Ken McLaughlin
Proposal: Topics Course, Spring 2013
Title: Asymptotic analysis in the complex domain with applications to random matrices

Topics:

1. random matrix theory and constrained energy problems in the plane
    a. Connection between (1) random matrix theory (2) variational problems (3) conformal mappings
    b. explicit calculation of limiting eigenvalue densities in the plane
    c. Open problems / open research directions
    c. Discussion of the Harmonic Measure conjecture
2. applications of dbar problems:
    a. integrable nonlinear PDEs in 2+1 dimensions (2 spatial dimensions, 1 time)
    b. special functions in the plane (both classical and neo-classical)
3. Along the way, examples will be encountered which will lead through some basic techniques of analysis:
    a. asymptotic analysis of integrals
    b. Riemann-Hilbert problems and their analysis
    c. Extensions to asymptotic analysis of singular integrals in higher dimensions
    d. Rudiments of Fredholm theory of operators, by example.

Prerequisites: 520A.