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WKB approximation for inflationary cosmological perturbations

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abstract A new method for predicting inflationary cosmological perturbations, based on the Wentzel–Kramers–Brillouin (WKB) approximation, is presented. A general expression for the WKB scalar and tensor power spectra is derived. The main advantage of the new scheme of approximation is that it is valid even if the slow-roll conditions are violated. The method is applied to power-law inflation, which allows a comparison with an exact result. It is demonstrated that the WKB approximation predicts the spectral indices exactly and the amplitude with an error lower than 10%, even in regimes far from scale-invariance. The new method of approximation is also applied to a situation where the slow-roll conditions hold. It is shown that the result obtained bears close resemblance with the standard slow-roll calculation. Finally, some possible improvements are briefly mentioned.