

# New Max Planck Center in London

Topics at the facility will include research into the causes of mental illnesses



Why do some people become depressed when under stress, while others don't? Why are some elderly people mentally active, while others suffer a marked decline in their cognitive faculties? The Max Planck UCL Centre for Computational Psychiatry and Ageing Research hopes to find the answers.

On April 1, 2014, the Royal Society in London hosted a ceremony to mark the opening of the new Max Planck UCL Centre for Computational Psychiatry and Ageing Research. Four research institutions are participating in the new center: the Gatsby Computational Neuroscience Unit (Peter Dayan), the Max Planck Institute for Human Development (Ulman Lindenberger), the Max

Planck Institute for Human Cognitive and Brain Sciences (Arno Villringer) and the Wellcome Trust Centre for Neuroimaging (Ray Dolan). The main goal of the newly established Max Planck Center is to study the causes of mental illnesses and the disparities in mental development in adulthood, with computer models of neuronal activity serving as a central theoretical tool. In addition to

the President and Chancellor of University College London, Michael Arthur, and the President of the Max Planck Society, Peter Gruss, speakers at the opening ceremony also included David Willetts, Britain's Minister of State for Universities and Science, and Nobel laureate Eric Kandel, a neuroscientist and Director at the Kavli Institute for Brain Science at Columbia University, New York.

Photomontage: MPI of Molecular Cell Biology and Genetics/iStockphoto

## Software Creates 3-D Avatars

Body Labs develops world-leading technology to support fully automated creation

This technology is the result of almost ten years of intensive research at Brown University and the Max Planck Institute for Intelligent Systems in Tübingen. It provides a simple means of creating highly accurate, realistic avatars that are able to imitate the entire spectrum of human movement sequences. The new possibilities now available have potential applications in areas such as clothing and product design, 3-D printing of special equipment and clothing, games, movie animation and online clothing sales. To create an av-

atar, customers can either upload a body scan to the online BodyHub app, or enter specific measurements. BodyHub also offers additional functions for 3-D clones, including the facility to alter size and posture, and animation. Fashion designers can load such avatars across to their computer-assisted CAD software. The virtual figures can then be clothed and animated, enabling the designer to see how his or her designs are suited to various body types, and how the garments morph and change in response to body movements.

# Women in Research

Max Planck Society's Minerva Program to be expanded

Increasing the number of women in senior positions is an issue that exercises not just industry, but science too. The figures remain sobering: the proportion of women at W3 level at the Max Planck Society is just 11.2 percent. In other words, the 254 male Directors have just 32 female counterparts. The picture admittedly looks much better at the W2 level – where the Max Planck Society has for years been way ahead of other non-university research institutions and universities. However, the positive development from 2005 through 2010 is stagnating and the proportion of women at this level has stabilized at just under 28 percent. In a self-imposed commitment, the Max Planck Society has set itself the goal of increasing the proportion of female scientists at levels W2 and W3 on the career ladder by 5 percentage points each within the 5-year period ending 2017. At the important W2 level, we are still lagging behind our target. The most



Successful careers in science: Kirsten Endres, Yvonne Groemping and Sandra Kortner (from left), Research Group Leaders under the W2 Minerva Program.

important instrument in our equal opportunities toolkit, the Minerva W2 Program, will therefore once again be substantially expanded with the investment of a further 20 million euros from 2014 through 2018. The inten-

tion is not only to increase the number of Minerva Groups from the current 33 to a total of 44 by the end of 2015, but also to extend the duration of funding, with the potential for two extensions of two years each.

