Gabor analysis: applications, theory, and mysteries

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In Gabor analysis one studies the construction and properties of series expansions of functions with respect to a set of time-frequency shifts (phase space shifts) of a single function. Such expansions, which are nowadays called Gabor series, are applied for the analysis and description of speech signals or music signals and play an important role in wireless communications for orthogonal frequency division multiplexing (OFDM). In physics they arise in quantum mechanics as coherent state expansions, in operator theory as non-commutative tori.

In the short course I will use these applications as a motivation for the beautiful mathematics of Gabor analysis.

Plan:

Lecture 1: What is Gabor analysis? Applications and basic concepts

Lecture 2: Mathematical structure of Gabor frames and bases. Coarse structure of Gabor frames, characterizations of Gabor frames.

Lecture 3: Fine structure of Gabor frames, Gabor frames with Gaussian window and with totally positive windows. Connection to sampling in shift-invariant spaces.