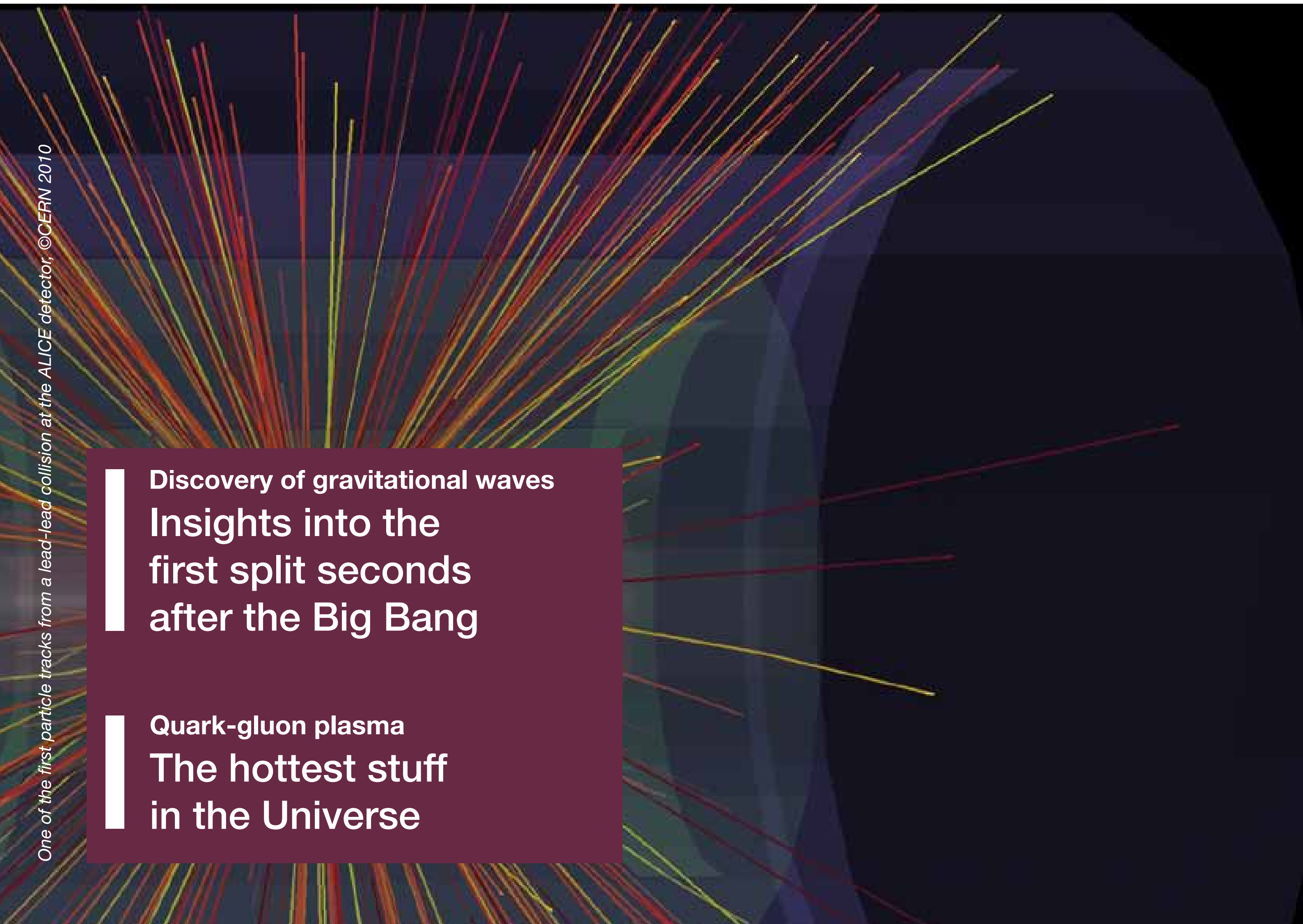
UniverseNews

Excellence Cluster Universe | Issue 1/2014



One of the first particle tracks from a lead-lead collision at the ALICE detector; ©CERN 2010

Discovery of gravitational waves

Insights into the first split seconds after the Big Bang

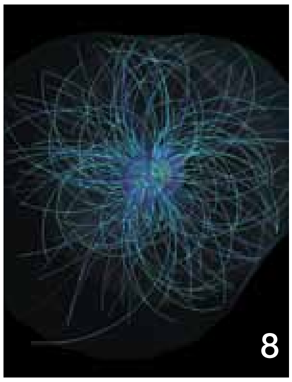
Quark-gluon plasma

The hottest stuff in the Universe

Dear readers,

The year 2014 had begun quietly with no spectacular discoveries in sight. But in mid-March rumours started to spread from the Harvard-Smithsonian Center for Astrophysics that a "major discovery" would be revealed soon. A short time later an invitation arrived to join a "special webcast" presentation. So, on 17 March the cosmologists of the Excellence Cluster Universe together with the partner institutes followed the news presentation of the US colleagues live via Internet. A long discussion followed: Is it possible that the American scientists actually measured gravitational waves in the cosmic microwave background? That would be a sensation. It is expected that the result will be confirmed or disproved within the next few months by Planck or another experiment. It seems that 2014 will be exciting after all.

Petra Riedel, PR Manager



Review

Photos: Riedel (EXC/TUM)

Fruits of the Universe
Lunch talks on Thursdays

The new talk series of the Excellence Cluster has been well received: While the audience has a light snack, a scientist gives a brief introduction to his field of research, only equipped with flip chart and pen. Up to 40 colleagues have been attending the Thursday talks. At the kick-off on 11 November 2013 a very prominent cluster guest provided a talk on the final parsec problem of binary supermassive black holes: Prof. Dr. Scott Tremaine (Princeton University). On the photo: Prof. Dr. Barbara Ercolano. Her topic: The mystery of planet formation (30.01.).

Interdisciplinary Workshops
on dark matter and statistics

In February, two Interdisciplinary Cluster Workshops brought together local researchers from Garching and selected external scientists. From 10 - 11 February, the experts in the field of dark matter met at MPE. A week later from 17 - 18 February, the specialists exchanged information on statistical methods. The aim of the workshops was to promote new projects and collaborations. The two events were so successful that another Interdisciplinary Cluster Workshop on the use of Graphics processing units (GPUs) in Physics is scheduled for 14 - 15 April.

Science for everyone
Lectures at the Deutsches Museum

Five evenings within the presentation season 2013/14 at the Deutsches Museum were hosted by the Excellence Cluster: Dr. Nadine Neumayer's (ESO) lecture on black holes was sold out in record time (05.02.). Prof. Dr. Immanuel Bloch (LMU/MPQ) (photo) presented experiments with the coldest objects in the Universe (19.02.). Prof. Dr. Stephan Paul and Prof. Dr. Andrzej Buras (TUM) gave insights into particle physics (29.01.). Further speakers: Prof. Dr. Alexander Heisterkamp (University Jena) on 27.11. and Dr. Stefan Gillessen (MPE) on 23.10.2013.


