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Limits of Orlicz Norms

Given a subset Ω of $\mathbb{R}^n$ and a 1-parameter family of Young functions $\{\Psi_j\}_j$, we are interested in when it is the case that

$$(1) \quad \lim_{j\to\infty} \|f\|_{L^{\Psi_j}(\Omega)} = \|f\|_{L^\infty(\Omega)} \tag{1}$$

for a suitable $f \in L^1$. In this talk, I present joint work with A. Mailhot where we show the above equality for families of iterated log-bump Young functions of the form

$$\Psi_j(t) = t^p \left(\prod_{k=1}^{n-1} \log^{(k)}(e_k - 1 + t) \right)^p \left(\log^{(n)}(e_n - 1 + t) \right)^j$$

where $1 \leq p < \infty$ is fixed and $j > 0$. More generally, in joint work with S.F. MacDonald, we give a sharp admissibility criterion for the Young functions Ψ_j that ensures (1) holds.