Øresundseminar

Thursday, 8. December 2016

Auditorium 3, H. C. Ørsted Institute, Universitetsparken 5, Copenhagen

ca. 12:45–12:55 Arrival and Coffee

You're welcome to have a coffee with us before the first talk in the lunch room on the top floor of the institute. (There is no cake though at this time.)

13:00–14:00 Marcello Porta (Zurich): Mean field evolution of fermionic systems

In this talk I will discuss the dynamics of interacting fermionic systems in the mean field regime. Compared to the bosonic case, fermionic mean field scaling is naturally coupled with a semiclassical scaling, making the analysis more involved. As the number of particles grows, the quantum evolution of the system is expected to be effectively described by Hartree-Fock theory. The next degree of approximation is provided by a classical effective dynamics, corresponding to the Vlasov equation. I will consider initial data which are close to quasi-free states, at zero (pure states) or at positive temperature (mixed states), with an appropriate semiclassical structure. Under mild regularity assumptions on the interaction potential, I will show that the time evolution of such initial data stays close to a quasi-free state, with reduced one-particle density matrix given by the solution of the time-dependent Hartree-Fock equation. The result can be extended to Coulomb interactions, under the assumption that the solution of the time-dependent Hartree-Fock equation preserves the semiclassical structure of the initial data. If time permits, the convergence from the time-dependent Hartree-Fock equation to the Vlasov equation will also be discussed. The results hold for all semiclassical times, and give effective bounds on the rate of convergence towards the effective dynamics as the number of particles goes to infinity.

14:10–15:10 Niels Martin Møller (Copenhagen): Gluing of Geometric PDEs: Obstructions vs. Constructions for Minimal Surfaces & Mean Curvature Flow Solitons

This talk will be concerned with two dual aspects of the theory of minimal surfaces and the closely related self-similar solitons (i.e. singularity models) in mean curvature flow: Non-existence/uniqueness results vs. existence results. The obstructions to existence rely on f. ex. maximum principle arguments, while the existence comes about constructively via gluing techniques for elliptic PDEs with geometric content, which linearize to Schrödinger operators (sometimes of Ornstein-Uhlenbeck type). Focusing mostly on this latter topic, I will explain the general setup, and then detail some of the technicalities involved in some recent existence theorems: Mean curvature solitons with genus and, in other recent work, examples of non-compactness in the moduli space of minimal surfaces.

(Some of the results are joint with Stephen Kleene and/or Nicos Kapouleas.)

15:10–15:50 Coffee Break

15:50–16:50 Jacob Christiansen (Lund): Chebyshev polynomials for subsets of $\mathbb{R}$

Given an infinite compact set $\mathsf{E} \subset \mathbb{R}$, the nth Chebyshev polynomial, $T_n(z)$, is the unique monic polynomial of degree n that minimizes the sup-norm, $\|T_n\|_{\mathsf{E}}$, on E. It has long been recognized that potential theory is essential to the study of Chebyshev polynomials. The lower bound $\|T_n\|_{\mathsf{E}} \geq \mathrm{Cap}(\mathsf{E})^n$ is classical (where $\mathrm{Cap}(\cdot)$ is the logarithmic capacity). In the talk, I shall discuss upper bounds of the form

$$\|T_n\|_{\mathsf{E}} \leq K \cdot \mathrm{Cap}(\mathsf{E})^n$$

for some $K > 0$. The main focus of the talk will be on asymptotics of $T_n(z)$. I'll explain how to solve a 45+ year old conjecture of Widom for finite gap subsets of $\mathbb{R}$ and discuss how one can go beyond this simple class of subsets. As we shall see, a key role is played by the sets

$$\mathsf{E}_n := T_n^{-1}\big([-\|T_n\|_{\mathsf{E}},\, \|T_n\|_{\mathsf{E}}]\big).$$

The talk is based on joint work with Simon and Zinchenko, and the interested reader is referred to

[1] J. S. Christiansen, B. Simon, and M. Zinchenko. Asymptotics of Chebyshev Polynomials, I. Subsets of $\mathbb{R}$. To appear in *Invent. Math.* (Doi: 10.1007/s00222-016-0689-x)

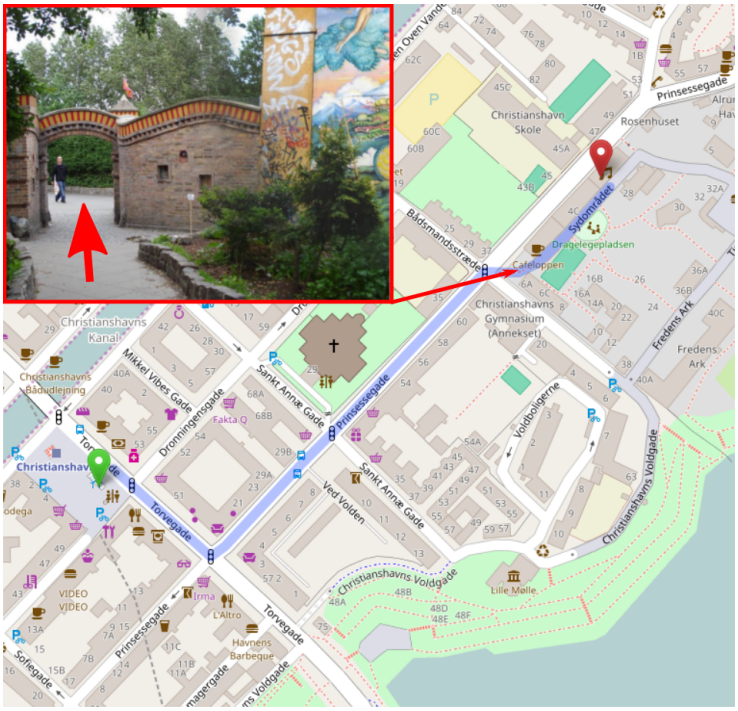
17:00–18:00 Marcus Carlsson (Lund): On the structure of general domain Hankel and Toeplitz operators, and applications to frequency estimation in several variables

Hankel and Toeplitz matrices have a long history of use in signal processing and frequency estimation. Each such operator is defined by (samples of) a function on an interval. The multidimensional frequency estimation problem poses several additional difficulties, one being that there is not natural counterpart for an interval. We therefore introduce a new class of integral operators which we label Hankel and Toeplitz operators on general domains, where the general domain may be almost any connected set. In this talk I will present results on their finite rank structure and positive semidefiniteness. More precisely we generalize the classical Kronecker and Caratheodory Fejer theorems to several variables. Time allowing, we show applications in multidimensional frequency estimation.

19:00 Social Dinner at Spiseloppen in Christiania

To get from the campus to Spiseloppen, take bus 15E, 150S, 184 or 185 (all departing from the big street right behind the math building) to Nørreport. There, change to the Metro (any line, direction to Vestamager or Lufthavnen) and get out at Christianshavn. Walk 400m, following the map below, entering Christiania through the small stone gate on the picture. Notice that on the bus, tickets can be bought only with cash (or you use a Rejsekort), but you can travel together with Jan Philip on a group card.

From door to door it takes about 30 minutes.



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