Photo: Steffen Richter/Harvard University

In the clear, dry air of the Antarctic, scientists were able to discover gravitational waves in the cosmic background radiation for the first time. The laboratory with the BICEP2 telescope (left) is about one kilometre away from the geographic South Pole.

Interview with Prof. Dr. Hans Böhringer on the detection of gravitational waves in the cosmic microwave background

"Insights into the first split seconds after the Big Bang"

The existence of gravitational waves is the last phenomenon asserted in the general theory of relativity that has not yet been directly observed. Now, an American research team claims to have discovered gravitational waves in the cosmic background radiation for the very first time and to have obtained information about the first trillionth of a second after the Big Bang causing a stir far beyond the world of science. An interview with Prof. Dr. Hans Böhringer from the Max Planck Institute for Extraterrestrial Physics. *Interview: Petra Riedel*

What is sensational about this discovery?

Prof. Dr. Hans Böhringer: The US scientists assume that they can see gravitational waves in their measurements that have been set in motion within the first trillionth of a second after the Big Bang. This is extraordinary for many reasons: To date, it has not been possible to directly detect gravitational waves. In addition, these gravitational waves come from the very early stages of the Universe, less than 10^{-30} seconds after the Big Bang. The earliest light and thus the earliest direct information that we have about our Universe is the cosmic microwave background showing the Universe some 380,000 years after the Big Bang. We can't see beyond that via electromagnetic radiation, because before that the Universe was an opaque plasma. But now we have possible indirect information that dates back much further, a signature of gravitational waves, imprinted on the cosmic microwave background.

What are gravitational waves?

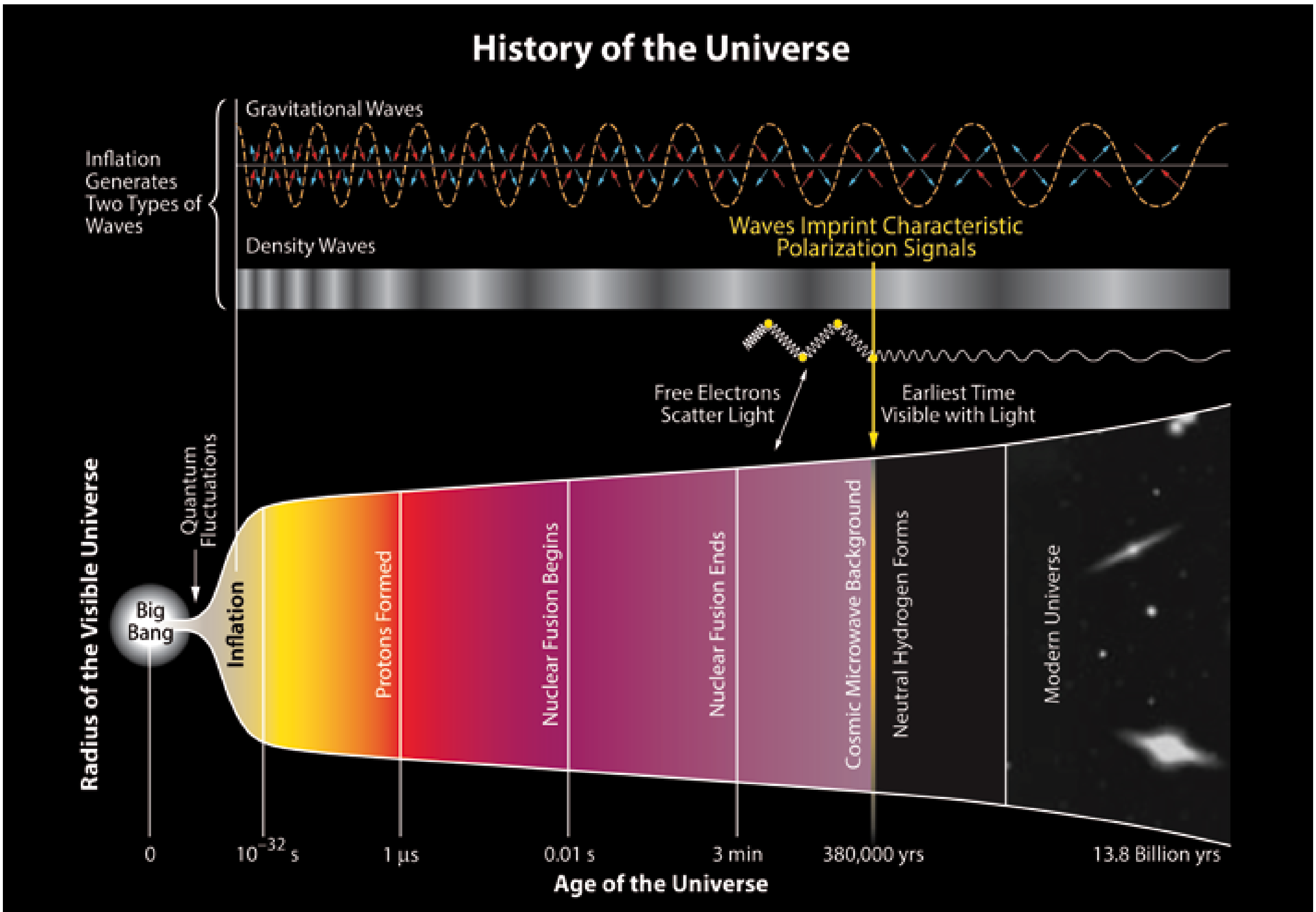
Gravitational waves originate from disturbances of space-time geometry which can propagate as waves. The existence of gravitational waves is a consequence of general relativity. However, the distortions of space-time are extremely small.

Why are these waves visible in the cosmic microwave background?

Gravitational waves generated today are usually so small that previously they were not measurable. Now, there is a theory that states that the Universe has expanded – depending on the theory – about 10^{-30} seconds after the Big Bang by at least a factor of 10^{26}. This is the equivalent of one centimetre growing to one thousand times the size of our Milky Way. According to the theory, this cosmic inflation has also inflated the gravitational waves.

The cosmic inflation is one of the most speculative theories of physics. Why is it so widely acknowledged?

If one accepts the hypothesis, than cosmic inflation can explain many of the



The History of the Universe: The earliest direct information about the universe that we know so far, is the cosmic microwave background; the time before that is only accessible indirectly. Now, there is possible earlier information, a signature of gravitational waves imprinted on the microwave background.

