

Bonn-Cologne Graduate School of Physics and Astronomy

## Intensive Week Course

### Numerical methods in N-body Dynamics

August 26 - 30, 2019, 9<sup>00</sup>-13<sup>00</sup> & 14<sup>00</sup>-18<sup>00</sup>

Seminar room - I. Phys. Institute, University of Cologne



#### Lecturers

Prof. Dr. Stefanie Walch-Gassner, Dr. Frantisek Dinnbier

#### Aims of the course:

Introduction to the problem of collisionless and collisional N-body dynamics. The main emphasis will be on state-of-the art numerical methods for the direct calculation of the collisional N-body problem and their applications to modelling star clusters.

#### Contents of the course:

Overview of the astrophysical systems which can be described by collisionless (galaxies) or collisional (star clusters, multiple stars and planetary systems, ...) N-body dynamics. The evolution of collisional N-body systems. Integrating schemes used in the N-body problem (Runge-Kutta, Leap-frog, predictor-corrector based on Hermite polynomials). Softening approximation and its perils.

Ahmad-Cohen neighbour method, external potentials (galactic and interstellar clouds), stellar evolution. Two-body regularization techniques (Burdet-Heggie regularisation, Kustaanheimo-Stiefel regularisation, brief mentioning of the three-body and chain regularisation).

Exercises will contain programming of the selected basic numerical methods, test simulations of small stellar systems (three body problem) and small star clusters. Analytical calculations of the basic models will also be included.

The number of attendants will be limited to about 15. Due to organizational reasons, we require you to register. Please indicate that you need the credit points (3 CP) / a grade for the course upon registration.

Please, send your informal registration requests until 26.07.2019 to [dinnbier@ph1.uni-koeln.de](mailto:dinnbier@ph1.uni-koeln.de).

