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Computing zeta functions for sparse hypersurfaces using Dwork cohomology

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We use the cohomology theory of Dwork, as developed by Adolphson and Sperber, to give an algorithm to compute the zeta function of a nondegenerate hypersurface. This algorithm seems especially well-suited for "sparse" hypersurfaces, those for which the number of nonzero monomials is small relative to the degree of the hypersurface. Our method applies equally well to toric, affine, and projective hypersurfaces, as well as to the case of exponential sums.

This is joint work with Steven Sperber.