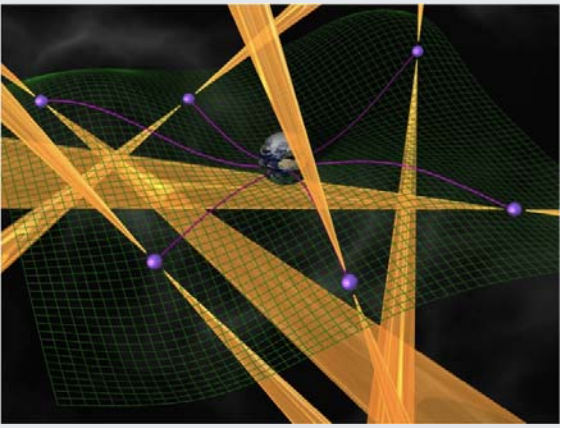
Großes Physikalisches Kolloquium an der Universität zu Köln



Prof. Dr. Michael Kramer
Max-Planck-Institut für Radioastronomie

Fundamental Physics with Radio Astronomy

Radio astronomy offers a unique way to study the fundamental forces in the Universe. We utilize this exciting window to probe fundamental physics on all scales - from the forces in super-dense matter, over precision tests of general relativity, to the large-scale cosmic magnetic fields. New technology promises to further revolutionize this field - as well as the rest of astronomy and astrophysics.
I will present some of the most exciting examples of this research, focusing in particular on gravitational physics such as precision tests of general relativity and the experiments to detect gravitational waves using pulsars. I conclude with an outlook into future and what will be possible with next generation of telescopes like LOFAR and the SKA.

Dienstag, 19.10.2010, 16:45
Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77

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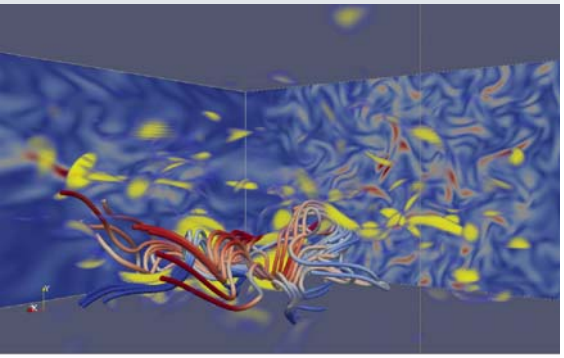

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Prof. Dr. Alex Lazarian
Alexander-von-Humboldt Fellow, University of Wisconsin-Madison

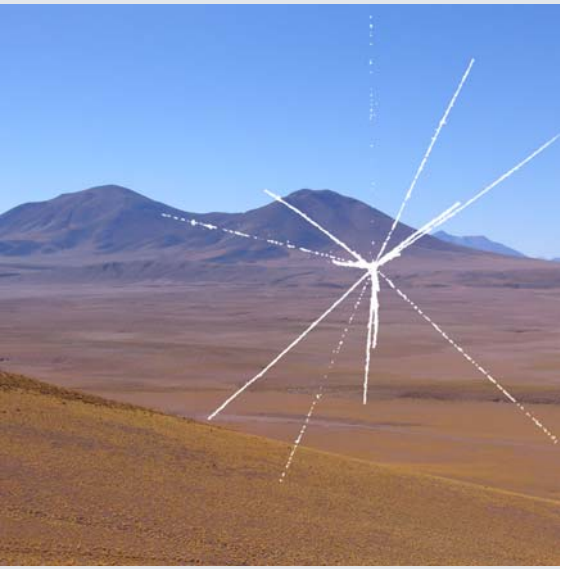
Magnetic Reconnection and the Change of the Star-Formation Paradigm

Recent years have been marked by a notable change in the star formation paradigm. Instead of quasi-static molecular clouds slowly evolving under the influence of gravity and ambipolar diffusion a new picture with more action and dynamics emerged. The molecular clouds are associated with turbulent density fluctuations and the structure of the interstellar medium evolves fast on the sound crossing times. However, these simulations are unable to reproduce correctly the dynamics of magnetic fields on scales of the created molecular clouds, in particular magnetic flux removal. We show that "reconnection diffusion" is responsible for removing magnetic flux from molecular clouds. For the giant molecular clouds (GMCs) and for many cloud cores the resulting rates of magnetic field removal dominate the ambipolar diffusion rates in partially ionized gas. Our numerical simulations validate the concept of "reconnection diffusion" and substantially modify the understanding of the role of magnetic fields in star formation.

