Northern California Symplectic Geometry Seminar

Berkeley – Davis – Santa Cruz – Stanford

Monday, February 2, 2009

BERKELEY, 375 New Le Conte Hall and 740 Evans Hall

2:30–3:30 in 375 New Le Conte Hall
(enter from North side, across the road from Evans Hall)

Shamgar Gurevich (UCB)
"Applications of Weil's metaplectic representation to digital signal processing"

(Joint work with Ronny Hadani (Chicago) and Nir Sochen (Tel Aviv)

I will explain how Weil's metaplectic representation of the finite linear symplectic group appears naturally in the context of discrete harmonic analysis and can be applied to solve concrete problems from digital signal processing. I will begin by describing our solution to the problem of finding a canonical orthonormal basis of eigenvectors of the discrete Fourier transform (DFT):

$$\frac{1}{\sqrt{p}}\begin{pmatrix} 1 & 1 & 1 & \dots & 1 \\ 1 & \zeta^2 & \zeta^4 & \dots & \zeta^{p-1} \\ 1 & \zeta^3 & \zeta^6 & \dots & \zeta^{2(p-1)} \\ \vdots & \vdots & \vdots & & \vdots \\ 1 & \zeta^{p-1} & \zeta^{2(p-1)} & \dots & \zeta^{(p-1)(p-1)} \end{pmatrix}, \quad \zeta = e^{\frac{2\pi i}{p}}.$$

Then I will explain how to generalize the construction to obtain a larger collection of functions that we call "The oscillator dictionary". Functions in the oscillator dictionary admit many interesting properties; I will explain several of these properties which arise in the context of problems of current interest in areas such as communication and radar.

If time permits, I will introduce the geometric Weil representation, which is an algebro-geometric (ℓ-adic Weil sheaf) counterpart of the Weil representation. Then, I will explain how the geometric Weil representation is used to prove the main results stated in the talk. Along the way, I will explain Grothendieck's geometrization procedure by which sets are replaced by algebraic varieties and functions by sheaf theoretic objects.

3:30-4:00
Tea break in 1015 Evans Hall

4:15–5:15
Matilde Marcolli (Caltech and MSRI)
"Noncommutative geometry and the 'field with one element' "

I will explain, based on my joint work with Connes and Consani `arXiv:0806.2401` and on my more recent `arXiv:0901.3167`, how the Bost-Connes quantum statistical mechanical system relates noncommutative geometry to the still conjectural geometry over the "field with one element". I will discuss the relation to Lambda-rings and some open questions in this approach.

Please contact alanw@math.berkeley.edu to arrange parking.
There will be a dinner at 6pm

Y. Eliashberg, D. Fuchs, V. Ginzburg, E. Ionel, R. Montgomery, A. Weinstein