@ BICEP2 Kollaboration

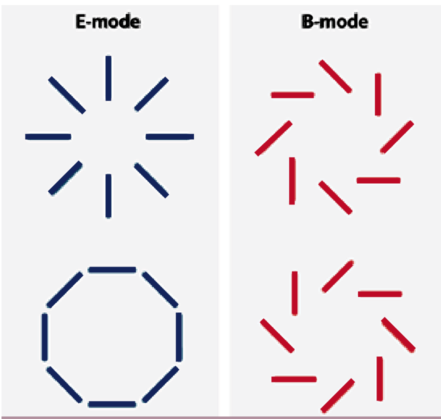
amazing features of our present Universe. For example, that the Universe is "flat", as the physicists say, which means that it has no measurable curvature of space, that on large scales the Universe looks uniform in all directions and that galaxies and galaxy clusters are the result of density fluctuations in the early Universe. That is why the theory of inflation is very popular among physicists. The question remains: Is it only a nice theory or is it backed up by facts?

And?

According to the prediction of a relatively simple, not too complicated theory of inflation, the irregularities in the density, i.e. the density fluctuations measured as temperature differences, should be distributed arbitrarily in the cosmic background radiation. All the experiments so far point in this direction, and the data of the Planck mission have refined the picture so that one is almost surprised at how well the Gaussian statistics fits here. This is definitely a nice validation of the inflation theory. For about ten years, theorists have also pointed out that the microwave background should show a signature of gravitational waves and how it could be identified. Such predictions are a strong support for a theory. But of course, further confirmation is needed.

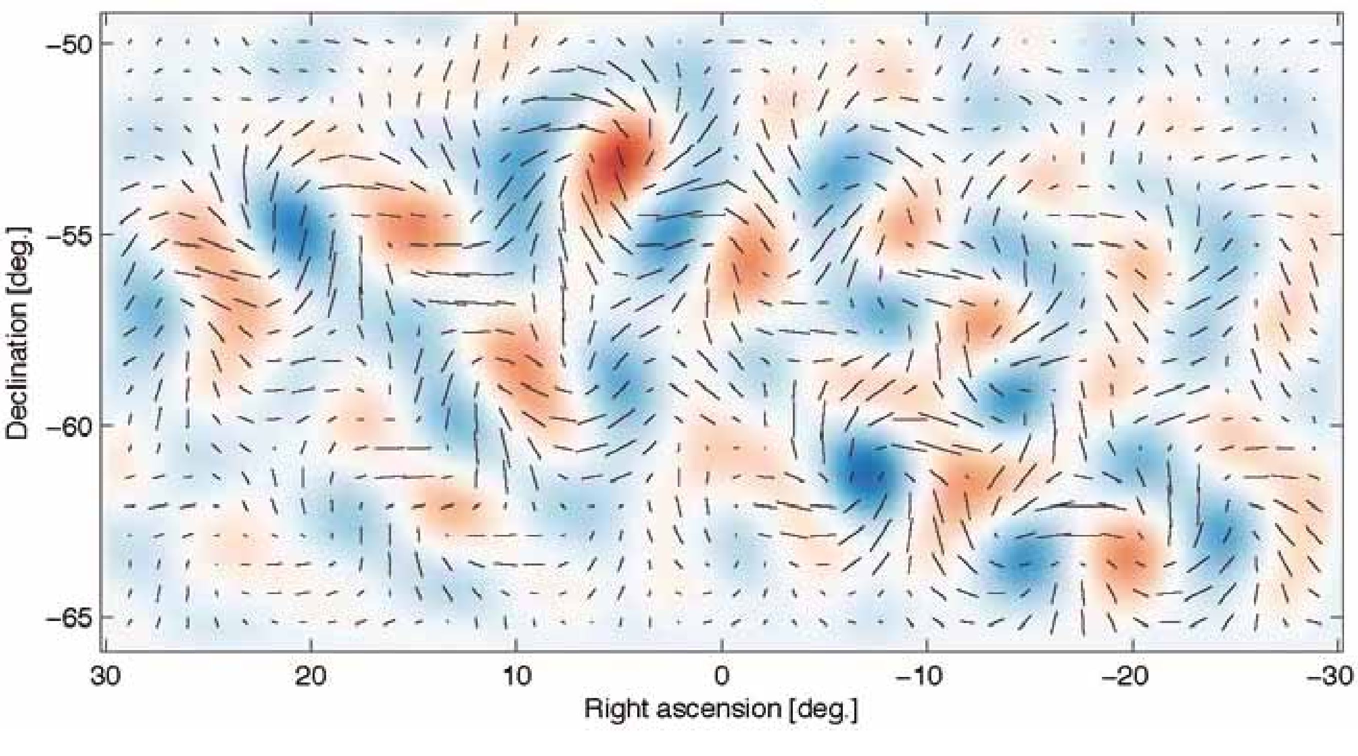
What does the signature look like exactly?

A small part of the cosmic microwave radiation should be polarized due to the irregularities in the early Universe. This means that the oscillations plane of a small portion of the electromagnetic radiation has a certain orientation. There are two types of patterns: one polarization pattern is aligned tangentially or radially to points of the microwave background and looks similar to the electric field of a point charge, that's why one refers to it as E-modes. In the other case, the field lines show vortices, as they are known from magnetic fields. These patterns are called B-modes (see picture to the right). The E-modes are caused by density fluctuations in the early Universe and, according to the theory, the vortex patterns are created due to fluctuations in the gravitational field. Such B-modes have now been found (see picture on p. 5). What complicates the matter is the fact that gravitational lensing can spin the E-modes to become B-modes. However, the US scientists say that this effect is small compared to the detected signal.



E-Modes show a polarization pattern with a radial or tangential orientation, the B-modes show vortices.

Diagram: AmaneTUM



A very faint but distinct polarization pattern is imprinted in the cosmic microwave radiation, a vortex pattern, which physicists refer to as B-modes. The diagram shows the pattern measured by the telescope BICEP2; the red and blue regions illustrate to which extent the field lines are oriented clockwise or counter-clockwise.

Is the signal also evident in the data of the Planck mission? After all, Planck measured the cosmic microwave background with unprecedented accuracy.

The Planck Collaboration so far has only published the analyses of the intensity differences in the cosmic microwave background. As I hear from the Planck colleagues, the evaluation of the polarization data will still take some time. We have to wait.

Apparently, the scientists were surprised by the strength of the signal. They were looking for a needle in a haystack and found a crowbar instead, as they are cited.

The strength of the signal is at the top of what had been expected. Prof. Dr. Viatcheslav Mukhanov from the Ludwig-Maximilians-Universität, Munich, has provided the key work in this field. According to him, the theoretically expected ratio of B-modes to E-modes could be as low as 0.01. The US scientists measured a ratio of 0.2.

How reliable is the measurement?

