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Exponential convergence of hp-version DG methods for linear elliptic PDEs in three dimensions.

We introduce and analyze *hp*-version discontinuous Galerkin (DG) finite element methods for the numerical approximation of linear second-order elliptic boundary-value problems in three dimensional polyhedral domains. In order to resolve possible corner-, edge- and corner-edge singularities, we consider hexahedral meshes that are geometrically and anisotropically refined towards the corresponding neighborhoods. Similarly, the local polynomial degrees are increased linearly and possibly anisotropically away from singularities. We design interior penalty DG methods on such *hp*-meshes and prove that they are stable and well-defined under the proposed *hp*-refinements. We then establish exponential rates of convergence in the number of degrees of freedom for problems with piecewise analytic data. (Received February 05, 2010)