Endpoint results for the Laguerre function maximal heat operator

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Abstract: The classical Laguerre functions $L^\alpha_k$ form for each $\alpha > -1$ an orthonormal system on the half-line. There is a corresponding Laplacian and a heat semigroup, and this has an obvious extension to several dimensions. For $-1 < \alpha < 0$, the heat semigroup behaves badly in the sense that it consists of operators which are not bounded on all $L^p$ spaces. The corresponding maximal operator is therefore also bounded only on certain $L^p$ spaces. We examine the endpoint cases here. The sharp results turn out to be rather intricate and depend strongly on the dimension. Some involve Lorentz-Zygmund spaces. The one-dimensional case was treated earlier by Macías, Segovia and Torrea.

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