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Fourier inequalities in weighted Lebesgue and Lorentz spaces

The Fourier transform is an operator of strong type $(1, \infty)$ and $(2, 2)$. By interpolation one obtains the Hausdorff-Young inequality which implies that the Fourier transform maps L^p into $L^{p'}$ when $1 \leq p \leq 2$. A generalization of this inequality to weighted L^p spaces with power weights is known as Pitt's inequality. However, a still open problem is to characterize those weight functions u, w for which the Fourier transform maps $L^p(w)$ into $L^q(u)$.

The Lorentz spaces, $\Lambda^p(v)$, provide a powerful tool to obtain Fourier inequalities in weighted Lebesgue spaces. Our focus is on the Fourier series in weighted Lorentz spaces. We provide relations between weight functions and exponents, that are necessary and sufficient for the boundedness of the Fourier coefficients, viewed as a map between Lorentz spaces. We also apply our results to weighted Lebesgue spaces, $L \log L$, and Lorentz-Zygmund spaces.

This is joint work with Gord Sinnamon.