Eun Kyoung Lee, Ratnasingham Shivaji and Byungjae Son* (b_son@uncg.edu),
Department of Mathematics and Statistics, UNCG, Greensboro, NC 27412. Positive radial solutions to classes of singular problems on the exterior domain of a ball.

We study positive radial solutions to singular boundary value problems of the form:

\[
\begin{cases}
-\Delta u = \lambda K(|x|) \frac{f(u)}{u^\alpha}, & \text{in } \Omega, \\
\frac{\partial u}{\partial \eta} + \tilde{c}(u)u = 0, & |x| = r_0, \\
u(x) \to 0, & |x| \to \infty,
\end{cases}
\]

where \(\Delta u := \text{div}(\nabla u)\) is the Laplacian operator of \(u\), \(\Omega = \{x \in \mathbb{R}^N | |x| > r_0 > 0, N > 2\}\), \(\lambda > 0\), \(K \in C([r_0, \infty), (0, \infty))\) is such that \(K(s) \leq \frac{1}{s^{N+\hat{\beta}}}\) for \(s \gg 1\) for some \(\hat{\beta} > 1\), \(\alpha < \min\{1, \frac{\hat{\beta}}{N-2}\}\) and \(\frac{\partial u}{\partial \eta}\) is the outward normal derivative of \(u\) on \(|x| = r_0\). Here, \(f \in C^1([0, \infty), \mathbb{R})\) is such that \(\frac{f(s)}{s^{1+\alpha}} \to 0\) as \(s \to \infty\), and \(\tilde{c} \in C([0, \infty), (0, \infty))\). We analyse the cases when (a) \(f(0) > 0\) and (b) \(f(0) < 0\). We discuss existence, non-existence, multiplicity and uniqueness results. We prove our existence results by the method of sub and supersolutions. (Received September 22, 2015)