Temple University Mathematics Colloquium

Daryl Geller

SUNY Stony Brook

will speak on

Exploring the Early Universe with Wavelets

ABSTRACT: Wavelets were originally developed on the real line, for the purpose of signal processing. Their advantage over the Fourier transform arose from their excellent localization both in time and in frequency. Recently, with Azita Mayeli, and with Isaac Pesenson, we have shown that many of the techniques used on the real line can be adapted to the manifold setting, by use of methods from modern harmonic analysis, pseudodifferential operators and PDE. In this talk we explain a particular application of this theory, to the statistical analysis of cosmic microwave background radiation, which has been called the "Rosetta Stone" of the Big Bang. Spherical harmonics are a primary tool of all the major research teams; but the use of spherical wavelets is being advocated by some prominent astrophysicists and astrostatisticians. A major reason for this, is that a large portion of the sky is not observed, because of interference from the Milky Way and other sources, so that it is useful to take inner products with well-localized functions such as wavelets, as opposed to spherical harmonics. These ideas have been exploited for a number of years to study CMB temperature. Our main contribution in this regard, is that one can study CMB *polarization* by wavelet methods as well. Polarization must be regarded as a section of a line bundle, and is not an ordinary scalar function like temperature. The Planck satellite, launched in 2009, is providing very clear polarization data, which is being analyzed by our physicist and statistician collaborators, by using wavelet methods.

Monday, 1 November 2010

Lecture at 4:00 pm

Coffee, tea, and refreshments from 3:30-5 pm

Room 617, Wachman Building

Department of Mathematics