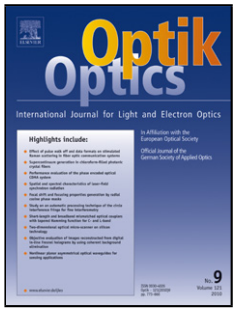

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Experimental observation of the bipolar super-regular breathers dynamics induced by modulation instability from arbitrary perturbed background

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Abstract：The solitons dynamics induced by more practical and complex forms of modulation instability (MI) have still not been revealed. In this paper, the solitons dynamics induced by MI with randomly perturbed initial conditions are observed experimentally. The mark of the MI development from linear stage to nonlinear development stage is the appearance of particular classes of super-regular breathers with bipolar complex oscillation structure. The interaction of the multiple sets of opposite quasi-degenerate four wave mixing processes can be treated as a sort of "turbulence" appearing as a result of nonlinear development of MI. Our results open up possibilities to explore the MI that develops from some kind of arbitrary perturbed background.

Keywords: Modulation instability; The nonlinear stage of MI; Regular breathers; Bipolar super-regular breathers; Fermi-Pasta-Ulam recurrence

1. Introduction

Modulation instability (MI) as a ubiquitous phenomenon in nature has been widely studied since 1967 [1], because of the intrinsic scientific interest and extensive applications in the field of material science, water hydrodynamics, and nonlinear optics. The initial stage of MI is found to be linear [2,3], however, the linearization theory becomes invalid as MI develops into nonlinear stage [4]. This