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Bichromatic Stationary Light Pulses in Cold Atomic Media YEN-WEI LIN, WEN-TE LIAO, THORSTEN PETERS, HUNG-CHIH CHOU, HUNG-WEN CHO, JIAN-SIUNG WANG, PEI-CHEN KUAN, ITE A. YU, Department of Physics, National Tsing Hua University, Hsinchu 30013, Taiwan — We study the creation of stationary light pulses (SLPs), i.e., light pulses without motion, in cold atoms. Based on the effect of electromagnetically induced transparency, the SLPs are formed via the retrieval of stored probe pulses with two counter-propagating coupling fields. Because of this counter- propagating excitation scheme there exist Raman transitions that create spatially rapidly oscillating ground-state coherences. While for room-temperature or hot media these coherences are negligible due to the atomic motion, we show that they are non-negligible in cold media and prohibit a SLP formation. We experimentally demonstrate a method to suppress these Raman excitations and realize SLPs in laser-cooled atoms. Furthermore, we present a more general explanation for the formation of SLPs, namely several balanced four-wave mixing processes sharing the same ground-state coherence. To demonstrate this new concept we report the first experimental observation of a bichromatic SLP at wavelengths for which no Bragg grating can be established. Our work opens the way to SLP studies in cold as well as in stationary atoms and provides a new avenue to low-light-level nonlinear optics. This work was supported by the NSC Grants No. 95-2112-M-007-039-MY3 and No. 97-2628-M-007-018.

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