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A Systematic Study of Techniques to Directly Measure the Saturable Absorption of Graphene JONAH MILLER, CHIEN-CHUNG LEE, THOMAS SCHIBLI, Department of Physics University of Colorado at Boulder —
Recent interest in the optical properties of graphene and in the development of new saturable absorbers merits a fresh look at the balanced detection technique of characterizing a saturable absorber. Balanced detection is a technique that allows us to directly measure the nonlinear optical absorption of a material—i.e., the absorption in terms of incident intensity on that material. This allows for feedback on the quality of a material as a saturable absorber and allows methods of production to be optimized for ideal optical qualities. Because the total absorption of many materials, most notably graphene, is small, nonlinear absorption is very difficult to detect—a change on the order of 10^{-3} of the total transmitted/reflected light over a dynamic range of three to four orders of magnitude. We constructed a balanced detection system and performed an analysis on the sources of error in the system and how to avoid them. Major sources of error were thermal dependence from neutral density filters and silver-coated mirrors, polarization dependence from optical components that rely on Fresnel effects, and nonlinear effects in photodiodes and electronics.

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