



Der Wissenschaftsfonds.



JOHANNES KEPLER
UNIVERSITÄT LINZ

Einladung

zum Vortrag im Rahmen des **SFB Colloquiums** (Standort Linz), mit dem Titel

Simulation of Residual Gas Particles in an Ultrahigh Vacuum System

VORTRAGENDE: **Ida Aichinger**, CERN

DATUM: Dienstag, 31. Jänner 2017

ZEIT: 13:45 Uhr

ORT: Science Park 3, S3 047, JKU Linz

Abstract: In the Large Hadron Collider (LHC) at the nuclear research institute CERN, particles are accelerated to immense energies (7 TeV) to later collide them among them in one of the four main experiments (collision points). The particle trajectories after the collisions are analysed and by doing so physicists can have an idea of what happened moments later after the big bang and therefore provide a deeper understanding of the fundamentals of the universe.

To achieve this, the beam pipes, through which particles are accelerated, must be as empty as possible. Ultra high vacuum is therefore a basic requirement. The quality of vacuum is measured in terms of pressure. The lower the better. In the beam pipes of the LHC, we observe values in orders of magnitude of 10^{-10} mbar.

Many factors impact on the vacuum quality, among them are normal material outgassing as well as more complex phenomena as desorption due to synchrotron radiation or impinging ions as well as electron clouds. My task was to set up a mathematical model that considers all influencing factors and that predicts the vacuum quality along an accelerator. Four coupled differential equations describe the mass conservation of the residual gas particles. I used an analytic approach to solve the equation system. This required a transformation to first order equations for which a general valid solution exists. Adding

a particular solution and the inclusion of appropriate boundary conditions define the solution function. I implemented the model in a Python environment and compared the simulation outputs to data of the LHC's gauges. I will end the talk with one concrete simulation of the LHC's experimental area around CMS with a total length of more than one kilometer.

For more introducing information:

<https://home.cern/about>

<https://home.cern/about/engineering/vacuum-empty-interstellar-space>

Das **SFB Colloquium** wird vom **FWF Special Research Program (SFB) Quasi-Monte Carlo Methods: Theory and Application** unterstützt