## Touring Success – from East to West

“Images of Science” in demand abroad

It's been a part of the Max Planck cosmos for some time now: Every year, numerous scientists from the Max Planck institutes participate in the competition for the best images from research. However, only the most spectacular images are selected for the exhibition, which has also enjoyed consider-

able success abroad in the past few years. “Images of Science” has been on the road in Russia since 2012, where they have already visited nine cities, and the itinerary includes at least three more stops – including Vladivostok in the “Far East.” A US edition of the images will be on display in the German Center for Research and Innovation in New York in June, and a cooperative exhibition project with the Patricia and Phillip Frost Museum of Science in Miami will be launched in the fall. The museum will incorporate the Max Planck exhibition in its portfolio of travelling exhibitions, enabling the lending of the presentation to museums and science centers all over North America. Also in June, another travelling exhibition will begin in Ukraine, this time in cooperation with the German embassy and financed by the Federal Ministry of Education and Research. The images made a very special appearance in fall 2013 in Oviedo, Spain: as part of the festivities surrounding the conferral of the Prince of Asturias Awards, they were exhibited for the first time as art in a public setting (photo left).



[www.images.mpg.de](http://www.images.mpg.de)

# “The first unequivocal indication for the inflation of the universe”

Interview with Max Planck Director Karsten Danzmann on the indirect observation of primordial gravitational waves



Karsten Danzmann

It is very rare that a discovery excites media and scientists alike. This was the case with the Bicep2 experiment: the antenna is installed 2,800 meters above sea level at the South Pole and receives microwave radiation that originates from the very birth of the universe. Researchers have found something like the fingerprints of gravitational waves in this cosmic baby photo. They seem to confirm the inflation theory, which states that the universe inflated abruptly immediately after the Big Bang 13.8 billion years ago, by around 30 powers of 10. Thus the name of the model, “inflation”, from the Latin *inflatio*. The MAX-PLANCKRESEARCH editorial team discussed the latest results with Karsten Danzmann, Director at the Max Planck Institute for Gravitational Physics in Hanover.

*Mr. Danzmann, on a scale from 0 to 10, how do you assess the value of your American colleagues' discovery?*

**Karsten Danzmann:** Definitely a 10! This is the first unequivocal experimental indication for an inflationary expansion immediately after the Big Bang.

*Are there no other observed indications for the inflation model?*

As a matter of fact, there are only indirect indications. Inflation was invented to provide this very explanation for the uniformity and flatness of the universe, which, of course, it does. Because it doesn't matter what direction we look in, by and large, the universe always looks the same. Moreover, it seems that space doesn't display any curvature – as if inflation has smoothed it. And finally, inflation explains the presence of galaxy clusters, which emerged from density fluctuations. These, in turn, were caused by quantum fluctuations, which inflation abruptly increased to cosmic scales.

*The universe was opaque immediately after it came into being, because the dense primordial soup meant the photons were continually colliding with other particles and didn't get through. The radiation was able to set off on its travels only when the fog lifted, some 400,000 years later. So everything we record today with our instruments originates from this later era. However, the gravitational waves observed were generated as early as the inflation period ....*

Indeed, the inflation took place long before the time when the universe became transparent. It is thus quite remarkable that a signature of the inflation was nevertheless found in the microwave background. This signature has apparently somehow survived the initial 400,000 years of the universe – stored in the primordial gravitational waves.

*The Bicep2 researchers observed the gravitational waves indirectly. This phenomenon was predicted 100 years ago by Albert Einstein – has no one seen it yet?* Gravitational waves are always generated when masses move. They speed away with

the velocity of light, causing space to compress and stretch. Direct detection is difficult and hasn't yet been successful. But our colleagues Russell Hulse and Joseph Taylor were awarded the Nobel Prize for their indirect detection in 1993. They were able to prove that the binary pulsar system PSR1913+16, which consists of two stars orbiting each other very rapidly, loses exactly as much energy as is expected through the emission of gravitational waves.

*Does this mean that the new Bicep2 data isn't really anything special?*

Of course it is! Because these measurements go one step further. They make it clear that not only does the emission of gravitational waves take place as the theory of general relativity predicts, but also that the interaction with matter happens precisely as the theory assumes: the impression that the gravitational waves stamped into the cosmic microwave background radiation 13.8 billion years ago looks exactly as has been assumed.

*What exactly does that mean?*

The measurements record polarization – a quantity that indicates the degree to which waves oscillate in the same direction. Now the patterns observed in the polarization appear to be essentially turbulent. They must therefore have been caused by wave movements that caused space-time to tremble. And really, the only waves that could have done this are gravitational waves. Incidentally, this makes us very confident that any traces that the gravitational waves might leave behind in our detectors today will also follow the predictions of the theory of relativity.

