1037-42-32 **Palle E. T. Jorgensen*** (jorgen@math.uiowa.edu), Department of Mathematics, 14 MacLean Hall, University of Iowa, Iowa City, IA 52242-1419, and **Dorin Dutkay** (ddutkay@mail.ucf.edu), Department of Mathematics, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL 32816-1364. *Spectral theory for multi-scale phenomena.* Preliminary report.

We study models for multi-scales include a variety of Cantor sets and their higher dimensional fractal variants. Multiscales of selfsimilarity allow for resolution of the data into bands from coarse to fine. Even such intrinsic non-periodic patterns as Penrose tilings exhibit selfsimilarity.

Selfsimilarity refers to a system of scales, or multi resolutions (as in wavelet algorithms, both continuous and discrete).

We present Fourier multiscales for a finite set of affine transformations in Euclidean space, called iterated function systems (IFS). We give a spectral theory for IFS-models, with Hutchinson measures μ. We answer this question: How many orthogonal Fourier frequencies in $L^2(\mu)$ are consistent with the intrinsic fractal geometry of the associated IFS?

Multiscale bases, Fourier or wavelets, in the Hilbert space $L^2(\mu)$ have proved practical. We focus on a class of IFSs for which $L^2(\mu)$ has at most a finite number of orthogonal Fourier frequencies. We determine the smallest upper bound for the cardinality of orthogonal frequencies in $L^2(\mu)$!

Open question: Non-IFS. Let D be the open disk with (restricted) Lebesgue measure μ. There cannot be an infinite orthogonal Fourier family in $L^2(D,\mu)$, but the smallest number is unknown. (Received January 03, 2008)