STANFORD UNIVERSITY
DEPT OF MATHEMATICS
ANNUAL BERGMAN LECTURES

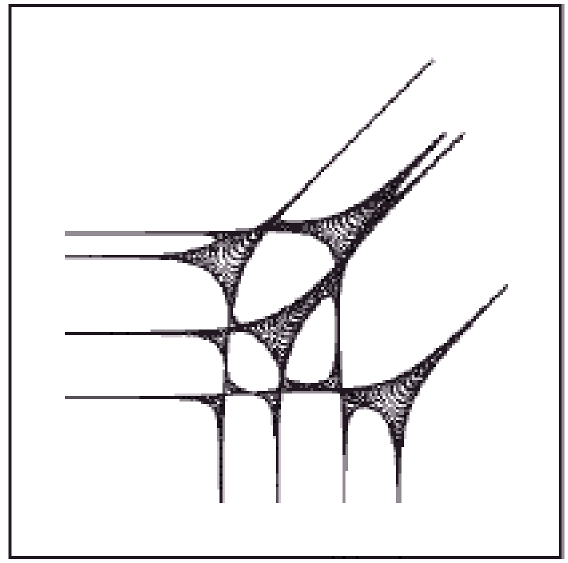
Tuesday, April 23 and Thursday, April 25, 2002

Math Corner, Building 380

Room 380-C, Tuesday, 4/23, 4:15 – 5:15 pm

Room 380-W, Thursday, 4/25, 4:15 – 5:15 pm

Tea at 3:30 in Third Floor Lounge (both days)



Steve Zelditch (Johns Hopkins University)

“Bergman kernels and statistical patterns in polynomials”

Abstract: My talks are about the distribution of zeros of one or several polynomials

$$f(z_1,\dots,z_m) = \sum_{\alpha:|\alpha|\leq N} c_\alpha z^\alpha$$

of a large degree *N* in *m* variables. If we take *m* polynomials in *m* variables, the simultaneous zeros almost always form a discrete set of points.

Question: How are they distributed? Do they ‘ignore’ each other and resemble particles of a gas, or do they interact? Attract or repulse?

The answer will be given in my first talk. It turns out to depend on the dimension *m*. It also of course depends on the polynomials, but we will regard the coefficients c_α as independent complex Gaussian random variables (with geometrically defined variances) and present the expected and almost sure behavior. The answer also turns out to be the same if we generalize the question from polynomials to holomorphic sections of any positive line bundle over any Kahler manifold. That is, the statistical patterns are universal (as N goes to infinity).

My second talk will revolve around the question:

How does the distribution of zeros (etc.) depend upon the Newton polytopes *P* of the polynomials? Surely it must, since the Bernstein-Kouchnirenko theorem states that even the number of zeros of a system of m polynomials in m non-zero complex variables depends on *P* (it equals m! Vol(P)). The answer is that P creates an ‘allowed’ region in which zeros are distributed as if no condition were present, and a ‘forbidden’ region where zeros are sparse.

The proofs of all the results are based on asymptotic properties of a variety of Bergman kernels. They represent joint work with Pavel Bleher and Bernie Shiffman. I hope to make the results accessible to a general audience, and will illustrate the phenomena with computer graphics.

Banquet: Wednesday eve. following lecture, sign up with Karen Morness 650/723-2603