It is the third generation of a series of experiments which studied the polarization in the microwave background. The data now published have been measured between 2010 and 2012, so they are more than one year old. The research team has a lot of experience, and one can assume that they have analysed their data with the utmost care. There are several other groups that take similar measurements. By the end of the year the result should be confirmed or disproved by Planck or another experiment, I should suppose.

The American team of scientists has made this observation with the telescope BICEP2 (Background Imaging of Cosmic Extragalactic Polarization) at the South Pole. The dry, clear air of the Antarctic provides almost as good measurement conditions as from space. Can a ground-based telescope replace a space mission?

No. The approaches are complementary. Planck provides a lot of data that cannot be observed from Earth. For a space experiment such as Planck or Herschel the technology used is determined about ten years before the start. A ground-based experiment is much less demanding, for example, there are no weight or power limitations. Moreover, intensive technical developments were made in the meantime. The researchers take their measurements at the South Pole, evaluate their data and improve the experiment. Satellite missions, however, are terribly demanding: Everything has to work when first turned on. It's fantastic that all large ESA experiments have done their job.

Photo: MPG

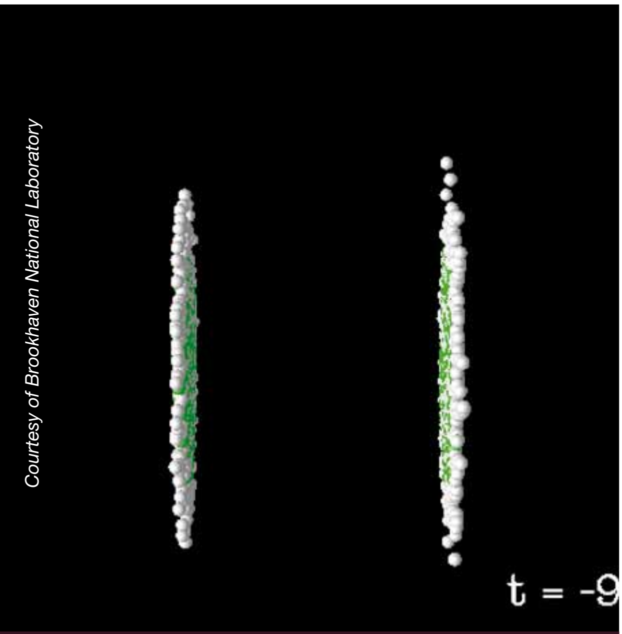
Prof. Dr. Hans Böhringer is head of the research group "Clusters of Galaxies and Cosmology" at the Max Planck Institute for Extraterrestrial Physics, professor at the Ludwig-Maximilians-Universität, Munich, and principal investigator at the Excellence Cluster Universe.

Dr. Torsten Dahms explores the properties of the quark-gluon plasma

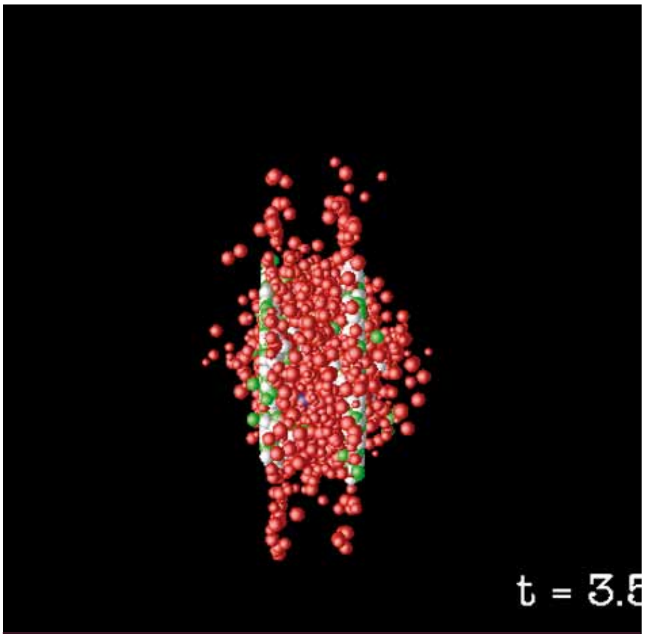
The hottest stuff in the Universe

A "soup" made of ultra-hot, ultra-dense elementary particles could have been the substance that has formed in the very first moments after the Big Bang. Scientists produce this curious state of matter at the two world's most powerful particle accelerators RHIC and LHC by smashing heavy atomic nuclei at super-high speeds. The experimental physicist Dr. Torsten Dahms, a new junior research group leader at the Excellence Cluster Universe, tries to get a better understanding of the properties of this amazing particle soup.

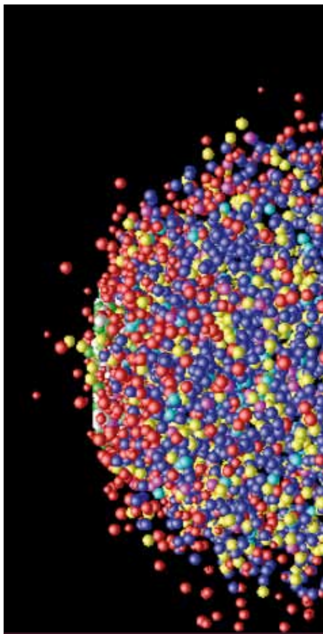
Courtesy of Brookhaven National Laboratory



Two bundles of lead ions about to collide (the ions appear as flat disks because of the relativistic effect called "Lorentz contraction").



The ion bundles collide.



Quarks and gluons are freed

The world around us and we ourselves are made of atoms. An atom consists of a nucleus, which in turn contains protons and neutrons. The quarks, the building blocks of the two nuclear particles, are held together by an inconceivably large force: the strong nuclear power, caused by gluons. They "glue" the quarks together so strongly that it is almost impossible to separate them – and their glue effect increases, the farther one tears those quarks apart. Different from the Big Bang: There, the Universe was so hot and dense for a fraction of a second that quarks and gluons were not yet bound together.

A mini Big Bang occurs

The formation of matter from this primordial soup had great influence on the evolution of our Universe. Therefore, physicists are trying to restore this initial state in the laboratory. With nearly the speed of light, bundles of billions extremely collimated atomic nuclei are forced to rush towards one another. When they collide with the highest energy in the smallest of spaces, a kind of mini Big Bang occurs, from which emerges an ultra-hot, ultra-dense particle soup with free quarks and gluons. Physicists refer to it as quark-gluon plasma.

In 2000, the CERN claimed to have produced the plasma at the Super Proton Synchrotron (SPS) for the first time ever. Currently, the efforts are continued at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory in New York and at the Large Hadron Collider (LHC) at CERN in Geneva. At CERN, a part of the yearly measurement campaigns are reserved for collisions of heavy nuclei such as lead. Some 1,000 physicists around the world are involved to carry out the heavy-ion experiment ALICE (A Large Ion Collider Experiment) and to evaluate the data. Furthermore, the ATLAS and CMS experiments also collect and analyse data from heavy-ion collisions.

