

Mathematical Physics in the Heart of Germany III

03.05.2024 @ Friedrich Schiller Universität Jena

HS5 Abbeanum (Fröbelstieg 1, 07743 Jena)

10.00 – 10.30 Welcome & Coffee

10.30 – 11.20 Marcel Schmidt (Leipzig)

Criticality Theory

11.30 – 12.20 Jens Hoppe (Braunschweig)

Relativistic membranes and the fast non-commutative sharp drop

Workshop Lunch @ Landgrafen Jena

14.40 – 15.30 Marcel Griesemer (Stuttgart)

Infraparticle scattering in the confined massless Nelson model

Coffee Break

16.00 – 16.50 Luca Fresta (Bonn)

Dynamics of Extended Fermi Gases at High Density

17.00 – 17.50 Jobst Ziebell (Jena)

Wetterich's Equation and Renormalisation

Abstracts

Marcel Schmidt (Leipzig): *Criticality Theory*

In this talk we give an overview over the criticality theory for quadratic forms inducing positivity preserving semigroups. We discuss why the dichotomy between the validity of Hardy inequalities and the existence of Agmon ground states (generalized ground states) depends on the existence of excessive functions at the bottom of the spectrum. Along the way we encounter weak Hardy inequalities and provide a partial answer to a question of Shep regarding abstract Schur tests.

Jens Hoppe (Braunschweig): *Relativistic membranes and the fast non-commutative sharp drop*

Infinitely many axially symmetric time-like minimal hypersurfaces in 4-dimensional space-time are constructed, as well as new matrix model solutions.

Marcel Griesemer (Stuttgart): *Infraparticle scattering in the confined massless Nelson model*

The confined, massless Nelson model is infrared singular in the sense that it has no ground state. This is expected to be accompanied with the emergence of infraparticles with a diverging number of soft photons as time evolves. We give a simple construction of such infraparticle states and we prove their asymptotic completeness assuming that asymptotic completeness holds for the Nelson model in an infrared regular (non-Fock) representation of the CCR.

Luca Fresta (Bonn): *Dynamics of Extended Fermi Gases at High Density*

In my talk, I will discuss the quantum evolution of many-body Fermi gases confined in arbitrarily large domains, focusing on a high-density/semiclassical scaling regime. I will show that, as the density approaches infinity, the many-body evolution of the reduced one-particle density matrix converges to the solution of the Hartree equation, with convergence rate depending on the density only. The result holds for short macroscopic times for non-relativistic particles, but extends to arbitrary times in the case of pseudo-relativistic dispersion. Joint work with Marcello Porta and Benjamin Schlein.

Jobst Ziebell (Jena): *Wetterich's Equation and Renormalisation*

I will present Wetterich's flow equation that formally connects the classical action and the quantum effective action via an infinite-dimensional PDE. The equation may be derived in a rigorous fashion for many regularised models. It will be shown how the validity of the equation in the non-regularised case is connected to renormalisation.