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**MGG7 Stimulated Brillouin
scattering in optically
amplifying fiber**

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Backward stimulated Brillouin scattering (BSBS) is reassessed for the novel case of an optical fiber with gain instead of loss. In these conditions (which are achievable in optical fibers lightly doped with rare earth ions) the threshold powers can become exceedingly small both directly because of the gain and indirectly because the amplified spontaneous noise augments the usual spontaneous noise that normally seeds the process. One consequence of this is that the assumptions made by Smith¹ to predict the thresholds for the onset of the process no longer always hold. Further new effects include: (1) the appearance of strong higher Stokes orders that must be taken into account in an accurate treatment of the problem, (2) augmentation or suppression of the line narrowing process normally associated with BSBS in a lossy medium, and (3) the possibility of bistability, instability, and oscillation owing to the low threshold powers. Such effects are of particular importance if optical amplifiers are used in sensor systems employing Sagnac loops or ring resonators.

The results of theoretical modeling are presented and the experimental viability and practical usefulness of the new effects assessed for a range of possible applications.

Reference

1. R. G. Smith, *Appl. Opt.* **11**, 2489–2494 (1972).