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Modulation instability of weakly nonlinear long internal wave packets

Tatiana Talipova^{1,2} and Efim Pelinovsky^{1,2,3}

¹Institute of Applied Physics RAS, Nizhny Novgorod, Russian Federation (tgtalipova@mail.ru)

²Nizhny Novgorod State Technical University na. R.E. Alekseev, Nizhny Novgorod, Russian Federation

³National Research University - Higher School of Economics, Nizhny Novgorod, Russian Federation

We exam the problem of the modulation instability of long internal waves. Such weakly nonlinear weakly dispersive wave packets in one-modal approximation are described by the Gardner equation (Korteweg-de Vries equation with both, quadratic and cubic nonlinearity and necessity condition for modulation instability of such quasi-harmonic waves is the positive coefficient of cubic nonlinear term, which is realized for certain density stratification. Nevertheless the linear dispersive relation used within the Gardner equation is valid for very long waves and does not describe waves of moderate length. It is why some other nonlinear evolution equations are applied in the theory of long surface waves like the Benjamin-Bona-Mahony (BBM) and Whitham equations. We use the extended versions of these equations including cubic nonlinear term and express all coefficients through modal functions and density stratification. Then, the modulational instability of weakly modulated wave packets is investigated after deriving the nonlinear Schrodinger equation. Improved dispersion relation influences on the increment and size of modulational instability. Obtained results are compared with those, which known within the Gardner model.

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