university of groningen | faculty of mathematics and natural sciences | DSSC | centre for data science and systems complexity

DSSC SEMINAR: Higgs Boson & Big Data

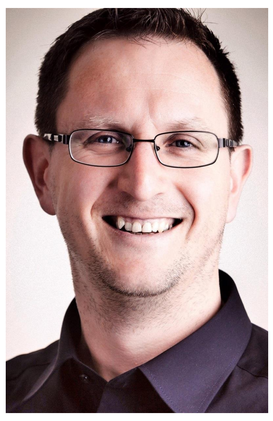
7 June 2016, 14.00-17.00, Room 5161.0151 (Bernoulliborg)

Introductory remarks

Prof. Dr. Elisabetta Pallante (Van Swinderen Institute for Particle Physics and Gravity)

Compute challenges in Experimental Particle Physics @ LHC

Speaker: Dr. Ir. Gerco Onderwater (Van Swinderen Institute for Particle Physics and Gravity)



Abstract: The Large Hadron Collider (LHC) at CERN in Geneva is the largest (particle) physics facility of the planet. Protons at the highest possible energies are collided to study the workings of the elementary particles and their interactions, and to search for as-of-yet unknown phenomena. Such collisions take place in four highly sophisticated large scale experiments (ATLAS, CMS, Alice, LHCb). Data collection and manipulation poses a severe challenge and requires state-of-the-art compute solutions. These challenges and their solutions are discussed within the framework of the LHCb experiment.

Bio: Gerco Onderwater has been involved in several high precision particle physics experiments. While his main interest is particle physics, he feels well at home at the bordering fields of mathematics and computer science.

Coffee break (15.15-15.30)

Data complexity at antiparticle-particle colliders

Speaker: Dr. Johan Messchendorp (KVI-Centre for Advanced Radiation Technology)

Abstract: The research conducted at particle colliders has been one of the driving elements in addressing various “big data” challenges. Over the past decades, the physics goals of these experiments has led to a dramatic increase in the interaction rates with an enormous complex sensor network. A new era in technology has emerged in which it has become necessary to reconstruct the decay topologies of each beam interaction “in-situ” to reduce significantly the huge rate from background. The challenge lies in the complexity of information requiring “smart algorithm” that can be deployed on embedded architectures to fish out the most opportune observables for discovery. In this seminar, I will give an overview of the most recent activities using a few examples in which a new form of matter has been successfully discovered exploiting state-of-the-art computational techniques. Moreover, I will outline the future challenges and the need for cross-fertilization with other fields.

Bio: The speaker is associate professor at KVI-Center for Advanced Radiation Technology. He obtained his Ph.D. at the University of Groningen in 1999. He is presently member of the BESIII and PANDA collaborations, thereby, conducting and planning future subatomic experiments at international antiparticle-particle colliders in Beijing and Frankfurt, respectively. His main physics interest lies in the field of the dynamics of the strong color force and the search for exotic forms of subatomic matter, such as glueballs, hybrids, and multi-quark states.

Tools for analyzing high-dimensional dynamical systems arising from fluid dynamics

Speaker: Dr. Ir. Fred Wubs (Johann Bernoulli Institute for Mathematics and Computer Science)

Abstract: Quantitative predictions for fluid dynamics problems require a high resolution discretization of the underlying partial differential equations. This invariably leads to huge dynamical systems. The traditional numerical techniques to analyze critical transitions in such a system are the solution of large (non)linear systems of equations and the solution of large eigenvalue problems. Recently, also the solution of Lyapunov equations became important in order to study the influence of noise on the dynamics.
We develop techniques that are both of high quality and amendable to parallel computing. For this reason we implement them on top of the data structures offered by the software package Trilinos. In the presentation, we hope to make clear that developing efficient numerical techniques requires knowledge of the underlying physics, the available numerical techniques and of parallel computers.

Bio: Fred Wubs is associate professor in numerical mathematics. His research interests are the solution of linear systems with large sparse matrices, eigenvalue computations of large sparse matrices, accurate and stable discretization of partial differential equations, parallel computing, fluid flow computations, bifurcation analysis and stability study of ocean flow circulations. A large part of his work is motivated by his long standing cooperation with Prof. Henk Dijkstra of the institute for marine and atmospheric research (IMAU) at Utrecht University.