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Lower bound theorems for balanced manifolds

Juhnke-Kubitzke and Murai proved a balanced generalized lower bound theorem for simplicial polytopes. We extend their result to balanced triangulations of orientable homology manifolds whose proper links have the weak Lefschetz property. As a corollary, we prove a conjecture of Klee and Novik that if Δ is a balanced triangulation of a connected $(d - 1)$ -dimensional orientable homology manifold, then $2h_2(\Delta) - (d - 1)h_1(\Delta) \geq 4\binom{d}{2}\tilde{\beta}_1(\Delta)$.