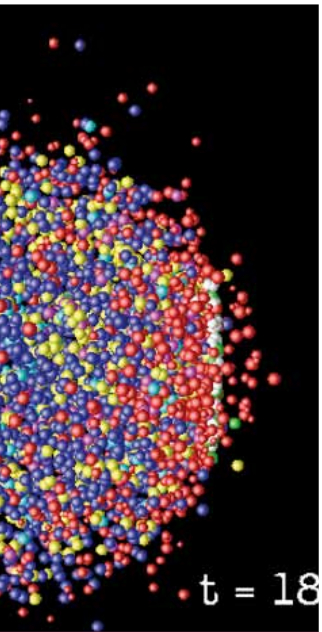
Hotter than the sun

The interpretation of the complex processes is highly dependent on the underlying theoretical model. One of the key parameters is the number of particles generated. More particles are formed when nuclei collide head-on. "The impact parameters have a great influence on the formation of the quark-gluon plasma, as well as its temperature and size", says Torsten Dahms, new junior research group leader at the Excellence Cluster Universe.

The quark-gluon plasma exists at unimaginable 2×10^{12} Kelvin, which is about 100,000 times hotter than in the core of the Sun. The scientists assume

Torsten Dahms is head of the junior research group “Studying the quark-gluon plasma via low-mass dileptons with ALICE” at the Excellence Cluster Universe since September 2013. He performed his undergraduate studies at the University of Würzburg and then moved to the Stony Brook University, USA, where he completed his studies and received his doctorate in 2008. In his doctoral thesis, he examined the dilepton spectra of proton and gold collisions at the collider RHIC at Brookhaven National Laboratory. Subsequently, he was a research fellow at CERN and joined the CMS experiment for two years. Until August 2013, he was a scientist at the École Polytechnique in Paris.

Photo: Amane/TUM



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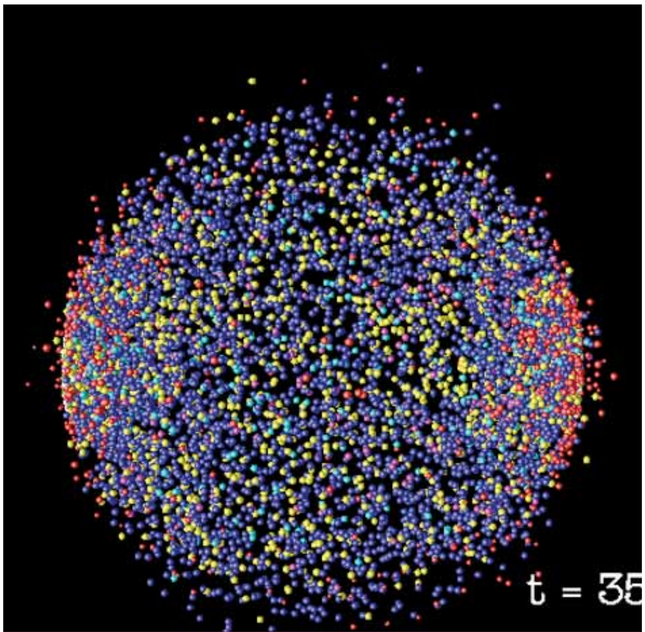
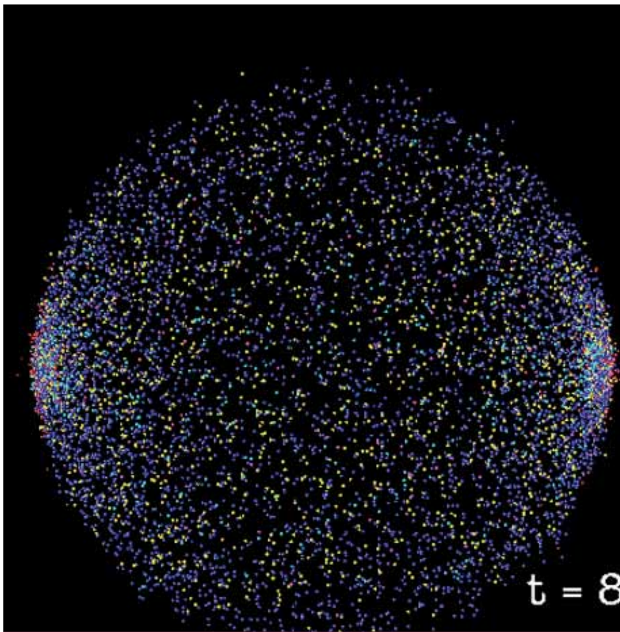


The quark-gluon plasma emerges.



The plasma expands and cools down.

that the particle soup constitutes a new state of matter. “In order to learn more about the conditions under which the phase transition takes place, we need to measure the temperature right after the collision”, says Torsten Dahms. Therefore, the physicists detect the photons that are generated during the collision. This electromagnetic radiation is not affected by the nuclear forces in the plasma and thus leaves the particle soup undisturbed.

