1078-65-182 **Michael McCourt*** (mccomic@mcs.anl.gov), 10 W. 32nd St., Rm. 208, Chicago, IL 60616, and **Greg Fasshauer** (fasshauer@iit.edu), 10 W. 32nd St., Rm. 208, Chicago, IL 60616. *Stable Computations with Gaussians.*

The practical application of kernels is often impeded by ill-conditioning present for certain choices of RBF. The most common choice in some communities, the Gaussian, is optimal for approximating sufficiently smooth functions; it is also the most susceptible to conditioning issues and thus the least trustworthy in many circumstances. This work provides a new way to compute and evaluate Gaussian RBF interpolants in a stable way in arbitrary dimensions with a focus on increasingly flat kernels. Motivated by the pioneering research of Bengt Fornberg and his co-workers, an eigenfunction (or Hilbert-Schmidt) expansion of the Gaussian is used to isolate ill-conditioned terms analytically. In addition to obtaining the true RBF interpolant, this technique can also be used to produce a highly accurate least-squares approximation at significantly less cost. Interpolation and regression results will be presented, as well as collocation results for boundary value problems. (Received December 06, 2011)