Highlights

- **Dancing Electrons Loose the RACE**

  Even more than 100 years after Einstein's explanation of photoemission the process still poses challenging surprises. In our study now published in Science (http://www.sciencemag.org/lookup/doi/10.1126/science.aam9598) ultrashort pulses of light were employed to start a race between electrons emitted from different initial states in a solid material. Timing this race reveals an unexpected result: Faster electrons arrive later. This observation made in Bielefeld's attosecond laboratory was explained in close collaboration with theoretical physicists at the Donostia International Physics Center (DIPC, San Sebastian, Spain). The motion of an emitted electron is strongly affected by interactions inside the atom from which the electron is emitted. The motion of these electrons around the nuclei, before being eventually emitted, is kind of a dance leading to an intuitive picture that the electrons that remain longer dancing around the atom lose the race and are emitted last. In contrast, electrons going straight win the race. This observation required a revision of common theoretical models describing the photoemission from solids, i.e. this initial intra-atomic interaction had to be taken into account and sets a new cornerstone for future improved models of the photoemission process from solids.

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- Healthy aging: New EU project on the human liver - Bielefeld University to coordinate programme with partners from nine countries

  At roughly 3.7 million Euros, the European Commission has now confirmed funding for a new programme in physics and biomedicine. Fourteen young scientists will be studying healthy aging under the microscope: They will be developing new optical procedures to study the liver with high-resolution microscopy. The goal is to find out how medical drugs affect the liver and how the organ changes with advancing age. The project DeLIVER, coordinated by Bielefeld University, will start in January 2018. This is now the seventh Marie Sk?odowska-Curie Action (European training network for young academics) at Bielefeld University.

- **Chip-based nanoscopy: Microscopy in HD quality - New invention at Bielefeld University and the University of Tromsø (Norway)**

  Physicists at Bielefeld University and tThe Arctic University of Norway in Tromsø have developed a photonic chip that makes it possible to carry out superresolution light microscopy, also called 'nanoscopy', with conventional microscopes. In nanoscopy, the position of single fluorescent molecules can be determined with a precision of just a few nanometres, that is, to a millionth of a millimetre. This information can be used to produce images with a resolution of about 20 to 30 nanometres, and thereby ten times that of conventional light microscopy. Until now, this method has required the use of expensive special instruments. Bielefeld University and the University of Tromsø have filed a patent for this new 'chip-based nanoscopy' procedure. On the 24th of April 2017 the researchers will be publishing the accompanying study in the journal 'Nature Photonics'.
- **Nanoinjection increases survival rate of cells - Physicists at Bielefeld University develop new method for microscopic research**

  How do tumours grow? And how do bacteria transform harmless substances into medical agents? When biophysicists want to understand what is happening in living cells, they have to introduce

fluorescent probes or other foreign molecules. There are several ways to overcome the cell wall without causing the cell permanent harm. Physicists at Bielefeld University have developed a particularly gentle method for this: nanoinjection. In a new study to be found in ‘Scientific Reports’ published by ‘Nature’, they show that with this method, nine out of ten cells survive being injected with foreign molecules.

- **Optical tractor beam traps bacteria-Physicists from Bielefeld University report on new methods in ‘Nature Communications'**
  Up to now, if scientists wanted to study blood cells, algae, or bacteria under the microscope, they had to mount these cells on a substrate such as a glass slide. Physicists at Bielefeld and Frankfurt Universities have developed a method that traps biological cells with a laser beam enabling them to study them at very high resolutions. In science fiction books and films, the principle is known as the ‘tractor beam’. Using this procedure, the physicists have obtained superresolution images of the DNA in single bacteria. The physicist Robin Diekmann and his colleagues are publishing this new development this Tuesday (13.12.2016) in the latest issue of the research journal ‘Nature Communications’.
- **Physicists find new explanation for key experiment - Researchers at Bielefeld University publish findings on spin caloritronics and are the first to apply measurement methods in the field**
  An experiment at Tohoku University (Japan) in 2008 laid the foundations for research on ‘spin caloritronics’ – a field that aims to develop more effective and energy-saving data processing in information technology. Since then, many new spincaloric effects have been studied, but the key experiment in Japan could not be replicated. Researchers at Bielefeld University’s Faculty of Physics have now found an explanation for this. They have published their findings in the journal Nature Communications. By applying a new measurement method available at major research facilities, they have also extended the experimental repertoire in spin caloritronics. These results can be found in the journal Physical Review Letters.
- **Hot electrons point the way to perfect light absorption - Physicists study how to achieve perfect absorption of light with the help of rough ultrathin films**
  Light-absorbing films can be found in many everyday applications such as solar cells or sensors. They are used to convert light into electrical current or heat. The films literally trap the light. Although such absorber films are applied widely, scientists still do not know which mechanism permits the most efficient absorption of light. A team of physicists at Bielefeld University, the University of Kaiserslautern, and the University of Würzburg have now proved that the very efficient scattering of light in ultrathin rough films traps light until it is absorbed completely. The researchers are now publishing their findings in the journal Nature Photonics. This research can help to make thin absorber films even more efficient and thereby save energy.
- **Filtering pollutants with nanomembranes - Bielefeld University participating in two European research networks**
  Bielefeld University’s Faculty of Physics is starting research on nanomembranes in two new projects. Both projects are investigating the use of ultrathin foils as filters. The one project belongs to the European Union’s (EU) flagship research programme on graphene – a flexible and solid material that is only one atom thick. The EU is investing roughly one billion Euros in this flagship project over the next 10 years. The other project is studying the filtering of gases with ultrathin nanomembranes that are very similar to graphene. It is being funded by the ‘M-era.Net’ initiative, a network of partners from 24 European nations and regions.
- **Cooling with molecules - Researchers at the universities in Bielefeld, Manchester, and Zaragoza present low-temperature experiment in Nature Communications**
  An international team of scientists have become the first ever researchers to successfully reach temperatures below minus 272.15 degrees Celsius – only just above absolute zero – using magnetic molecules. The physicists and chemists are presenting their new investigation today (22 October 2014) in the scientific journal Nature Communications. It was developed by six scientists from Bielefeld University, the University of Manchester (Great Britain), and the Universidad de Zaragoza (Spain).