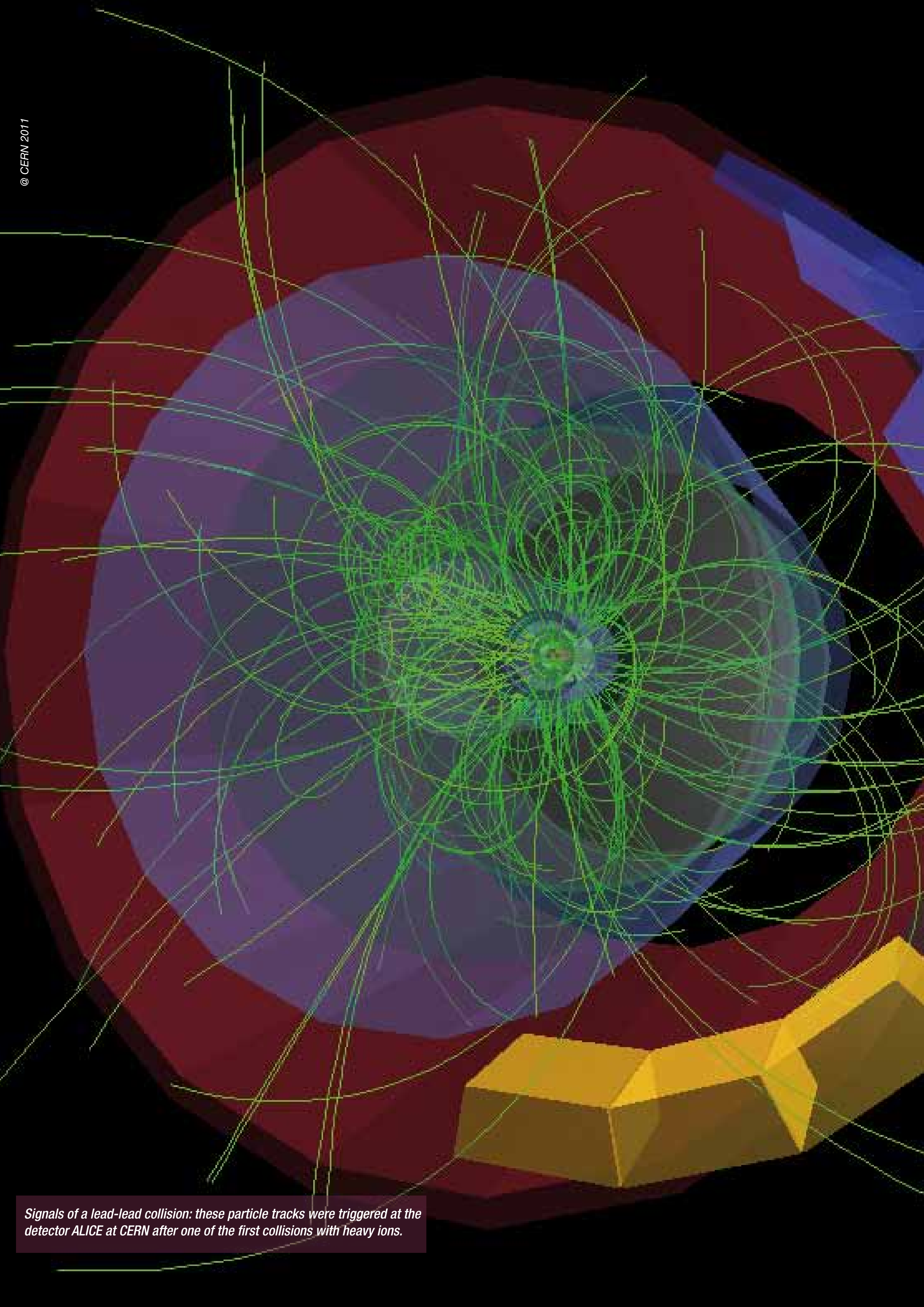
“But the main challenge is to detect the quark gluon plasma at all”, says Torsten Dahms. After all, it exists only for a split second and a direct detection is impossible. “So we need to focus on reliable evidence”, the particle physicist explains. “A clear indication for example, represents the formation of pairs of electrons with their antiparticles, the positrons.” Those dileptons are emitted during the entire existence of the plasma. Once sent out, they travel through the plasma as undisturbed as photons and carry direct information about the matter’s state.

Best kind of fluid

A further characteristic took the physicists by surprise: In theory, they expected that the quark-gluon plasma should behave like a gas, similar to the plasma of free charge particles. But the experiment revealed something different: The matter flows like a liquid with almost no internal friction. So far, the phenomenon of super-fluidity has only been observed in helium and lithium isotopes close to absolute zero. Apparently, the Universe’s hottest and coldest matter are the best kinds of fluid. “In addition, the quark-gluon plasma proves to be so dense that it is opaque even for the most energetic particles which we expected to shoot out from the plasma like “jets”.” The reasons however, are still under investigation.

At present, the researchers’ interest is focused on pairs of heavy quarks and their anti-quarks, the so-called quarkonia. Theoretically, these compounds should melt in the quark-gluon plasma like wax in the sun. Thus, the absence of such quarkonia would be another characteristic signature. Measurements at the SPS and at RHIC indicate, however, that their production and suppression is more complicated than originally anticipated. “The current measurements at the LHC complete the picture, but give rise to new questions, too”, says Torsten Dahms. Therefore, the particle physicist is looking forward to the LHC’s next run in 2015 to further investigate and hopefully resolve the many puzzles around the quark-gluon plasma (see also p. 8/9).

Petra Riedel



Signals of a lead-lead collision: these particle tracks were triggered at the detector ALICE at CERN after one of the first collisions with heavy ions.

Seed Money Project of the Excellence Cluster Universe

Research for ALICE

At CERN work is underway to upgrade the LHC. The goal is to achieve higher energies and more particle collisions. However, not only the accelerator ring must be optimized but also the detectors. The TUM research groups of Prof. Dr. Laura Fabbietti and Prof. Dr. Bernhard Ketzer take part in an extensive research program to get the heavy-ion experiment ALICE ready for the new collision rates. Financed by the Seed Money Program of the Excellence Cluster, they are exploring and testing new solutions for the Time Projection Chamber.

Prof. Dr. Laura Fabbietti

The strong nuclear force provides the almost insurmountable cohesion of the quarks in the nuclear components of atoms. Only at extremely high temperatures and particle densities, this force is overcome and the protons and neutrons "melt" to a plasma of "free" quarks and gluons. Such extreme conditions can only be produced at the world's most advanced particle accelerators. At the Large Hadron Collider (LHC) at CERN, the physicists speed up lead ions to near-light velocities and smash them. Lead is the element with the heaviest stable nucleus.

The experiment ALICE (A Large Ion Collider Experiment) at LHC is designed specifically for the study of collisions with heavy ions. Within the LHC program, four weeks of each year are reserved for that purpose. The aim of ALICE is to detect all particles produced in the mini-fireball and the subsequent phase of expansion and cooling, that survive long enough to reach the sensitive detector layers. During each collision, thousands of different particles are produced, such as electrons, photons and pions. To be able to observe all of these particles as well as their charges, a number of detector techniques are combined in ALICE.

The identification of the tracks as well as the determination of the velocities of fast, charged particles occurs in a Time Projection Chamber (TPC), which allows a three-dimensional reconstruction of the particle tracks. The particles can be detected due to the energy loss they suffer by ionization of gas molecules when flying through the detector chamber. The electron-ion-pairs that are left behind are separated by an electric field and accelerated so that they can be read out at the electrodes at the end of the chamber. To be detectable, the signal needs to be amplified by a high factor. This is done via an additional electric field just before the read-out anode, which speeds up the electrons so powerfully that further gas molecules are ionized. In this way, a TPC is able to simultaneously pursue thousands of particles.

However, the solution has a weak point: The ionization of gas molecules in the amplifier results in a backflow of ions into the TPC, which distorts the signal. The detector requires a certain time to filter out the backflow ions. So far, this does not yet pose a problem, however, at the LHC a number of upgrades are planned to significantly increase the number of particle collisions. The full luminosity, as physicists say, will be reached after the last upgrade in 2018. At this time, the ALICE detector must be capable to continuously record data.

Therefore, an extensive research and development program is underway around ALICE. At the Technische Universität München (TUM), the groups of Prof. Dr. Laura Fabbietti and Prof. Dr. Bernhard Ketzer are responsible for the development of a prototype that solves the backflow problem (Bernhard Ketzer has accepted an appointment to the University of Bonn, see p. 12). Currently, the ALICE collaboration favours signal amplification using GEM foils (Gas Electron Multiplier).

