wave search and allowed for a significant step towards the exploration of the Universe with a completely new enquiry instrument", says Federico Ferrini, director of the European Gravitational Observatory (EGO) and project coordinator of the design study for the Einstein Telescope.

ET is one of the 'Magnificent Seven' European projects recommended by the ASPERA network for the future develop-



ment of astroparticle physics in Europe. It would be a crucial European research infrastructure and a fundamental cornerstone in the realisation of the European Research Area.

Further information, images and movies at:  
[www.et-gw.eu](http://www.et-gw.eu)

### Press contact for Italy:

Antonella Varaschin  
INFN - Istituto Nazionale di Fisica Nucleare  
Ufficio per la Comunicazione  
email: antonella.varaschin@presid.infn.it  
Tel: +39 066868162

### Press contact for France:

Marsollier Arnaud  
email: amarsollier@admin.in2p3.fr  
Tel: +33 1 44 96 40 35 / +41 76 487 2769

### Press contact for the Netherlands:

Melissa van der Sande  
email: sandem@nikhef.nl  
Tel: +31 20 592 5075

### Press contact for Germany and the UK:

Susanne Milde  
email: milde@mildemarketing.de  
Tel: +49 331 583 93 55

### List of experts:

France	Germany
Raffaele Flaminio	Karsten Danzmann
Benoit Mours	Harald Lück
Italy	The Netherlands
Federico Ferrini	Jo van den Brand
Michele Punturo	Chris Van Den Broeck
Fulvio Ricci	David Rabeling
UK	
Andreas Freise	
Stefan Hild	
Sheila Rowan	
B. Sathyaprakash	

### NOTES

- The Einstein Telescope Project (ET) is a joint project of eight European research

# Scientists present their design for Einstein Telescope

institutes, under the direction of the European Gravitational Observatory (EGO). The participants are EGO, an Italian-French consortium located near Pisa (Italy), the Istituto Nazionale di Fisica Nucleare (INFN) in Italy, the French Centre national de la recherche scientifique (CNRS), the German Albert Einstein Institute (AEI) in Hannover, the Universities of Birmingham, Cardiff and Glasgow in the UK, and the Dutch Nikhef in Amsterdam. Scientists belonging to other institutions in Europe, as well as the US and Japan, actively collaborated in the realisation of this design study.

- The direct detection of gravitational waves – predicted by Einstein's theory of gravity, the General Theory of Relativity – is one of the most important fundamental research areas in modern science. Apart from verifying General Relativity, especially for extreme gravitational fields found in the vicinity of a black hole, GW detection could allow us, for the first time, to look back at the earliest moments of the Universe just after its birth. Cosmological observations are currently limited to those using electromagnetic waves and cosmic rays (high-energy particles such as protons). This information can reach us from the past, but from a time no earlier than 380,000 years after the Big Bang. Before then, light and matter continually interacted, so that the Universe was rendered opaque. The Universe became transparent only when matter and light separated during this epoch. Cosmological epochs dating further back have thus far remained hidden, so it has not been possible to verify from observations the various theories about their nature. The direct measurement of gravitational waves may allow us "to listen" back as far as the first trillionth of a second after the Big Bang. This would give us totally new information about our Universe.

- GW research is a global effort because full information about many GW sources can be obtained only with several interferometers working simultaneously in different places. Therefore, the US (LIGO), German-UK (GEO600), Italian-French and Dutch (Virgo) scientific communities have been working together closely for a long time. They share technology R&D and theoretical advances, as well as data-analysis methods and tools. The joint European project ET will help to improve further this worldwide collaboration.

