APPLIED MATHEMATICS COLLOQUIUM

Bases of time-frequency shifts and the uncertainty principle

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Abstract: The Balian-Low Theorem (BLT) is an uncertainty principle-type result that precludes the existence of a Gabor orthonormal basis (ONB) of the form $\{e^{2\pi i kx/a }g(x-an) \}_{k, n=-\infty}^{\infty},$ where $a>0$, and g is well-localized in phase space. A related ONB with a well-localized generator (hence does not obey the BLT) was numerically introduced by K. Wilson in the 80s, and formalized by Daubechies, Jaffard, and Journ\'e. The latter system is called a Wilson basis and was recently featured in the detection of the gravitational waves.

In the first part of the talk, I will review some basic structures as well as the relationship between these two systems. I will then present some recent and ongoing work on constructing Wilson-type systems from more general Gabor families.
(This is a joint work with D. Bhimani, M. Bownik, M. Jakobsen, and J. Lemvig).

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