CMB polarization from secondary vector and tensor modes

Silvia Mollerach Centro Atómico Bariloche, Av. Bustillo 9500
mollerach@cab.cnea.gov.ar Diego Harari Departamento de Física, FCEyN, Universidad de Buenos Aires
harari@df.uba.ar Sabino Matarrese Dipartimento di Fisica ‘G. Galilei’, Università di Padova
matarrese@pd.infn.it

abstract

We consider a novel contribution to the polarization of the Cosmic Microwave Background induced by vector and tensor modes generated by the non-linear evolution of primordial scalar perturbations. Our calculation is based on relativistic second-order perturbation theory and allows to estimate the effects of these secondary modes on the polarization angular power-spectra. We show that a non-vanishing B-mode polarization unavoidably arises from pure scalar initial perturbations, thus limiting our ability to detect the signature of primordial gravitational waves generated during inflation. This secondary effect dominates over that of primordial tensors for an inflationary tensor-to-scalar ratio $r < 10^{-6}$. The magnitude of the effect is smaller than the contamination produced by the conversion of polarization of type E into type B, by weak gravitational lensing. However the lensing signal can be cleaned, making the secondary modes discussed here the actual background limiting the detection of small amplitude primordial gravitational waves.