A GEM foil is a thin film of polyamide that is on both sides coated with a very thin layer of copper, into which more than 1,000 tiny holes per square centimetre are etched. If a voltage is applied between the surfaces of the film, very high field strengths occur within the holes due to their small dimensions. Driven by the external field of the TPC, a charged particle is strongly accelerated when passing one of the holes, and subsequently triggers an avalanche of ionized particles. If the voltage applied to the film is greater than the external field, the ion backflow is prevented.

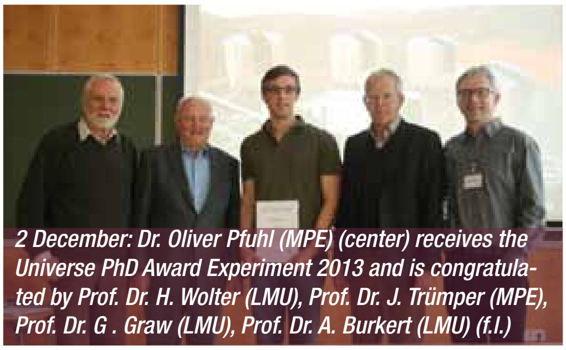
"Thus, GEMs have the advantage that basically no time-out phase is necessary, but data read-out is continuous", says Laura Fabbietti. Within the first round of the Excellence Initiative, a GEM-TPC has been designed and built at the TUM with the financial support of the Excellence Cluster Universe. The prototype has already been tested in the ALICE cavern under LHC conditions. "The tests were successful", says Laura Fabbietti, "but we must continue to work on optimizing it." Currently, the groups of Fabbietti and Ketzer are systematically testing new solutions based on a combination of other microstructured gas detectors (Micro-Pattern Gas Detector, MPGD). The project is funded by the Seed Money Program of the Excellence Cluster Universe. "This approach is turning away from what is currently used, but we hope that it will completely solve the problem", says Fabbietti.

Petra Riedel

Review

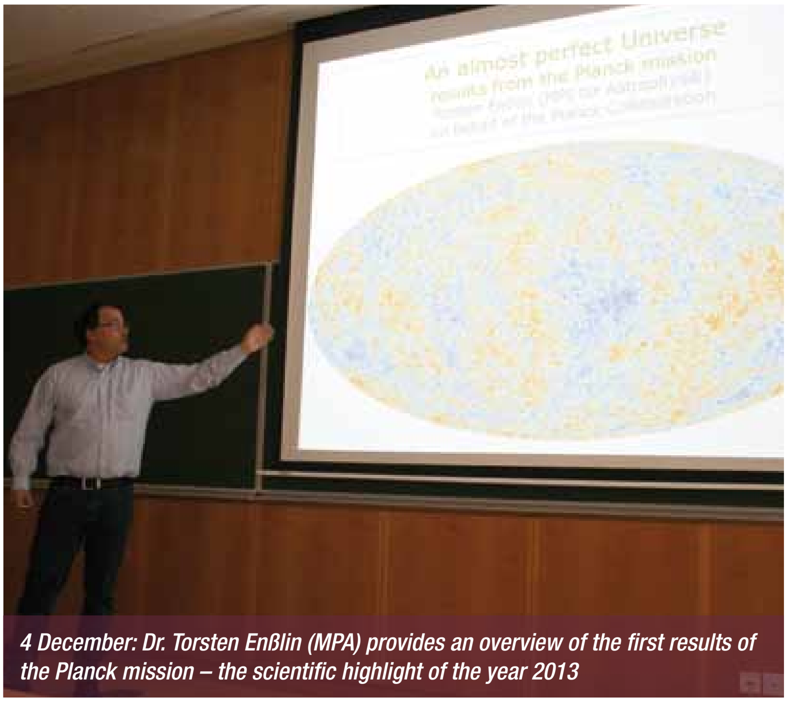
Science Week 2013

At the beginning of December 2013 an overview of last year's research work at the Excellence Cluster Universe was given. Researchers and students presented their work and discussed the current problems in their fields. The Science Week also provided the framework for the acknowledgement of the best PhD theses of the year 2013 and for the official kick-off of the Computational Center for Particle and Astrophysics (C2PAP) of the Excellence Cluster Universe. As usual, the Scientific Advisory Committee was also invited to the Science Week and was represented by four of its members.



2 December: Dr. Oliver Pfuhl (MPE) (center) receives the Universe PhD Award Experiment 2013 and is congratulated by Prof. Dr. H. Wolter (LMU), Prof. Dr. J. Trümper (MPE), Prof. Dr. G . Graw (LMU), Prof. Dr. A. Burkert (LMU) (f.l.)

4 December: Dr. Martin Winkler (TUM) (2. f. r.) is presented with the Universe PhD Award Theory 2013 by Prof. Dr. S. Paul (TUM), Prof. Dr. H. Wolter (LMU) and Prof. Dr. A. Burkert (LMU) (v.l.)

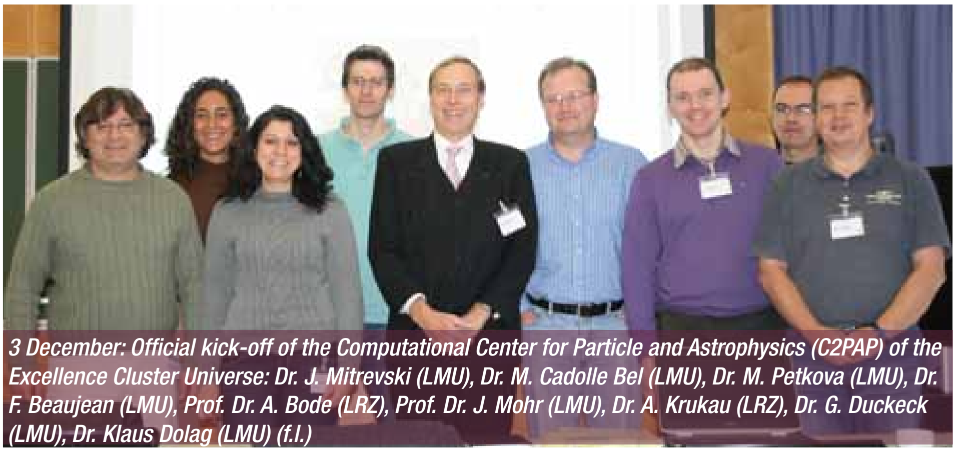


4 December: Dr. Torsten Enßlin (MPA) provides an overview of the first results of the Planck mission – the scientific highlight of the year 2013

Members of the Scientific Advisory Committee in discussion: Prof. Dr. W. Buchmüller (DESY) (l.), Prof. Dr. J. Ellis (CERN) (2. f. r.), Prof. Dr. Françoise Combe (Observatoire de Paris) (r.)

