Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Multi-Soliton Pulse Areas and the Bright-Dark Basis[1] E. GROVES, J.H. EBERLY, University of Rochester — We study the fully coherent interaction of four short optical pulses propagating through a particular four-level medium. We present an exact analytic solution for this system which incorporates elements of V- and Λ-type systems. In the early stages of propagation, a single pair of solitons drives transitions in the atoms while farther into the medium the second pair of pulses is amplified as the first pair is depleted. Throughout the medium there are three stable "total" pulse areas. Our numerical solutions show that pulse transfer (the amplification of two pulses at the expense of the other two) occurs for a variety of input pulse shapes and areas along with SIT-type pulse reshaping. As in the three-level case examined by Clader and Eberly (2008), we find that our four-level system can be described in terms of bright and dark states. Working in the bright-dark basis we show that temporally-matched pulses obey a four-pulse area theorem and that the three pulse areas control the evolution of the system.

[1]We acknowledge financial support from NSF Grant PHY 0601804 and receipt of a Frank Horton Fellowship by E.G.

Elizabeth Groves
University of Rochester

Date submitted: 23 Jan 2009 Electronic form version 1.4