Material slow light and structural slow light: similarities and differences for nonlinear optics [Invited]: comment

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Received February 17, 2012; revised April 25, 2012; accepted May 2, 2012; posted July 23, 2012 (Doc. ID 163281); published August 31, 2012

We comment on the article [J. Opt. Soc. Am. B, **28**, A38–A44 (2011)] regarding the topic of coherent population oscillation (CPO)-based slow light.

OCIS codes: 190.0190, 190.5530, 260.2030.

The December issue of the Journal of the Optical Society of America B (2011) contained an interesting article by R. Boyd titled "Material slow light and structural slow light: similarities and differences for nonlinear optics [Invited]" [1]. The two approaches to the experimental realization of slow light are fundamentally different, and the issue considered in this paper is really topical and useful for researchers working in this field of quantum optics. The experimental facts and theoretical models used by the author are mainly well-established and accepted by the scientific community. This is not the case, however, with slow light based on the coherent population oscillation (the so-called CPO-based slow light), which is considered by the author in the framework of the old model [2], which was shown in a number of publications to be inadequate or at least disputable. Indeed the experimental observations attributed to CPO do not rule out a mechanism of simple time-dependent saturable absorption and are in fact consistent with the latter (see, e.g., [3–7]. At the same time, it was demonstrated experimentally that the effects ascribed to the CPO-based slow light and to light with a negative group velocity can be easily observed with broadband incoherent light when the model of the coherent population oscillation (CPO) is inapplicable [8]. In [9], it was shown that the effect of pulse delay in a saturable absorber is not specifically an optical phenomenon and can be observed even in certain electric circuits. And, eventually, it was noted in these publications that all the experimental observations underlying the "CPO-based slow light" have been known for more than 40 years [10,11], are perfectly understood, and do not need to be revised. It is also noteworthy that the two alternative models describing pulse delay in a saturable absorber are essentially different in physical content and deserve to be distinguished. Specifically, the pulse delay in the model of saturable absorption does not imply any pulse compression inside the medium, and the question of possible enhancement of nonlinear processes, addressed by R. Boyd, looks, in this case, irrelevant.

The paper by R. Boyd does not cite any of the above literature. We believe that this is an unfortunate omission, which means that the article, as far as CPO-based slow light is concerned, is incomplete and possibly misleading.

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