1092-65-170 **Jianliang Qian*** (qian@math.msu.edu), Department of Mathematics, Michigan State University, East Lansing, MI 48823, and **Songting Luo** and **Robert Burridge**. *High-Order Factorization Based High-Order Hybrid Fast Sweeping Methods for Point-Source Eikonal Equations.*

The solution for the eikonal equation with a point-source condition has an upwind singularity at the source point as the eikonal solution behaves like a distance function at and near the source. As such, the eikonal function is not differentiable at the source so that all formally high-order numerical schemes for the eikonal equation yield first-order convergence and relatively large errors. Therefore, it is a long standing challenge in computational geometrical optics how to compute a uniformly high-order accurate solution for the point-source eikonal equation in a global domain. In this paper, we propose high-order factorization based high-order hybrid fast sweeping methods for point-source eikonal equations to compute just such solutions. Observing that the *squared* eikonal is differentiable at the source, we propose to factorize the eikonal into two multiplicative or additive factors one of which is specified to approximate the eikonal up to arbitrary order of accuracy near the source, and the other of which serves as a higher-order correction term. This decomposition is achieved by using the eikonal equation and applying power series expansions to both the squared eikonal and the squared slowness function. (Received August 08, 2013)