IRTG PhD days 2012

Tuesday 9 October 2012 - Wednesday 10 October 2012

Desy

Scientific Programme

Prof. Dr. Tobias Osborne
Quantum information and computation: foundations and current status
In recent years we've seen the birth of an exciting new field known as quantum information (QI) theory. In these lectures I will introduce the basic concepts of QI, namely, qubits, quantum circuits, and quantum algorithms. I will also introduce some of the guiding problems of the field and describe recent applications of QI concepts to the study of strongly correlated physics.

PD Dr. Walter Winter
Neutrino physics

In these lectures, I discuss three aspects of neutrino physics: neutrino oscillations, neutrino mass, and neutrino astrophysics. In neutrino oscillations, the recent measurement of the mixing angle theta13 has opened the possibility to discover leptonic CP violation, which would motivate the possibility that the baryon asymmetry of the universe is connected with neutrino physics. I discuss the current understanding of neutrino oscillations and briefly comment on the future perspectives. As far as neutrino mass is concerned, I focus on questions such as: Are massive neutrinos to be interpreted as physics beyond the Standard Model? What model ingredients are needed if neutrino mass is connected with physics as the TeV scale, and thus potentially observable at the LHC? What kind of "new physics" may be showing up in the neutrino sector only? What does the discovery of a large theta13 mean for the theory of flavor? In neutrino astrophysics, I highlight the possibility to test the sources of the ultra-high energy cosmic rays with neutrinos, and I illustrate how neutrino oscillations in the Sun work.

Prof. Dr. Götz Neuneck
Physics and Nuclear Disarmament: Political and Technical Challenges of a World free of Nuclear Weapons

After the end of the Cold War, there was much hope that nuclear weapons can be reduced drastically. Despite some arms control successes, nuclear weapons still play a major role in world politics. The high nuclear arsenals between the USA and Russia are still based on Cold War doctrines facing new challenges such as the introduction of Ballistic Missile defense and precise conventional strike systems. technical expertise is necessary to analyse nuclear dismantlement and deep cuts in nuclear stockpiles, as well as the verification of fissile materials and the remocal of tactical nuclear weapons. The dispute on Iran´s ambivalent nuclear programmes reveals the thin line between civilian and military applications. Additional scientific-technical measures are necessary to strengthen non-proliferation and arms export control. The talk presents what scientists have done in the past to apply there skills for arms control and disarmament. Finally, the talk describes the

scientific challenges of a world free of nuclear weapons and gives some examples of physical methods.