Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Compressed modes for variational problems in mathematical physics and compactly supported multiresolution basis for the Laplace operator[1] VIDVUDS OZOLINS, Department of Materials Science and Engineering, University of California, Los Angeles, RONGJIE LAI, Department of Mathematics, University of California, Irvine, RUSSEL CAFLISCH, STANLEY OSHER, Department of Mathematics, University of California, Los Angeles — We will describe a general formalism for obtaining spatially localized ("sparse") solutions to a class of problems in mathematical physics, which can be recast as variational optimization problems, such as the important case of Schrödinger's equation in quantum mechanics. Sparsity is achieved by adding an L_1 regularization term to the variational principle, which is shown to yield solutions with compact support ("compressed modes"). Linear combinations of these modes approximate the eigenvalue spectrum and eigenfunctions in a systematically improvable manner, and the localization properties of compressed modes make them an attractive choice for use with efficient numerical algorithms that scale linearly with the problem size. In addition, we introduce an L_1 regularized variational framework for developing a spatially localized basis, compressed plane waves (CPWs), that spans the eigenspace of a differential operator, for instance, the Laplace operator. Our approach generalizes the concept of plane waves to an orthogonal real-space basis with multiresolution capabilities.

[1]Supported by NSF Award DMR-1106024 (VO), DOE Contract No. DE-FG02-05ER25710 (RC) and ONR Grant No. N00014-11-1-719 (SO).

Vidvuds Ozolins
Department of Materials Science and Engineering,
University of California, Los Angeles

Date submitted: 15 Nov 2013 Electronic form version 1.4