Program INT13-1b

Quantum Noise

May 6 - 10, 2013

Monday, May 6, 2013

Room C421, Physics/Astronomy Tower

- 11:00 am: David Kaplan, INT
  "Noise and sign problems in Monte Carlo simulations"
  Currently, computing properties of matter from the underlying theory of QCD is exponentially difficult because of a sign problem. Sign problems in Monte Carlo simulations of QCD can be related to noise problems encountered in computing correlators, and both can be seen to result from the existence of a deep bound state of a quark and anti-quark, the pion. In some ways the problem is similar to that of an electron traversing a disordered medium, with quarks playing the role of the electron and the stochastic color gauge field playing the role of the medium. I discuss how relating the noise to properties of the physical spectrum provides some clues as to how the sign problem might some day be circumvented.

Tuesday, May 7, 2013

Room C421, Physics/Astronomy Tower

- 11:00 am: Amy Nicholson, University of Maryland
  "Lessons learned from Monte Carlo noise: unitary fermions, Efimov states and the lognormal distribution"
  Lattice calculations of certain observables are plagued by Monte Carlo noise, in some cases manifesting itself in the form of a long-tailed probability distribution. In this talk, I will discuss signal-to-noise problems in the context of a lattice study of non-relativistic fermions propagating through a Hubbard-Stratonovich field, with an interaction tuned to the unitary limit. I will show how a better understanding of correlator distributions leads to great improvement in the extraction of observables. Furthermore, the origin of signal-to-noise problems often lies in the dynamics of the systems under consideration, so that an understanding of probability distributions can in turn give new insight about the underlying physics. From the probability distribution of a correlator for two particles at unitarity, I will show that new information about universal clusters related to the Efimov effect can be obtained.

Wednesday, May 8, 2013

Room C421, Physics/Astronomy Tower

- 11:00 am: Kim Splittorff, Niels Bohr Institute
  "The sign problem as a total derivative"
  Our knowledge about the phases of strongly interacting matter is limited to the case where there is an exact ballance between quarks and anti-quarks. At any non-zero quark density the QCD sign problem prohibits nonperturbative first principle studies. In this talk we consider the sign problem as a signal to noise problem and show that (i) the noise produced by the sign problem can be seen as a total derivative, (ii) the average quark number is orthogonal to this noise. We discuss the impact of these observations on current lattice QCD simulations.

Thursday, May 9, 2013

Room C421, Physics/Astronomy Tower

- 11:00 am: Jacques Verbaarschot, SUNY Stonybrook
  "Tail States and Collective Fluctuations in Wilson Dirac Spectra"
  At zero lattice spacing the spectrum of the Hermitian Wilson Dirac operator has as gap [-m, m]. At nonzero lattice spacing states intrude the gap in the same way as states from a gapped superconducting Hamiltonian intrude the gap because of impurities. We discuss the Dirac spectrum in terms of a nonlinear sigma model (or chiral Lagrangian) and identify two types of terms. First, those that lead to spectral fluctuations which are typical for disordered systems, and second those that originate from collective spectral fluctuations. We show that the second class of fluctuations can avoid gap closure (or Aoki phase) and instead given rise to a first order phase transition. Finally, we derive consistency relations for fluctuations of various observables as well as the sign of the low energy constants.

- 2:00 pm: Misha Reznikov, Technion
  "Charge counting statistics in a quantum point contact"
  I shall discuss measurements of the statistics of a charge, transferred through a Quantum Point contact (QPC). For non-interacting electrons at zero temperature the statistics of a voltage-biased QPC is predicted to be binomial. It happened, however, that Coulomb interactions lead to substantial corrections to all the charge cumulants above the second one even for a system, which can otherwise be treated as a non-interacting. We show that by properly accounting for these corrections one can recover the underlying binomial statistics for a "noninteracting" QPC. I then shall revisit the notion of an "ideal" A-meter. It happened that, in contrast to the familiar current and noise measurements, for which an ideal A-meter would just have zero resistance, an ideal A-meter for the higher cumulant measurements should also generate zero noise, so be effectively at zero temperature. Finally, I shall mention a possible technical resolution of the confusion, which accompanied an early stage of the charge counting statistics.