## The current observatories:

- GEO600, is a German-UK detector located near Hannover, Germany, and is operated by researchers at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute/AEI) in Hannover and at the Universities of Glasgow, Cardiff and Birmingham in the UK. It is funded by the Max Planck Society, the state of Lower Saxony, the Volkswagen Foundation and the UK Science and Technologies Facilities Council (STFC). GEO works in close cooperation with the cluster of excellence, QUEST (Centre for Quantum Engineering and Space-Time Research), in Hannover.
- Virgo is a 3-kilometre arm interferometer at Cascina, near Pisa, Italy. This project accomplished the additional goal of making low-frequency measurements at around 10Hz. Initially, Virgo was funded by the CNRS (Centre National de la Recherche Scientifique) and the INFN (Istituto Nazionale di Fisica Nucleare) but has now expanded to include Dutch, Polish and Hungarian research groups.
- The US LIGO detectors consist of 2-kilometre and 4-kilometre instruments at Hanford, Washington, and a 4-kilometre instrument at Livingston, Louisiana. The LIGO project has been developed and is operated by the California Institute of Technology (CalTech) and the Massachusetts Institute of Technology (MIT), and funded by the National Science Foundation (NSF).

ASPERA Press Release

# Classified

In the last issue of the Bulletin, we have discussed recent implications for privacy on the Internet. But privacy of personal data is just one facet of data protection. Confidentiality is another one. However, confidentiality and data protection are often perceived as not relevant in the academic environment of CERN.

**B**ut think twice! At CERN, your personal data, e-mails, medical records, financial and contractual documents, MARS forms, group meeting minutes (and of course your password!) are all considered to be sensitive, restricted or even confidential. And this is not all. Physics results, in particular when being preliminary and pending scrutiny, are sensitive, too. Just recently, an ATLAS collaborator copy/pasted the abstract of an ATLAS note onto an external public blog, despite the fact that this document was clearly marked as an "Internal Note". Such an act was not only embarrassing to the ATLAS collaboration, and had negative impact on CERN's reputation --- it is also a serious violation of the CERN Computing Rules, and has been followed up with the people concerned.

If you own data, documents, code or web sites which are supposed to be sensitive, confidential or restricted in access, make sure that they are clearly marked as such, and that access is restricted in a way that only people with a need to read them, can do so. AFS, DFS, and the central web service provide means to properly protect your documents. If you have access to a restricted document, respect the rules: only share the documents with those who are eligible. If in doubt, check with the owner of that document, and ask for authorization. Finally, if you are a developer or system administrator, ensure that your code and servers are secured and do not leak data! Follow the appropriate CERN Technical Training courses for designing secure software, when in doubt.

Of course, if you have questions, suggestions or comments, please contact the Computer Security Office or visit us at

<http://cern.ch/security>

Computer Security Team

# CERN relay race took place on Thursday 19 May



Library  
Bibliothèque

*News from the Library*

**A**CM Digital Library is available to the CERN community. The most popular journal here at CERN is Communications of the ACM. However, the collection offers access to a series of other valuable important academic journals such as Journal of the ACM and even fulltext of a series of classical books.

In addition, users have access to the *ACM Guide to Computing Literature*, the

## A one-stop-shop for computing literature: ACM Digital Library

The Association for Computing Machinery, ACM, is the world's largest educational and scientific computing society. Among others, the ACM provides the computing field's premier Digital Library and serves its members and the computing profession with leading-edge publications, conferences, and career resources.

most comprehensive bibliographic database focusing on computing, integrated with ACM's full-text articles and including features such as *ACM Author Profile Pages* - which provides bibliographic and bibliometric data for over 1,000,000 authors in the field.

*ACM Digital Library* is an excellent complement to the IEEE Electronic Library, which has been available at CERN for many years.

Access to ACM Digital Library at:

[portal.acm.org/dl.cfm](http://portal.acm.org/dl.cfm)

Please don't hesitate to contact us for any questions or commentaries at

[library.desk@cern.ch](mailto:library.desk@cern.ch)

*CERN Library*



## Official news

Members of the personnel shall be deemed to have taken note of the news under this heading. Reproduction of all or part of this information by persons or institutions external to the Organization requires the prior approval of the CERN Management.

### REMINDER : DEADLINE FOR SUBMISSION OF REIMBURSEMENTS CLAIMS TO UNIQA

We would like to remind you of the resolution which took effect from 1 June 2010 changing the deadline for submitting a claim from 24 months to 12 months from the invoice date (as opposed to from the time of treatment).

