Gravitational lensing as a contaminant of the gravity wave signal in CMB

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abstract Gravity waves (GW) in the early universe generate $B$-type polarization in the cosmic microwave background (CMB), which can be used as a direct way to measure the energy scale of inflation. Gravitational lensing contaminates the GW signal by converting the dominant $E$ polarization into $B$ polarization. By reconstructing the lensing potential from CMB itself one can decontaminate the $B$ mode induced by lensing. We present results of numerical simulations of $B$ mode delensing using quadratic and iterative maximum-likelihood lensing reconstruction methods as a function of detector noise and beam. In our simulations we find the quadratic method can reduce the lensing $B$ noise power by up to a factor of 7, close to the no noise limit. In contrast, the iterative method shows significant improvements even at the lowest noise levels we tested. We demonstrate explicitly that with this method at least a factor of 40 noise power reduction in lensing induced $B$ power is possible, suggesting that $r = P_B/P_R \sim 10^{-6}$ may be achievable in the absence of sky cuts, foregrounds, and instrumental systematics. While we do not find any fundamental lower limit due to lensing, we find that for high-sensitivity detectors residual lensing noise dominates over the detector noise.