Friday, May 10, 2013

Room C421, Physics/Astronomy Tower

- 11:00 am: Felix von Oppen, Freie Universität Berlin

  "Adiabatic quantum motors"

  When parameters are varied periodically, charge can be pumped through a mesoscopic conductor without applied bias. Here, we consider the inverse effect in which a transport current drives a periodic variation of an adiabatic degree of freedom. This provides a general operating principle for adiabatic quantum motors, for which we develop a comprehensive theory. We relate the work performed per cycle on the motor degree of freedom to characteristics of the underlying quantum pump and discuss the motor's efficiency. Quantum motors based on chaotic quantum dots operate solely due to quantum interference, motors based on Thouless pumps have ideal efficiency.

INT Program Participants May 6 - 10, 2013

Oded Agam	Hebrew Univ	agam@phys.huji.ac.il	*5/8~5/16*	C404	5-3348
Igor Aleiner	Columbia Univ	aleiner@phys.columbia.edu	*5/6~5/31*	C420	5-9780
Boris Altshuler	Columbia Univ	bla@altshuler.net	*5/5~5/25*	C438	5-9830
Anton Andreev	UW	aandreev@uw.edu	*local*	B425	3-3901
Alessandro Braggio	CNR	alessandro.braggio@spin.cnr.it	*5/5~5/31*	C420	5-9781
Marcel den Nijs	Univ of Washington	dennijs@phys.washington.edu	*local*	B429	3-7305
Joaquin Drut	UNC-CH	drut@email.unc.edu	*5/5~5/11*	C437	5-3620
Lara Faoro	CNRS	faoro@lpthe.jussieu.fr	*5/6~5/31*	C422	5-9778
Yuval Gefen	Weizmann Inst Science	yuval.gefen@weizmann.ac.il	*5/6~5/17*	B468	5-9721
Leonid Glazman	Yale Univ	leonid.glazman@yale.edu	*5/5~5/23*	C411A	5-3633
Zoran Hadzibabic	Univ of Cambridge	zh10001@cam.ac.uk	*5/8~5/16*	B468	5-9723
Lev Ioffe	CNRS	ioffe@lpthe.jussieu.fr	*5/6~5/31*	C422	5-9779
Alan Jamison	Univ of Washington	jamisona@uw.edu	*local*	B426	3-5074
David Kaplan	INT	dbkaplan@uw.edu	*local*	C411B	5-3546
Ahmet Keles	Univ of Washington	keles@uw.edu	*local*	B442	3-9085
Israel Klich	Univ of Virginia	isklich@gmail.com	*5/6~5/24*	B449	5-9773
Amy Nicholson	Univ of Maryland	annicholson@gmail.com	*5/5~5/12*	B447	6-5006
Michael Pustilnik	Georgia Inst Technology	pustilnik@gatech.edu	*5/6~6/1*	C424	5-9828
Misha Reznikov	Technion	misha.reznikov@gmail.com	*5/5~5/12*	C404	5-3971
Zoran Ristivojevic	Ecole Polytechnique	mg94c17@gmail.com	*5/5~6/1*	C418	5-9782
Kim Splittorff	Niels Bohr Insititute	split@nbi.dk	*5/6~5/17*	C437	5-3620
Jacobus Verbaarschot	SUNY Stony Brook	jacobus.verbaarschot@stonybrook.edu	*5/8~5/15*	C438	5-9831
Felix von Oppen	Freie Univ Berlin	vonoppen@physik.fu-berlin.de	*5/5~5/11*	B449	5-9726
Vladimir Yudson	Inst Spectroscopy, RAS	v.yudson@gmail.com	*5/6~5/31*	C424	5-9827

Please send or bring a .pdf or .ppt of your presentation to Janine in C411:

janine@phys.washington.edu