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Fast Light, Slow Light and Causality: Four Wave Mixing in Potassium Vapor[1] JON SWAIM, RYAN GLASSER, Tulane University — The propagation of information in dispersive media has been of wide interest to the physics community, due to its relevance in information technologies as well as fundamental physics such as special relativity and causality. In particular, experiments involving anomalous dispersion have demonstrated optical pulses with group velocities greater than the speed of light in vacuum, or negative. In this work, we study fast and slow light phenomena associated with optical pulses generated via four wave mixing in hot potassium vapor. The relatively small ground state splitting of potassium combined with Doppler broadening produces overlapping atomic resonances, resulting in spectral reshaping of optical pulses that is due to a combination of gain and absorption in the medium. We show that superluminal or subluminal group velocities can be obtained, depending on the choice of experimental parameters. Furthermore, we also investigate the causal connection between abrupt (or non-analytic) features introduced into the input pulse and the resulting features observed after the four wave mixing process, in an attempt to show that information causality is preserved.

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