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Enhancement of Gravitational Waves Induced by Scalar Perturbations due to a Sudden Transition from an Early Matter Era to the Radiation Era

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We study gravitational waves induced from the primordial scalar perturbations at second order around the reheating of the Universe. We consider reheating scenarios in which a transition from an early matter dominated era to the radiation dominated era completes within a timescale much shorter than the Hubble time at that time. We find that an enhanced production of induced gravitational waves occurs just after the reheating transition because of fast oscillations of scalar modes well inside the Hubble horizon. This enhancement mechanism just after an early matter-dominated era is much more efficient than a previously known enhancement mechanism during an early matter era, and we show that the induced gravitational waves could be detectable by future observations if the reheating temperature $T_{\rm R}$ is in the range $T_{\rm R}$\lesssim 7×10^{-2} GeV or 20 GeV \lesssim $T_{\rm R}$ \lesssim 2×10^{7} GeV. This is the case even if the scalar perturbations on small scales are not enhanced relative to those on large scales, probed by the observations of the cosmic microwave background. This talk will be based on our paper, arXiv:1904.12879.

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