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Prescribed projections and efficient coverings of sets by curves

A remarkable result of Davies shows that an arbitrary measurable set in the plane can be covered by lines "efficiently", in the sense that the parts of the lines not needed form a set of measure zero in the plane. This theorem has an equivalent dual formulation which says that one can find a single set in the plane with given "prescribed" projections in almost every direction, up to measure zero errors. We extend these results to a non-linear setting and prove that a set in the plane can be covered efficiently by translates of a single curve satisfying a mild curvature assumption.