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Nonlinearly driven second harmonic of Alfvén cascades¹ B. N. BREIZMAN, The University of Texas at Austin, H. SMITH, M. LISAK, D. ANDERSON, Chalmers University of Technology, Göteborg, Sweden — In recent experiments on Alcator C-Mod [J.A. Snipes, et al., Phys. Plasmas **12**, 056102 (2005)], measurements with Phase Contrast Imaging through the plasma core show a second harmonic of the basic Alfvén cascade (AC) signal. The present paper describes a theory that interprets the second harmonic perturbation as a nonlinear sideband produced by the Alfvén cascade eigenmode via quadratic terms in the magneto-hydrodynamic equations. It is shown that in a low-pressure plasma the non-linear coupling to compressional Alfvén perturbations and acoustic perturbations can be neglected when calculating the second harmonic intensity. The derived expressions for the second harmonic density perturbation can be used together with the experimental measurements to determine the AC amplitude inside the plasma, rather than just at the edge as with magnetic probes.

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