As a transitional measure, it is still possible to submit invoices issued prior to 1 June

2010 as long as they do not date back to more than two years (from the invoice date) at the time of submission. The deadline for transitional claims is 31 May 2011.

You are advised to check any outstanding submissions that you have since, as from 1 June 2011, no transitional claims will be accepted.

*HR Department*

## Take note



### RECYCLING SITE

The recycling site currently situated near building 133 has been transferred to the car park of building 156. The site is identified by the sign "RECYCLING" and the above logo. In this new, more accessible site, you will find recycling bins for the following waste:

- PET (recyclable plastic bottles);
- Aluminium cans;
- Nespresso coffee capsules.

### MUSIC ON THE LAWN 2011

As part of the Fete de la Musique 2011, the CERN MusiClub is organizing Music on the Lawn, an informal concert for Club musicians/bands. The event will take place from 14h00 to 20h00 on Saturday 25 June on the terrace of Restaurant No. 1.

This year 8 MusiClub bands will be performing...

- \* WOT
- \* Home Cookin'
- \* Picture Flame
- \* DANGERZ
- \* The Nearlies
- \* RISE
- \* A Drop of Red
- \* The Groovy Gang

So put the date in your diaries and spend a sunny afternoon listening to some great live music (and unlike Paleo and Montreux it's FREE!!!!)

For more information on the CERN MusiClub see

<http://muzipod.free.fr/>

## Take note

### MACINTOSH SUPPORT IS PROVIDED AT THE LEVEL OF THE SERVICE DESK

Since September 2010 the Apple laptops & desktops with Mac OS are recognized and supported at CERN by the IT department. Therefore, the "Macintosh support" procedure now follows the same ITIL\* schema as for all IT services, i.e.:

- \* All CERN users must address any request for support on Macintosh PCs to the Service Desk.
- \* The Service Desk will move on questions or problems they cannot solve to "IT 2nd level" support people, provided by the "computing support" contract managed by IT department.
- \* Mac OS being officially supported by the IT department, a 3rd level support is provided by CERN IT staff; they may give specialized expert assistance, within the scope described at the ITUM-2 presentation, for all incidents or requests which can be neither resolved nor fulfilled by the Service Desk (1st level) and the 2nd level support people.

Therefore, users who have problems related to Mac OS should simply fill-in the

appropriate form from the Service Portal (<https://cern.service-now.com/service-portal/>), call the CERN Service Desk at 77777 (+41 22 76 77777 from outside CERN) or visit the service in building 55, just outside entrance B of CERN. The Service Desk is open work days, from 7:30 to 18:30, Geneva time. The email address "mac.support@cern.ch" is also linked to the Service Desk but free text emails sent to Service Desk are not recommended and users should rather use the Service Portal on the web.

For reference, the decision to support Mac OS computers was officially announced and approved at the 6th IT Service Review Meeting on 1st September 2010 and the scope of the Mac service provided by IT was explained to the user community at the 2nd IT Technical User Meeting (ITUM-2) on 6th October 2010 (slides are available at <https://indico.cern.ch/getFile.py/access?contributionId=2&resId=1&materialId=slides&confId=104129>). Since then, the IT computing helpdesk (tel. 78888) has been replaced, as of 15th February 2011, by the CERN Service Desk in building 55 (tel. 77777) with a "Service Portal" available on the web.

*The IT User Support Team, IT-UDS-HUS*

\* Information Technology Infrastructure Library.

### RESTAURANT OPENING TIMES OVER THE ASCENSION AND WHITSUNTIDE

Restaurants Nos. 2 and 3 will be closed over the Ascension (2-5 June inclusive) and Whitsuntide (11-13 June inclusive) weekends. Restaurant No 1's opening times over these periods will be the same as for a normal weekend, i.e. 7 a.m. to 11 p.m.



## Academic training

### CERN ACADEMIC TRAINING PROGRAMME 2011

#### Regular lecture

**24, 25, 26 and 27 May 2011**

from 11:00 to 12:00

at CERN (Bldg. 222-R-001 - Filtration  
Plant)

#### Particle Dark Matter

by Pippa Wells (CERN)

I review the phenomenology of particle dark matter, including the process of thermal freeze-out in the early universe, and the direct and indirect detection of WIMPs. I also describe some of the most popular particle candidates for dark matter and summarize the current status of the quest to discover dark matter's particle identity.

