Module name	**Physics Based Graphics**
Module number	CMS-TRK-PBG
Senior Lecturer	Prof. Dr. Stefan Gumhold stefan.gumhold@tu-dresden.de
Qualification objectives	Students have an overview of the use of physics in computer graphics. You know Newtons Axiome and the main force laws. You can derive equations of motion. You know the Rendering equation in different forms, you can explain the individual components in detail and you can derive the links between different forms. They master Monte Carlo and cache-based solutions and can implement them and analyse them in terms of duration, errors and biases. They are familiar with surface reflective and emission models and can assess which materials and light sources can be approximated with them. The foundations of the physical animation are familiar to them, they can numerically solve common differential equations and know what phenomena are simulated with particles in computer graphics. You know the rigid body modelling in detail and how to deal with collisions. In the simulation of fluids, they are familiar with the Navier Stokes equation and efficient solutions for incompressive fluids suitable for rapid simulation.
Contents	The content of the module shall be physical bases, such as numerical release of differential equations, global lighting and physical-based simulation. For global lighting, the Rendering equation, surface representation models and light sources, stochastic and cache-based resolution methods for the Rendering equation are included. In the physics-based simulation, simulation techniques for rigid bodies, including collision management, as well as selected topics from the fields of fluid simulation, clothing simulation and softbody simulation are included in the module.
Forms of teaching and learning	The module includes lectures of 2 SWS, exercises of 2 SWS and self-study. The language of the lectures and exercises will be English.
Eligibility for participation	The skills to be acquired in the CMS-TRK-FCG Foundations of Computer Graphics module are required.

Usability	In the Masters Course Computational Modeling and Simulation, the module is a compulsory optional module in Track Visual Computing and in Track Computational Life Science, to be selected in accordance with Annex 2 to the Specific Examination Regulations. The module cannot be chosen in the Master's Course Computational Modeling and Simulation if this or a module with substantially the same content from a Course with which the entry conditions under § 3 of the Studienordnung have been met has already been completed. The module provides the pre-requisites for the modules it designates under the pre-requisites for participation.
Conditions for the award of credits	Credits are awarded when the module test is passed. The module test consists of a non-public oral test performance as an individual test lasting 20 minutes. Bonus performance for oral examination performance is the disengagement of 15 hours of exercise tasks. The language of the test will be English.
Credits and marks	The module allows 5 credit points to be obtained. The module score corresponds to the test performance score.
Frequency of the module	The module is offered every winter semester.
Workload	The total workload is 150 hours.
Duration of the module	The module covers 1 semester.