# Asymptotic Analysis of the $p$-Laplacian Flow in an Exterior Domain

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We consider the Dirichlet problem for the $p$-Laplacian evolution equation, $u_t = \Delta_p u$, where $p > 2$, posed in an exterior domain in $\mathbf{R}^N$, with zero Dirichlet boundary condition and with integrable and nonnegative initial data. We are interested in describing the influence of the holes of the domain on the large time behaviour of the solutions. Such behaviour varies depending on the relative values of $N$ and $p$. We must distinguish between the behaviour near infinity of space (outer analysis), and near the holes (inner analysis). We obtain that the outer analysis is given in all cases by certain self-similar solutions and the inner analysis is given by quasi-stationary states. Logarithmic corrections to exact self-similarity appear in the critical case $N = p$. The low dimensional case $N < p$ is treated by an optimal barrier technique and provides new solution of the $p$-Laplacian parabolic equation.