# On singular elliptic boundary value problems via a harmonic analysis approach

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**Abstract.** We consider a class of elliptic problems in the half-space $\mathbb{R}^n_+$ with nonhomogeneous boundary conditions containing nonlinearities and critical singular potentials. We obtain existence and regularity results by means of a harmonic analysis approach based on a framework of weighted spaces in Fourier variables. This framework seems to be new in the context of elliptic boundary value problems and allows us to consider Hardy's potential $\lambda_1/|x|^2$ in $\mathbb{R}^n_+$ and Kato's potential $\lambda_2/|x'|$ on the boundary $\partial\mathbb{R}^n_+$, as well as their versions with multiple poles, without using the so-called Kato and Hardy inequalities. Singular boundary forcing terms can also be addressed. Moreover, our results cover supercritical nonlinearities, such as $\pm u^p$ in $\mathbb{R}^n_+$ and $\pm u^q$ on $\partial\mathbb{R}^n_+$ with integers $p > 2^* - 1$ and $q > 2_* - 1$.

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