Title:	Coherently controlling metamaterials
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Abstract:	Two independent significant developments have challenged our understanding of light-matter interaction, one, involves the artificially structured materials known as metamaterials, and the other, relates to the coherent control of quantum systems via the quantum interference route. We theoretically demonstrate that one can engineer the electromagnetic response of composite metamaterials using coherent quantum interference effects. In particular, we predict that these composite materials can show a variety of effects ranging from dramatic reduction of losses to switchable ultraslow-to-superluminal pulse propagation. We propose parametric control of the metamaterials by active tuning of the capacitance of the structures, which is most efficiently engineered by embedding the metamaterial structures within a coherent atomic/molecular medium. This leads to dramatic frequency dependent features, such as significantly reduced dissipation accompanied by enhanced filling fraction. For a Split-ring resonator medium with magnetic properties, the associated splitting of the negative permeability band can be exploited for narrow band switching applications at near infrared frequencies involving just a single layer of such composite metamaterials. © 2008 Optical Society of America
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