Prof. Dr. P. Jenni (CERN), member of the Scientific Advisory Committee

5 December: The Research Area Coordinators provide an overview over the ongoing activities, here: Prof. Dr. S. Schönert (TUM)



3 December: Official kick-off of the Computational Center for Particle and Astrophysics (C2PAP) of the Excellence Cluster Universe: Dr. J. Mitrevski (LMU), Dr. M. Cadolle Bel (LMU), Dr. M. Petkova (LMU), Dr. F. Beaujean (LMU), Prof. Dr. A. Bode (LRZ), Prof. Dr. J. Mohr (LMU), Dr. A. Krukau (LRZ), Dr. G. Duckeck (LMU), Dr. Klaus Dolag (LMU) (f.l.)

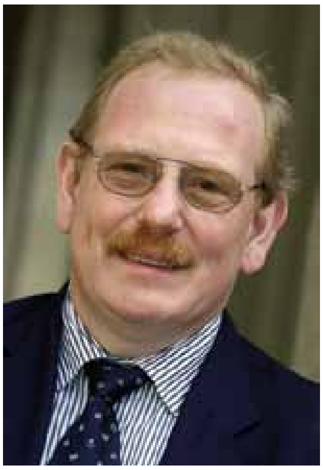
Photos: Fierlinger/Riedel (EXC/TUM)

Preview

Within the next couple of months, the Excellence Cluster Universe will organize numerous scientific and public events. The conferences and workshops highlighted in red are primarily addressing experts. All other events are aimed at the interested public.

02. - 03.04.2014, 10:00 - 17:00	10. International Particle Physics Masterclasses for teachers und pupils	MPI for Physics, Föhringer Ring 6, Munich
08.04.2014, 19:00	Café & Kosmos: Prof. Dr. Lothar Oberauer (TUM): „Neutrinos: Die Rätsel der himmlischen Boten“	Vereinsheim, Occamstr. 8, Munich
09.04.2014, 16:30	Universe Colloquium followed by wine & cheese Dr. Assaf Sternberg (TUM): “High resolution spectra of type Ia supernovae and their progenitors”	Excellence Cluster Universe, Boltzmannstr. 2 (seminar room basement), Garching
9. - 11.04.2014	Workshop: N-Body Simulations of modified Gravity Models	MPI for Astrophysics, Karl-Schwarzschild-Str. 1 (seminar room 006), Garching
14. - 15.04.2014	Interdisciplinary Cluster Workshop: Evaluation of Likelihood Functions on GPUs www.universe-cluster.de/gpu-workshop2014	Excellence Center/IGSSE, Boltzmannstr. 17 (seminar room ground floor), Garching
16.04.2014, 16:30	Special Universe Colloquium Prof. Dr. Viatcheslav Mukhanov (LMU): “Quantum Universe: Theory and Observations”	Institute for Advanced Studies, Lichtenbergstr. 2a (seminar room ground floor), Garching
23.04.2014, 16:30	Universe Colloquium followed by wine & cheese Dr. Francesco Riva (École Polytechnique Lausanne): “The Safest Routes to Islands beyond the Standard Model”	Excellence Cluster Universe, Boltzmannstr. 2 (seminar room basement), Garching
30.04.2014, 16:30	Universe Colloquium followed by wine & cheese Andreas Hein (TUM): “How to travel to the Stars and Fermi‘s Paradox” for more events see www.universe-cluster.de	Excellence Cluster Universe, Boltzmannstr. 2 (seminar room basement), Garching
08.05.2014, 12:30	Fruits of the Universe lunch talk Dr. Paola Popesso (TUM): “No food, no star - The complex Evolution of a Galaxy Star Formation Activity”	Excellence Cluster Universe, Boltzmannstr. 2 (foyer 1st floor), Garching
20.05.2014, 19:00	Café & Kosmos: Prof. Dr. Laura Fabbietti (TUM), (tba) for details see www.cafe-und-kosmos.de	Vereinsheim, Occamstr. 8, Munich
22.05.2014, 12:30	Fruits of the Universe lunch talk Prof. Dr. Peter Fierlinger (TUM), (tbc) for more events see www.universe-cluster.de	Excellence Cluster Universe, Boltzmannstr. 2 (foyer 1st floor), Garching
26.05. - 20.06.2014	MIAPP 2014 Workshop I: The Extragalactic Distance Scale (registration completed), registration for the topical workshop “NIAPP” (10. - 12.07.) on www.munich-iapp.de	Munich Institute for Astro- and Particle Physics, Boltzmannstr. 2, Garching
03.06.2014, 19:00	Café & Kosmos for details see www.cafe-und-kosmos.de	Vereinsheim, Occamstr. 8, Munich
30.06. - 25.07.2014	MIAPP 2014 Workshop II: Neutrinos in Astro- and Particle Physics (registration completed), registration for the topical workshop “Top Quark Physics Day” (11.08.) on www.munich-iapp.de	Munich Institute for Astro- and Particle Physics, Boltzmannstr. 2, Garching

Personalia | Honours & Awards, New entries & Farewells




Photos: MPE, TUM, Argonne National Laboratory, privat

Prof. Dr. Reinhard Genzel, Director at the Max Planck Institute for Extraterrestrial Physics and professor at the University of California, Berkley, will receive this year's Herschel Medal of the Royal Astronomical Society for his outstanding contributions to observational astrophysics. Genzel made pioneering observations to map the motions of stars close to the Galactic center, leading to firm evidence for the existence of a supermassive black hole at the center of the Milky Way.

Dr. Bernhard Ketzer, research associate at the Department E18, TUM, received a call to the Rheinische Friedrich-Wilhelms-Universität, Bonn. Since 1 December 2013 he is head of the research group "Structure and spectroscopy of hadrons, development of high-Resolution particle detectors and data analysis" at the local Helmholtz-Institute for Radiation and Nuclear Physics. Since 2012 Bernhard Ketzer is an associate member of the ALICE collaboration at CERN.

Prof. Dr. Walter Henning, acting head of the TUM Department E12, Hadron and Nuclear Physics, and Deputy Research Area Coordinator at the Excellence Cluster Universe, leaves Munich at the end of March 2014. He will relocate his life back to the US continuing the efforts to build a proposed exotic beam facility for nuclear physics research at Argonne National Laboratory where he was scientist from 1977 - 1986 and Director of the Physics Division from 1992 - 1999.

Dr. Stefan Hilbert is head of the junior research group "Formation and evolution of the cosmic large-scale structure" at the Excellence Cluster Universe since 1 February 2014. The astrophysicist studied at Humboldt University, Berlin, and at Loughborough University, UK. In 2008 he received his PhD from the Ludwig-Maximilians-Universität, Munich. Most recently, he was a postdoctoral fellow at the Max Planck Institute for Astrophysics.

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