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Robustness considerations in time-frequency and Fourier analysis via modulation spaces

It is well known that wavelets are an appropriate tool to study the classical Besov-Triebel-Lizorkin spaces or Calderon-Zygmund operators. Modulation spaces play a similar role with the short-time Fourier transform playing the role of the continuous wavelet transform. However, due to the Balian-Low theorem there are no Gabor orthonormal bases, just Banach frames for modulation spaces. A specific role is played by the space $M^1(R^d)$, also known as Segal algebra $S_0(R^d)$ and its dual space, $M^\infty(R^d)$ resp. S_0'.

In this presentation we will go through a long list of questions concerning robustness issues in Gabor analysis. Among others it is known, that any sufficiently dense family of points in the time-frequency plane allows to generate a Gabor frame, if the window/atom is in S_0. For the lattice case the dual window depends continuously on the lattice parameters, which opens up a computational approach to find approximate dual windows. Aside from many other related questions we plan to address also the issue of Gabor multipliers resp. so-called Anti-Wick operators (STFT multipliers in another terminology) and emphasize the role of such robustness results for the applications.