HGSFP

NEWSLETTER

Heidelberg Graduate School of Fundamental Physics

No. 4/January 2010

Main Topics:

Editorial

It is a pleasure to give you some news on developments in the Graduate School. We have a year to look back on in which we can once again be proud of our members - our doctoral students, our junior group leaders and our professors. Our doctoral students have taken the initiative in organizing a very successful workshop on sustainable solutions. Furthermore, they have performed a survey amongst the students which we take very seriously. I guarantee that we definitely will use this fruitful input for improving our School - many thanks for this input! Two of the HGSFP junior group leaders were successful in obtaining Hengstberger prizes to host significant conferences that will take place in May and October of 2010, to mention but a few highlights. We wish everyone lots of fun in reading this edition of our newsletter. Do keep in mind that you are warmly welcome to provide contributions, give us feedback and make suggestions for improvements.

Markus Oberthaler

Student Projects

■ As announced in the last newsletter, 35 of our students are looking forward to participate in the by now annual HGSFP Winterschool. They will spend four days in Obergurgl, where they will participate in specific course programmes for each branch. The schedule offers time for discussions with lecturers and fellow students as well as for exploring the Ötztal valley.

In the past months, the student organized Heidelberg Astronomers' Convention and newly introduced autumn workshop on sustainability brought together scientists and students for fruitful discussions.

Doctoral students at the Workshop on Sustainability

An online survey to find out how our graduate students perceive the Graduate School was designed and implemented by the graduate students representatives. More than 100 doctoral students that belong to the HGSFP participated in the survey. An initial brief report was given by Patrick Plötz during the annual general meeting of the HGSFP in November 2009. Preparation of a comprehensive report is underway and will be presented to the directorate of the School and the students soon.

New student representatives have been elected: Joachim Welte (welte@kip.uni-heidelberg.de) and Baybars Külebi (bkulebi@ari.uni-heidelberg.de). In the Astronomy Branch of the HGSFP, the IMPRS-HD has also elected new student representatives per generation. These are Kelly Foyle and Leonard Burtscher (3rd generation), Mario Gennaro and Alexander Hansson (4th generation) and Tessel van der Laan and Raoul Haschke (5th generation).

The student representatives of the HGSFP hold a monthly meeting to discuss graduate matters and to plan student projects. The meetings are announced by email and typically take place in the beginning of the month. For further information please contact Joachim Welte or Baybars Külebi directly. ◀

Hengstberger Conferences 2010

■ The HGSFP is pleased to announce that two groups have won the prestigious Hengstberger Prize. Thorsten Lisker has won this prize in order to hold a conference on »Early-type Dwarf Galaxies: Origin, Evolution, Characteristics« (18.10.-20.10.2010); Tobias Paul and Sandro Wimberger have also won this prize to hold the conference on »Hybrid Quantum Systems: New Perspectives in Controlling Quantum States« (12.05.-15.05.2010).

Both conferences are supported in part by the HGSFP. ◀

IMPRS for Precision Tests of Fundamental Symmetries

■ In addition to the Max Planck Research Schools for Astronomy (IMPRS-HD) and for Quantum Dynamics (IMPRS-QD), a new school for Precision Tests of Fundamental Symmetries has been granted.

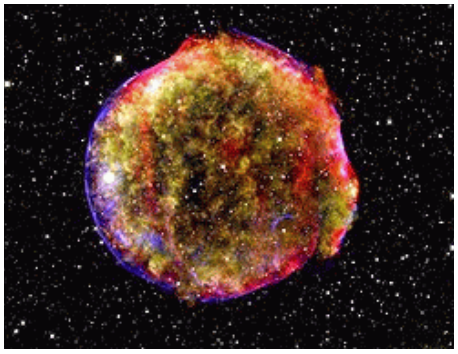
This school falls in the Branch »Fundamental Interactions and Cosmology« and commences formally on April 1, 2010. ◀

The »Graduate Days«

■ The coming »Graduate Days« will take place in spring from the 6th to the 9th April 2010. As usual, one of the highlights of the »Graduate Days« is the Hans Jensen Lecture, which this time will be held by Gordon Baym, from the University of Illinois on »Using Ultracold Atoms to learn about Dense Nuclear and QCD Matter«. The lecture programme this time will again contain one soft skills course together with sets of lectures on various topics in both theoretical and experimental physics. ◀

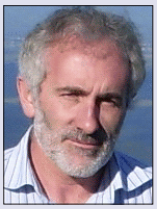
Supernova »SN1572«

■ SN1572 is a supernova of type Ia, a kind of star explosion that emits a fixed amount of radiation. This constant energy output dilutes with the space-time geometry and therefore, if the supernova is sufficiently far, allows astronomers to derive the cosmological expansion rate. By observing many of these explosions, cosmologists have obtained evidence for the accelerated expansion. ◀



The remnant of the supernova SN1572.

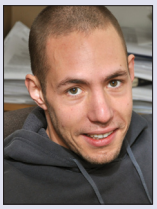
(NASA/CXC/JPL-Caltech/Calar Alto; O. Krause et al.)



Luca Amendola

Timo Weigand

Joachim Welte



Baybars Külebi

Personalia

■ In this edition of our newsletter, we profile Luca Amendola, Timo Weigand and our student representatives Joachim Welte and Baybars Külebi.

