Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Statistical mechanics of Coulomb gases as quantum theory on Riemann surfaces[1] TOBIAS GULDEN, MICHAEL JANAS, Department of Physics, University of Minnesota, ALEX KAMENEV, Fine Theoretical Physics Institute, Department of Physics, University of Minnesota — Statistical mechanics of 1D Coulomb gases may be mapped onto (in general) non-Hermitian quantum mechanics. We use this example to develop non-Hermitian instanton calculus. Treating momentum and coordinate as independent complex variables, constant energy manifolds are given by Riemann surfaces of genus $g \geq 1$. The actions along principal cycles on these surfaces obey an ODE in the moduli space of the Riemann surface known as the Picard-Fuchs equation. Solving the Picard-Fuchs equation yields semiclassical spectra as well as instanton effects such as width of Bloch bands (the latter determines energy barrier for charge transport). Both are shown to be in perfect agreement with numerical simulations. Applications include transport through biological ion channels as well as nanofluidics, e.g water filled nanotubes.

[1]The work was supported by NSF grant DMR1306734.

Tobias Gulden
Department of Physics, University of Minnesota

Date submitted: 14 Nov 2013 Electronic form version 1.4