DVR 0065528

"Tensor networks & entanglement"

within the programme "Quantum Paths"

May 22 – May 25 2018

organized by
Pasquale Calabrese (SISSA, Trieste), Fabian H. L. Essler (Oxford U), Giuseppe Mussardo (SISSA, Trieste), Jörg Schmiedmayer (TU Vienna), German Sierra (IFT Madrid), Frank Verstraete (U Vienna)

- **Tuesday, May 22, 2018**
  11:00
  Tomaz Prosen (University of Ljubljana)
  A Minimal Solvable Model of Many-Body Quantum Chaos

  I will describe a simple model of locally interacting quantum spin 1/2 chain, namely Floquet-Ising chain with transverse and longitudinal fields, where the spectral form factor can be computed exactly (in the thermodynamic limit) due to a particular space-time duality symmetry of the model, and shown to match the prediction of Random Matrix Theory.Our result implies ergodicity for any finite amount of disorder in the longitudinal field, rigorously excluding the possibility of many-body localization in the model.
  Reference: B. Bertini, P. Kos, and T. Prosen, arXiv:1805.00931

- **Wednesday, May 23, 2018**
  11:00
  Aditi Mitra (NY University)
  Transport signatures of transient superfluids

  Recent advances in ultra-fast measurement in cold atoms, as well as pump-probe spectroscopy of K3C60 films, have opened the possibility of rapidly quenching systems of interacting fermions to, and across, a finite temperature superfluid transition. However, determining that a transient state has approached a second-order critical point is difficult, as standard equilibrium techniques are inapplicable. We show that the approach to the superfluid critical point in a transient state may be detected via time-resolved transport measurements, such as the optical conductivity. We leverage the fact thatquenching to the vicinity of the critical point produces a highly time dependent density of superfluid fluctuations, which affect the conductivity in two ways. Firstly, by inelastic scattering between the fermions and the fluctuations, and secondly by direct conduction through the fluctuations. The competition between thesetwo effects leads to non-monotonic behavior in the time-resolved optical conductivity, providing a signature of the critical transient state.

- **Thursday, May 24, 2018**
  11:00
  Andreas Klümper (Bergische Universität Wuppertal)
  Universality and quantum criticality of the one-dimensional spinor Bose gas

  We investigate the universal thermodynamics of the two-component one-dimensional Bose gas with contact interactions in the vicinity of the quantum critical point separating the vacuum and the ferromagnetic liquid regime. We find that the quantum critical region belongs to the universality class of the spin-degenerate impenetrable particle gas which, surprisingly, is very different from the single-component case and identify its boundaries with the peaks of the specific heat. In addition, we show that the compressibility Wilson ratio, which quantifies the relative strength of thermal and quantum fluctuations, serves as a good discriminator of the quantum regimes near the quantum critical point. Remarkably, in the Tonks-Girardeau regime the universal contact develops a pronounced minimum, reflected in a counterintuitive narrowing of the momentum distribution as we increase the temperature. This momentum reconstruction, also present at low and intermediate momenta, signals the transition from the ferromagnetic to the spin-incoherent Luttinger liquid phase and can be detected in current experiments with ultracold atomic gases in optical lattices.

- **Friday, May 25, 2018**
  11:00
  Joe Bhaseen (King's College London)
  Stochastic Approach to Non-Equilibrium Quantum Spin Systems

  We discuss a stochastic approach to non-equilibrium quantum spin systems based on recent insights linking quantum and classical dynamics. Exploiting a sequence of exact transformations, quantum expectation values can be recast as averages over classical stochastic processes. We illustrate this approach for the quantum Ising model by extracting the Loschmidt amplitude and the magnetization dynamics from the numerical solution of stochastic differential equations. We show that dynamical quantum phase transitions are accompanied by clear signatures in the associated classical distribution functions, including the presence of enhanced fluctuations. We demonstrate that the method is capable of handling integrable and nonintegrable problems in a unified framework, including those in higher dimensions.
  [1] S. De Nicola, B. Doyon and M. J .Bhaseen; arXiv:1805.05350