Organiser: Maureen Prola-Tessaur/PH-EDU



## Safety Training Course

Isabelle CUSATO - HSE Unit - Tel. 77381  
Isabelle.Cusato@cern.ch

### SAFETY TRAINING: SCHEDULED SESSIONS IN APRIL

The following training courses are scheduled in May. You can find the full Safety Training programme on the online Safety Training catalogue:

<https://espace.cern.ch/info-safetytraining-official/Pages/Newcourses.aspx>

If you are interested in attending any of the courses below, please talk to your supervisor, then apply electronically via EDH from the course description pages, by clicking on SIGN-UP.

Registration for all courses is always open – sessions for the less-requested courses are organized on a demand-basis only. Depending on the demand, a session will be organised later in the year.

#### Biocell Training

24-MAY-11 (08.30 – 10.00) in English  
24-MAY-11 (10.30 – 12.00) in English

#### Laser Users

27-MAY-11 (09.00 – 12.30) in English

#### Radiological Protection

27-MAY-11 (08.30 – 12.30) in English

#### Recyclage - Conduite de plates-formes élévatrices mobiles de personnel (PEMP) \*

30-MAY-11 (08.00 – 17.00) in French

#### Recyclage - Pontier-élingueur \*

31-MAY-11 (08.00 – 17.00) in French

#### Secourisme – Cours de base

26-MAY-11 to 27-MAY-11 (08.30 – 17.30 and 08.30 – 12.30) in French

#### Secourisme - Cours de recyclage

27-MAY-11 (13.30 – 17.30) in French

#### Sécurité Radiologique

27-MAY-11 (13.30 – 17.30) in French

#### Utilisation des équipements de protection respiratoire

30-MAY-11 (08.30 – 12.00) in French  
30-MAY-11 (13.00 – 16.30) in French  
31-MAY-11 (08.30 – 12.00) in French  
31-MAY-11 (13.00 – 16.30) in French

\* Session in French with the possibility of receiving the documentation in English



## External meeting

Université de Genève  
Département de physique

24, quai Ernest-Ansermet  
CH-1211 Genève 4

Tél: (022) 379 62 73  
Fax: (022) 379 69 92

**Wednesday 25 May 2011**

PARTICLE PHYSICS SEMINAR

at 17.00 hrs – Stückelberg Auditorium

### Muon radiography of volcanoes and the MU-RAY project

Prof. Paolo Strolin, Università Federico II and INFN, Napoli

Thanks to their penetration power, high energy muons generated in the interactions of cosmic rays with the Earth's atmosphere offer the possibility to perform "muon radiographies" of geological structures and in particular volcanoes. The principle is similar to that of the imaging of the interior of human body through the observation of the absorption of X rays.

Muon radiography has been first applied in 1970 to the search of unknown burial chambers in the Chefren's pyramid. Since 2000, the technique has been successfully applied to volcanoes in Japan. Quasi-horizontal muons have provided spectacular radiographies of volcanoes' edifices over rock thicknesses of the order of one kilometer.

The radiography of the upper part of volcanoes like Mt. Vesuvius or Stromboli implies the challenging task of observing the low flux of muons of such a high energy to be able to penetrate a larger rock thickness. This requires the development of instruments having a sensitivity larger by one order of magnitude or more. This implies correspondingly larger area and background rejection power.

The MU-RAY project is presently developing a "muon telescope" based on the use of plastic scintillator strips read by wavelength shifting fibers and Silicon Photo-Multipliers (SiPM). The very low power consumption of the SiPMs makes them suitable for the operation of the muon telescope in a volcanic environment where the power supply may have to come from solar energy. The R&D related to the use of SiPMs and the design of the readout electronics is carried out in collaboration with physicists facing similar requirements for experiments in Space.