Humboldt-Lecture - Dienstag, 02.11.2010, 16:45

Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77

Großes Physikalisches Kolloquium an der Universität zu Köln



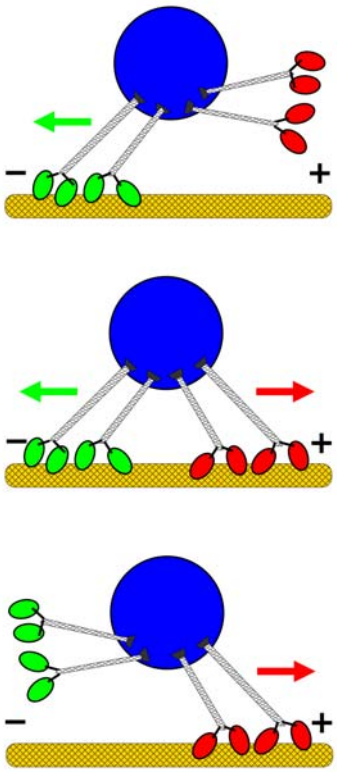
Prof. Dr. Tibor Dunai
Geologisches Institut, Universität zu Köln

Kosmische Strahlung durch die Brille der geologischen Anwendungen betrachtet

Die Energie der kosmischen Strahlung ist ausreichend um in der Erdatmosphäre und an der Erdoberfläche, durch Kernreaktionen mit dort vorhandenen Atomen, neue Nuklide zu schaffen. Diese neugeschaffenen kosmogenen Nuklide sind Grundlage für vielfältige geologische Anwendungen. Die Radiokohlenstoffdatierung wurde schon früh, seit den vierziger Jahren, für archäologische und geologische Anwendungen entwickelt. Erst durch technologische Durchbrüche im Bereich der Beschleuniger-Massenspektrometrie, Mitte der Achtziger Jahre, wurden weitere Nuklide für die Nutzung in den Geowissenschaften erschlossen. Die Anwendung dieser Nuklide löste einen Umbruch unseres Verständnisses von Vorgängen an/nahe der Erdoberfläche aus, eine wissenschaftliche Revolution, die bis heute anhält. Der Vortrag erläutert anhand von Beispielen wie kosmogene Nuklide zu unserem Verständnis unserer Lebensumwelt beitragen.

Dienstag, 16.11.2010, 16:45
Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77

Großes Physikalisches Kolloquium an der Universität zu Köln



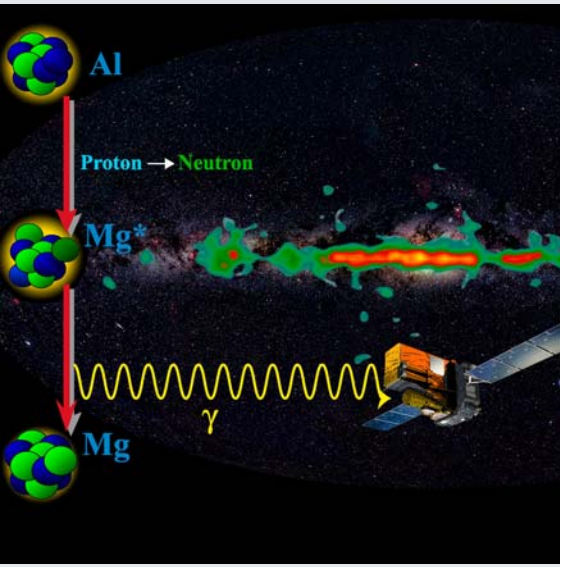
Prof. Dr. Reinhard Lipowsky
Department of Theory & Bio-Systems, MPI of Colloids and Interfaces, Potsdam

What keeps us going: Force generation and transport by molecular motors

All eukaryotic cells including those of our body contain a large variety of molecular machines that convert the chemical energy released from nucleotide hydrolysis into mechanical work. This talk focusses on molecular stepping motors such as kinesin, which use their two motor domains or "heads" to walk along very thin filaments.
Our theory for these motors starts from their enzymatic activity during ATP hydrolysis and from the corresponding nucleotide states. This approach provides a general classification scheme for the different motor cycles, each of which can be characterized in terms of its free energy transduction and entropy production arbitrarily far from chemical and/or mechanical equilibrium. The properties of single motors are then used to describe the cooperative behavior of many motors. The latter behavior includes cargo transport by one or two (antagonistic) team of motors. Systems consisting of many motors and cargo particles can undergo traffic phase transitions.

