

MAR14-2013-008969

Abstract for an Invited Paper  
for the MAR14 Meeting of  
the American Physical Society

### **Engineering vacuum and thermal fluctuations with metamaterials**

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In 1987, the search for a medium that expels vacuum fluctuations in a prescribed bandwidth and rigorously forbids spontaneous emission led to the concept of the photonic crystal. Here, we argue that the search for the opposite effect: enhancing vacuum and thermal fluctuations inside a medium within a prescribed bandwidth can be accomplished by an artificial medium known as a hyperbolic metamaterial. We will present the fluctuational electrodynamics of such media with hyperbolic dispersion and show that they exhibit broadband super-planckian thermal emission in the near-field. We will also present the quantum nanophotonics of such media where the enhanced vacuum fluctuations within the medium leads to a broadband Purcell effect. Finally, we will present associated effects in such artificial media such as optical topological transitions which make it viable to experimentally detect the signatures of these predicted effects.