Luca Amendola obtained his PhD in Rome in 1993, and thereafter spent a year at Fermilab. He has been a visiting scientist at several institutions (Astrophysics Institute, Potsdam, Dartmouth College, USA; LPT, University Paris VI; University of Montpellier, France, and Gunma College in Japan). From 1994 to 2009, he has been a permanent researcher at the Italian Institute of Astrophysics, Observatory of Roma and guest professor at the Universities of Rome »La Sapienza« and »Roma Tre«. He has authored roughly 100 papers and recently written an advanced graduate-level book on cosmology, entitled »Dark Energy: Theory and Observations«, in collaboration with S. Tsujikawa. He joined the Department of Physics and Astronomy in Heidelberg as Professor of Theoretical Physics in November 2009, contributing to this newsletter with »Supernova« and »Dark Energy«. We are delighted to welcome him as an active member of the Graduate School.

Timo Weigand studied physics at the »Ludwig-Maximilians-Universität Munich« and at the University of Cambridge in the United Kingdom, where he obtained his PhD in 2006. Thereafter he held positions at the University of Pennsylvania, Philadelphia and at SLAC at Stanford University. In October 2009, he joined the Institute of Theoretical Physics as a lecturer in the group of Arthur Hebecker. His research interests lie in string phenomenology. We welcome him too!

Joachim Welte and Baybars Külebi have been newly elected as the student representatives of the HGSFP. Joachim Welte is studying in the group of Markus Oberthaler and is working on the development of a new method of detecting the radioactive isotope Ar-39, which is intended for use in the field of environmental physics, in order to date groundwater. Baybars Külebi is working at the »Astronomisches Recheninstitut« on the topic of Magnetic White Dwarfs with Stefan Jordan. His project deals with improving the theoretical modeling of the magnetic atmospheres in order to analyze the new objects discovered in the Sloan Digital Sky Survey and the Hubble Sky Telescope data of the fastest spinning and most massive magnetic white dwarf, REJ 0317-0853.

We are looking forward to a productive year in which we will further improve the School and optimize the boundary conditions for a creative environment. ◀

Dark Energy and »Euclid«

■ In the quest for the ultimate space-time map of our cosmic environment, cosmologists have found strong evidence that what appears as empty space is in reality filled with some form of energy that looks surprisingly much like the vacuum, but which is capable of accelerating the overall cosmic expansion, easily winning against the gravitational pull of ordinary matter. This new vacuum-like substance, called »Dark Energy« will drive the recession of galaxies faster and faster until they all redshift away from our sight.

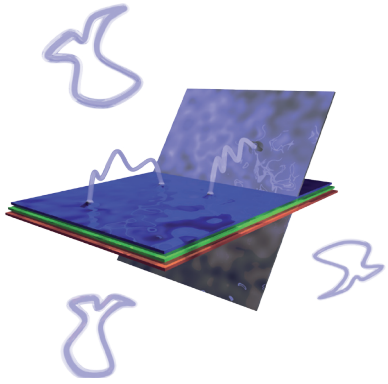
In order to understand »Dark Energy« better, a new era of large scale map-making effort has been launched to reconstruct the cosmic geography and history. In particular, Luca Amendola is involved in the European satellite mission »Euclid«, which should map the universe down to distances of several billions of light years, where the universe is half its current age. The »Euclid« map will contain a huge amount of information on the detailed evolution, distance, correlation and shape of hundreds of millions of galaxies, and should help decide whether the stuff that accelerates the vacuum is a new form of vacuum, matter or gravity, in order to complete our understanding of the universe. ◀

String Phenomenology – or why is the universe the way it is?

■ The idea of string theory is as simple as powerful: The fundamental entities in nature are not pointlike, but one-dimensional objects whose vibrational modes determine their physical properties such as mass, spin or charge. This idea is enough not only to formulate a theory which is widely believed to be free of the ultra-violet divergences of conventional quantum field theory, but which is also known to unify gravity and Yang-Mills interactions in a unique consistent framework. The mathematical structure of this theory predicts that spacetime is ten-dimensional.

One of the questions of string phenomenology is therefore how to compactify the extra six dimensions on small, internal manifolds in such a way that the resulting four-dimensional effective theory is in agreement with observations. Each such compactification corresponds to a dynamical solution of the underlying unique ten-dimensional theory in the same manner as, say, our solar system is one particular solution of general relativity. Studying this so-called landscape of string vacua therefore means studying the possible universes that can arise from string theory.

One particular class of such compactifications describes our world as a lower-dimensional brane in ten-dimensional spacetime. The light observed matter fields and their couplings depend on the geometry of this brane, leading to an exciting interplay between mathematics and phenomenology. Traditional questions of particle physics such as the pattern of masses and couplings in the Standard Model or the hierarchy between the weak and Planck scale might therefore be understandable in terms of the complex geometry of the compactification space. ◀



You're welcome:

... to send us suggestions of topics which you would like to be mentioned in the next newsletter: info@gsfp.uni-heidelberg.de

Edited by: S.P. Klevansky; Published by the Central Office of the Heidelberg Graduate School of Fundamental Physics, Albert-Ueberle-Str. 3-5, 69120 Heidelberg, Germany.