Dienstag, 30.11.2010, 16:45
Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77

Großes Physikalisches Kolloquium an der Universität zu Köln



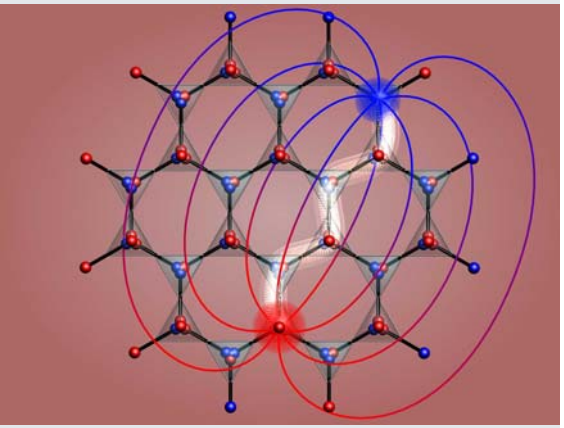
Priv-Doz. Dr. Roland Diehl
Max Planck Institut für extraterrestrische Physik, Garching

Kosmische Radioaktivität und Astronomie mit Gammastrahlen-Teleskopen

Kernfusions-Reaktionen in Sternen und in Supernova-Explosionen bringen die Vielfalt der chemischen Elemente hervor, die wir im Universum vorfinden. In diesen Prozessen entstehen auch Beimischungen instabiler Atomkerne. Deren radioaktiver Zerfall im interstellaren Raum geht meist einher mit Aussendung charakteristischer Linienstrahlung bei Gammastrahlen-Energien. Astronomische Teleskope im Weltraum können so einen Blick auf kosmische Nukleosynthese erhalten. Die ESA-Mission INTEGRAL liefert seit 2002 Beobachtungsdaten von verschiedenen Regionen in unserer Milchstrasse. Insbesondere langlebige Isotope wie ^{44}Ti, ^{26}Al und ^{60}Fe wurden gemessen, aber auch Annihilationsstrahlung von interstellaren Positronen. Die Technik der Gammastrahlenteleskope wird im Vortrag vorgestellt, bevor die astrophysikalischen Prozesse, die bisherigen Erkenntnisse und offene Fragen diskutiert werden. Hierbei werden insbesondere Kernfusionsprozesse in kosmischer Umgebung, Supernova-Explosionen und das interstellare Medium behandelt.

Dienstag, 14.12.2010, 16:45
Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77

Großes Physikalisches Kolloquium an der Universität zu Köln



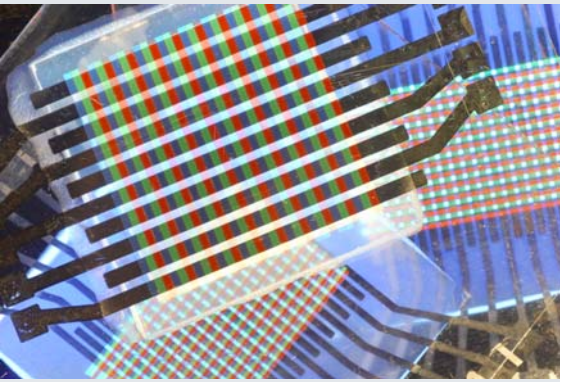
Prof. Dr. Roderich Moessner
Max-Planck-Institut für Physik komplexer Systeme, Dresden

Magnetic Monopoles in Spin Ice

Fractionalisation is a counterintuitive phenomenon, in which an 'elementary' particle appears to break into two independent entities. A celebrated example of this is spin-charge separation, in which an electron's magnetic (spin) and electric (charge) degrees of freedom appear to become independent. Spin ice materials such as $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$ provide a rare instance of fractionalisation in three dimensions: their elementary excitations carry a fraction of the magnetic moment of the microscopic spin degrees of freedom, and they can be thought of as magnetic monopoles. The peculiar nature of these excitations leads to unique signatures in the equilibrium and response properties of spin ice materials. These include unusual neutron scattering structure factors, dynamical arrest and long lived non-equilibrium metastable states, as well as a response to external magnetic fields that promotes spin ice as a magnetic analogue of an electrolyte. This talk reviews several of these striking phenomena, and discusses open questions and future perspectives.

Dienstag, 11.01.2011, 16:45
Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77

Großes Physikalisches Kolloquium an der Universität zu Köln



Prof. Dr. Klaus Meerholz
Institut für Physikalische Chemie, Universität zu Köln

Optoelectronics with Semiconductive Photoresists

Organic light emitting diodes (OLEDs) based on electroluminescent conjugated polymers are considered as a promising alternative for display and lighting applications, mainly due to their better compatibility with low-cost production techniques and large substrates
A challenge is multiple-layer deposition to improve the efficiency of the devices and, as a result, their lifetime.
This contribution summarizes recent trends in the field of OLED with an emphasis on solution-processed devices. We have in the past developed photochemically crosslinkable semiconductors for fabrication of complex multilayer OLED with a potential for eventually becoming organic lasers and RGB-pixelation. Recently, we demonstrated a surface-initiated crosslinking process which simplifies deposition and improved the devices lifetime.

Dienstag, 25.01.2011, 16:45
Hörsaal 3 der Physikalischen Institute Köln, Zülpicher Straße 77