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Injective metrics and affine hyperplane arrangements

A complex affine hyperplane arrangement is a locally finite collection of affine hyperplanes (complex codimension-1 subspaces) in a finite dimensional complex affine space. Since these subspaces have complex codimension 1, the complement of their union is a connected manifold. It is a broad, longstanding problem with many connections to different areas of mathematics to determine the arrangements for which this manifold is aspherical (has contractible universal cover). A subset of this problem dating back to the 1970s, commonly attributed to Arnol'd, Brieskorn, Thom, and Pham, concerns arrangements arising from reflection groups in real affine space.

One approach that has seen success is to construct a cell complex which is homotopy equivalent to this complement and endow it with some kind of non-positive curvature. Along these lines, by showing that a specific cell complex (based on a construction of Falk) carries an injective metric, we show that a broad class of affine arrangements (including the infinite families of affine reflection arrangements, modulo a conjecture about D_n-type) have aspherical complement. In particular, this provides some of the first examples of infinite affine arrangements which have aspherical complement, but do not arise from reflection groups. This also provides many new natural examples of injective metric spaces. This is joint work with Jingyin Huang.