Abstract Submitted
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Photonic Beam-Plasma Instabilities and Imaging[1] DMITRY V. DYLOV, JASON W. FLEISCHER, Princeton University, Princeton, NJ 08544 — We consider an all-optical version of the bump-on-tail instability and show that signal-noise interactions can be modeled as a beam-plasma instability. Theoretically, the mapping follows by treating partially-coherent light using a wave-kinetic approach[2]. We analytically derive a Bohm-Gross dispersion relation, showing that optical speckles interact via Langmuir-type modulation waves. Experimentally, we confirm the theory by demonstrating single[2] and multiple[3] bump-on-tail instabilities in a self-focusing photorefractive crystal. We then observe the recovery and amplification of noise-hidden images, showing that the coherent-incoherent coupling is a photonic beam-plasma instability. Remarkably, the plasma formula recovers a formula from information theory describing stochastic resonance, extended to include the dynamical coupling of transverse modes. The results link the fields of optics, plasma, and information theory in unanticipated ways and suggest new uses for beam shaping in material plasma.

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[2] D.V. Dylov and J.W. Fleischer, *Phys. Rev. Lett.* **100**, 103903(2008)
[3] D.V. Dylov and J.W. Fleischer, *Phys. Rev. A* **78**, 061804R (2008)

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