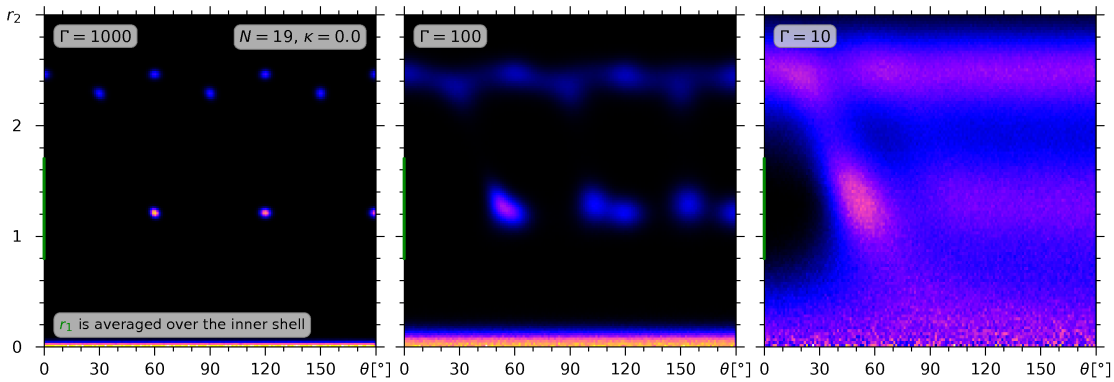
The Triple Correlation Function as a Tool for Angle Resolved Structural Analysis of Spherical Clusters

H. Thomsen[1], P. Ludwig[1], M. Bonitz[1], and G. Kalman[2]
[1]*Christian-Albrechts Universität zu Kiel, Germany*
[2]*Boston College, USA*
ludwig@theo-physik.uni-kiel.de

Finite charged particle ensembles in externally controlled confinement geometries allow for a systematic investigation of correlation effects over broad ranges of plasma parameters. Additionally, the formation of distinct shells emerges as a governing finite-size effect in systems of trapped ions and dusty plasma as well [1].

As a sensitve tool to study the internal cluster structure, we introduce the "Triple Correlation Function" (TCF), which allows for an angle resolved structure analysis.[2] The TCF can not only resolve the transition probability of particles between shells, but also structural modifications within the shells during dynamic processes, e.g. melting or excitation. In particular this quantity is not affected by rotational invariance (i.e. rotation of the entire cluster).

Using the TCF we study the effect of Coulomb screening, temperature, and special symmetries of different ground and metastable states with respect to the exact particle number as well as the limiting case of large N.



TCF for a 2D Coulomb cluster with N=19 particles during the melting process

[1] M. Bonitz, C. Henning, and D. Block, Reports on Progress in Physics **73**, 066501 (2010)
[2] P. Ludwig, H. Thomsen, K. Balzer, A. Filinov, and M. Bonitz, Plasma Phys. Control. Fusion **52**, 124013 (2010)