*Would you have any chance of detecting primordial gravitational waves with your GEO600 detector?*

That depends very much on what exactly happened back in the early universe. Directly, the Bicep2 data tells us only something about how strong primordial gravi-

tational waves are at extremely low frequencies of  $10^{-16}$  hertz. If the standard model of inflation describes everything correctly, then waves from the Big Bang will be too weak for the current generation of detectors on Earth. And even the planned LISA satellites stationed in space wouldn't be able to detect them. But the birth of the universe was probably much more complicated than that. There are thus a large number of possible processes that all generate much stronger signals at the higher frequencies for detectors on Earth and in space.

*When do you expect the first direct proof of gravitational waves?*

The first generation of ground-based Ligo and Virgo detectors are currently being modified to achieve a significantly higher sensitivity. Only our GEO600 installation in Ruthe near Hanover is still on the lookout for occasional events in our neighborhood. When the detectors on Earth have reached their design sensitivity in around 2019, it would be very surprising if we didn't detect quite a few events within a very short time.

Interview: Helmut Horning

## In Search of Earth's Twin

Max Planck Institute for Solar System Research establishes data center for the European mission *PLATO*

How widespread are planets like the Earth in our galaxy? Do these celestial bodies offer the conditions for life to evolve? *PLATO* (*PLANetary Transits and Oscillations of stars*) will make a decisive contribution to answering these questions. The European Space Agency ESA has now officially given the go-ahead for the mission, due to launch into space in 2024. The probe will spend six years searching a million stars for their planets. The object is to precisely define the characteristics of 85,000 of these systems. Germany is taking a lead role in close collaboration

with its European partners: the Institute of Planetary Research at the German Aerospace Center (DLR) is heading the overall mission, while the Max Planck Institute for Solar System Research in Göttingen will oversee the evaluation of data. "*PLATO* will discover planets like Earth that offer the necessary preconditions for life," says Laurent Gizon, Director at the MPI in Göttingen. To help it do so, the probe is equipped with 34 telescopes.



Space scout: This is what the *PLATO* observatory could look like. This image shows a design proposed by Thales Alenia Space.

## On the Net



### Dancing Institute

Pharrell Williams's feel-good song "Happy" has taken the music charts by storm, as well as inspiring numerous imitators on the Web. One great version was recorded by the Max Planck Institute for Molecular Cell Biology and Genetics in Dresden. Almost the entire institute staff of 400 joined in the dancing, including the Directors. In its first two weeks, the video notched up over 10,000 views on YouTube, as well as 160 Likes and positive comments such as: "Science is fun here!" "You're happy when ... you work at a Max Planck institute!" [www.youtube.com/user/mpicbg/happy](http://www.youtube.com/user/mpicbg/happy)

### Answers about Language

What causes dyslexia? Is there such a thing as a universal body language? Why can't apes speak? These are the kinds of questions about language that scientists at the Max Planck Institute for Psycholinguistics in Nijmegen are answering. Over 60 answers have already been published on the website and more are being added regularly. Anyone who is not a language researcher in their own right can ask a question by e-mail. It will then be answered as quickly as possible – in simple, understandable, but detailed terms – by experts at the institute.

[www.mpi.nl/q-a/questions-and-answers](http://www.mpi.nl/q-a/questions-and-answers)

### A Snapshot of the Oceans

The Ocean Sampling Day (OSD) will take place on the longest day in the northern hemisphere in 2014, during the summer solstice on June 21. On this day, up to 160 science teams all around the world will take water samples from the ocean in order to identify the microbes in it. The outcome of this global effort will be nothing less than the biggest data set in marine research that has ever been taken on one single day. Become a citizen scientist and get out on a field trip by yourself or with family and friends, and collect environmental data. You can help scientists unravel the mysteries of the marine microbial world with a few simple steps, which are described in an online tutorial, and enter the measured data in the OSD app. It is now available for Android and iOS smartphones.

[www.microb3.eu/myosd](http://www.microb3.eu/myosd)