The Origin of Mass, Matter and the Early Universe

The German Research Foundation DFG and the German Center for Research and Innovation (GCRI) are proud to present Jonathan R. Ellis and Paul J. Steinhardt in an evening of public lectures moderated by Dieter Lüst. This evening is being organized within the context of a scientific conference sponsored by the International Research Program "The Particle Physics and Cosmology of Supersymmetry and String Theory".

Thursday, March 20, 2014, 6:30 p.m.
German House Auditorium
871 UN Plaza, 49th Street @ First Avenue, New York City

John R. Ellis: The Higgs Boson and Beyond
Paul J. Steinhardt: The Great Cosmic Debate

Moderated by Dieter Lüst

German Center for Research and Innovation – New York

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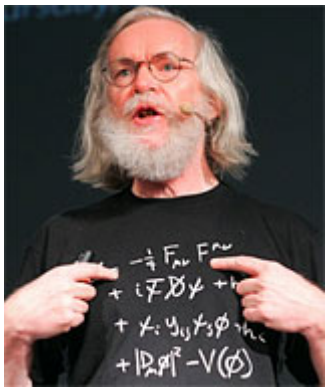

Jonathan R. Ellis CBE, FRS is the Clerk Maxwell Professor of Theoretical Physics at King's College in London and a member of the Theory Division of CERN, Geneva.
Ellis joined the European Organization for Nuclear Research (CERN) in 1978 and he played a seminal role in the 1984 workshop on physics to be done with CERN's then conceived Large Hadron Collider (LHC). Ellis has written many articles on searches for Higgs bosons and supersymmetric particles at the LHC, both for the particle physics community and at a more popular level. His most recent LHC physics review appeared in a Nature Insight supplement on July 19, 2007.
Ellis' research interests focus on the phenomenological aspects of particle physics, though he has also made important contributions to astrophysics and cosmology and quantum gravity. Most of his publications relate directly to experiment, from interpreting measurements and the results of searches for new particles, to exploring the physics that could be done with future accelerators. He was one of the pioneers of research at the interface between particle physics and cosmology, which has since become a sub-specialty of its own: particle astrophysics.
In the 1980s, Ellis became a leading advocate of models of supersymmetry. In one of his earliest works, he showed that the lightest supersymmetric particle is a natural dark matter candidate. In 1991, he showed that radiative corrections to the mass of the lightest Higgs boson in minimal supersymmetric models increased that mass beyond the reach of the Large Electron–Positron Collider (LEP) searches. More generally, Ellis and collaborators pioneered the analysis of so-called "benchmark scenarios" meant to illustrate the range of phenomenology to be expected from supersymmetric models.

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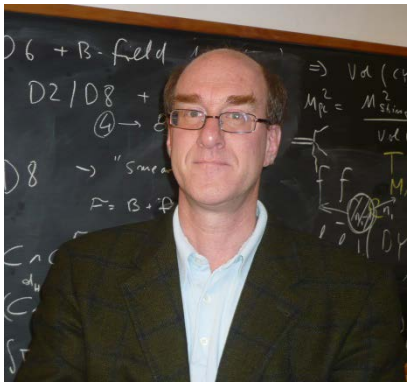
Paul J. Steinhardt, the Albert Einstein Professor in Science and Director of the Princeton Center for Theoretical Science, is on the faculty of both the Department of Physics and the Department of Astrophysical Sciences at Princeton University. He is a Fellow in the American Physical Society and a member of the National Academy of Sciences. He received the P.A.M. Dirac Medal from the International Centre for Theoretical Physics in 2002 for his contribution to the development of the concept of inflation in cosmology; and he won the Oliver E. Buckley Prize of the American Physical Society in 2010 for his contributions to the theory of quasicrystals.

Steinhardt is a theorist whose research spans problems in particle physics, astrophysics, cosmology and condensed matter physics. He is one of the architects of the ”inflationary model” of the universe, an important modification of the standard big bang picture which explains the homogeneity and geometry of the universe and the origin of the fluctuations that seeded the formation of galaxies and large-scale structure.