Information : <http://dpnc.unige.ch/seminaire/annonce.html>

Organizer : G. Pasztor



# Seminars

•••••••••••••

## MONDAY 23 MAY

### IT INFORMATICS TUTORIAL

10:30 - /Bldg. 593-R-011

### Travailler avec Windows 7 au CERN

M. BUDZOWSKI / CERN

### COMPUTING SEMINAR

11:00 - IT Auditorium, Bldg. 31-3-004

### Security Analysis of the Un-hackable Victorinox Secure Device

M. VUAGNOUX

### IT INFORMATICS TUTORIAL

15:30 - /Bldg. 593-R-011

### Migrer en douceur vers Office 2007 ou 2010

P. GRZYWACZEWSKI / CERN

## TUESDAY 24 MAY

### ACADEMIC TRAINING LECTURE

### REGULAR PROGRAMME

11:00 - Bldg. 222-R-001 - Filtration Plant

### Particle Dark Matter (1/4)

D. HOOPER

### TH STRING THEORY SEMINAR

14:00 - TH Auditorium, Bldg. 4

### Minimal Model Holography

M. GABERDIEL

## WEDNESDAY 25 MAY

### ACADEMIC TRAINING LECTURE

### REGULAR PROGRAMME

11:00 - TH Auditorium, Bldg. 4

### Particle Dark Matter (2/4)

D. HOOPER

### TH COSMO COFFEE

11:00 - TH Auditorium, Bldg. 4

### Antimatter in the cosmic radiation. Recent results and their uncertain implications

D. GRASSO (INFN, PISA)

### TH THEORETICAL SEMINAR

14:00 - TH Auditorium, Bldg. 4

### Light WIMPs

D. HOOPER / FERMILAB

## WEDNESDAY 25 MAY

### TH STRING THEORY SEMINAR

14:30 - TH Auditorium, Bldg. 4

TBA

H. JOHANSSON

## THURSDAY 26 MAY

### ACADEMIC TRAINING LECTURE

### REGULAR PROGRAMME

11:00 - Bldg. 222-R-001 - Filtration Plant

### Particle Dark Matter (3/4)

D. HOOPER INSTITUTE, LJUBLJANA, SLOVENIA

### COLLIDER CROSS TALK

11:00 - TH Auditorium, Bldg. 4

### Hadronic SUSY searches with the Razor at CM

C. ROGAN / CALIFORNIA INSTITUTE OF TECHNOLOGY

### TH BSM FORUM

14:00 - TH Auditorium, Bldg. 4

### The collider variable $m_{T2}$ : derivation, properties, and an application to SUSY GUTs

D. GUADAGNOLI / UNIVERSITÉ PARIS XI<sup>E</sup>

## FRIDAY 27 MAY

### ACADEMIC TRAINING LECTURE

### REGULAR PROGRAMME

11:00 - Bldg. 222-R-001 - Filtration Plant

### Particle Dark Matter (4/4)

D. HOOPER

### TH INFORMAL LATTICE MEETING

11:00 - IT Auditorium, Bldg. 31-3-004

TBA

N. TANTALO / ROME UNIVERSITY "TOR VERGATA"

### PARTICLE AND ASTRO-PARTICLE PHYSICS

### SEMINARS

14:00 - TH Auditorium, Bldg. 4

TBA

S. CHANDRASEKHARAN

## MONDAY 30 MAY

### TH INFORMAL LATTICE MEETING

11:00 - TH Auditorium, Bldg. 4

### SUSY Breaking '11

S. ABEL / IPPP DURHAM, G. GIUDICE, C. GROJEAN / CERN

## TUESDAY 31 MAY

### TH STRING THEORY SEMINAR

14:00 - Council Chamber, Bldg. 503

### The holographic fluid dual to vacuum Einstein gravity

P. MCFADDEN / AMSTERDAM

## WEDNESDAY 1 JUNE

### TH STRING THEORY SEMINAR

11:00 - TH Auditorium, Bldg. 4 (note unusual time)

### Homogenous spaces dynamics and asymptotic behaviors of closed strings (massive) excitations

M. CARDELLA / UNIVERSITY OF MILAN BICOCCA