MSS-Seminar
CIP-Pool, Konrad-Zuse-Str. 3-5
16.11.21, 14:15-15:45   **18.11.21, 14:15-15:45**
23.11.21, 14:15-15:45   **25.11.21, 14:15-15:45**

MSS

Crash Course: Advanced Lattice Boltzmann Simulations

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In this seminar I will introduce a simple and scalable method developed in my group to produce a new class of complex functional nanomaterial. The approach is based around the heterogeneous nucleation and growth of thin noble metal coatings on spherical core particles. Depending on the conditions used, these coatings can be dense or fractal in nature. The system presents both opportunities and challenges. I will give details of our attempts to understand the formation mechanism of the coatings and also show how the optical properties strongly depend on the morphology. The latter support the in situ analysis of the coating formation and, in future could enable autonomous production of particles with targeted function.

Lattice-Boltzmann methods (LBM) are powerful schemes to reproduce the time evolution of many systems, including fluids, acoustics, electrodynamics, and even general relativity. In contrast with other methods that also divides the space into cells (like FEM or CFD), information flows from cell to cell transported by hypothetical particles that collide each other reproducing in the macroscopic limit the desired partial differential equations. So, each cell can evolve without asking the neighboring cells for information, making LBM full-parallelizable schemes. They are also very easy to implement, and results can be obtained from scratch in just a single session.

This four-session crash course introduces LBM and shows applications on waves, fluids and electromagnetic fields. It starts from scratch, intended for anyone programming on C++ or Python that has never tried a LBM before, but it also illustrates on further possibilities and introduces some advanced applications, like waves on curvilinear coordinates or electrodynamics. The course is planned as a hands-on workshop, where each one works on his/her laptop computer with a plain text editor (like Emacs), a plotter (like Gnuplot) and a C++ compiler (like g++). If you don't have those programs installed on your computer, a virtual machine will be also at disposal to download on a USB, that you can reboot and work from there.