He introduced the concepts of “quintessence,” a dynamical form of dark energy that may account for the recently discovered cosmic acceleration. He has also explored novel models for dark matter. Recently, Steinhardt and Neil Turok (Cambridge U.) proposed the “cyclic model” of the early universe, a radical alternative to big bang/inflationary cosmology in which the evolution of the universe is periodic and the key events shaping the large scale structure of the universe occur before the big bang. In condensed matter physics, Steinhardt and Dov Levine (Technion) introduced the concept of quasicrystals, a new phase of solid matter with disallowed crystallographic symmetries, and Steinhardt has continued to make contributions to understanding their unique mathematical and physical properties. Recently, he has worked with Weining Man (Princeton) and Paul Chaikin (NYU) to develop a photonic quasicrystal for efficiently trapping and manipulating light in selected wavebands.



Dieter Lüst is Chair for Mathematical Physics at the Ludwig-Maximilians-Universität (LMU) in Munich and director of the Arnold-Sommerfeld-Center for Theoretical Physics at LMU as well as director of the Max-Planck-Institute for Physics in Munich. From 1988 through 2004, he was professor for theoretical physics at the Humboldt-Universität zu Berlin and as well as working in the theory division at CERN, a result from dealing with many aspects of superstring theory since the early 1980s. In 1986, he was among the first to construct string theories in four dimensions, showing that string theory allows for an incredibly huge number of solutions, when going from ten to four space-time dimensions. This discovery was crucial for the socalled landscape discussion in string theory, which started about ten years ago. In 1990, he was among the first to discuss strong-weak-coupling duality (S-duality) in string theory, which about five years later was a key element in the formulation of M-theory as an unifying description of all known forces in nature. In 2000, he was among the inventors of intersecting D-brane models, which describe realistic string models in four dimensions. During the recent years, he is actively working on possible signatures of strings at the Large Hadron Collider at CERN as well as on a new formulation of string theory that involves non-associative geometry. For his achievements he was awarded the Gottfried Wilhelm Leibniz-Preis of the DFG in 2000. In the year 2006 he received the Humboldt-Gay-Lussac prize of the Alexander-von-Humboldt-Foundation together with the French Minister of Science. Since 2012 he is holder of an Advanced Grant of the European Research Council (ERC).

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The International Research Program on "**The Particle Physics and Cosmology of Supersymmetry and String Theory**" is a research collaboration involving the University of Pennsylvania in the USA, Oxford University and Imperial College in the UK, and Ludwig Maximilians University and DESY Laboratory in Germany. The conference – to be held March 20-22, 2014 at the German House in NYC – is the fourth in a series sponsored by this collaboration. The conference shares its title with the research program and will cover a range of topics: Particle Physics topics will include the theory and low-energy phenomenology of superstring/supersymmetric models, supersymmetric searches at the Large Hadron Collider, topics in F-theory, supergravitation, generalized geometry, and the mathematical physics of superstring vacuum states. Cosmological topics will include a discussion of the present observational data on the cosmic microwave background, and Galileon, modified gravity and supersymmetric "big bounce" theories of the early universe.

The **German Research Foundation (DFG)** is the central, self-governing organization funding science and basic research in Germany. Serving all branches of science and the humanities, its members comprise German research universities, non-university research institutions, scientific associations and the Academies of Science and the Humanities. The chief task of the DFG is to fund the best research projects by scientists and academics at universities and research institutions, which are selected on the basis of a multi-layered peer review process. The DFG is a cornerstone of Germany's strength as a research nation and it plays a key role in structuring academic research in Europe.

The **German Center for Research and Innovation in New York (GCRI)** was established in 2010 as one of five German Houses of Research and Innovation (DWIHs) worldwide and is part of the German government's initiative to internationalize science and research. Under the joint leadership of DFG and the German Academic Exchange Service (DAAD) it provides information and support for the realization of collaborative projects between North America and Germany, and is one of five centers worldwide. GCRI's mission is to strengthen transatlantic collaboration in science and technology to help solve the global challenges of the 21st century. Its areas of focus include health and nutrition, mobility, security, communication, climate, and energy.

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