Abstract Submitted
for the TSF07 Meeting of
The American Physical Society

The Fourier-Bessel Method PATRICK NASH, University of Texas at San Antonio — Fourier split-step techniques are often used to compute soliton-like numerical solutions of the nonlinear Schrodinger equation. We discuss a new fourth-order implementation of the Fourier split-step algorithm for problems possessing azimuthal symmetry in 3+1-dimensions. This implementation is based, in part, on a finite difference approximation D=1/r d/dr 1/r that possesses an associated exact unitary representation of exp(i D) . The matrix elements of this unitary matrix are given by special functions known as the associated Bessel functions [Nash2004]. Hence the attribute Fourier-Bessel for the method. The Fourier- Bessel algorithm is shown to be unitary and unconditionally stable. The Fourier-Bessel algorithm is employed to simulate the propagation of a periodic series of short laser pulses through a nonlinear medium. This numerical simulation calculates waveform intensity profiles in a sequence of planes that are transverse to the general propagation direction, and labeled by the cylindrical coordinate z. These profiles exhibit a series of isolated pulses that are offset from the time origin by characteristic times, and provide evidence for a physical effect that may be loosely termed "normal mode condensation." Normal mode condensation is consistent with experimentally observed pulse filamentation into a packet of short bursts, which may occur as a result of short, intense irradiation of a medium.

Patrick Nash
University of Texas at San Antonio

Date submitted: 21 Sep 2007 Electronic form version 1.4