Non-Gaussianity from Lifshitz Scalar

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Because Lisfhitz scalar with z=3 does not scale, primordial perturbations of
Lifshitz scalar can become scale-invariant without inflation.

(Shinji Mukohyama 2009)

Because of the behavior of scale-invariance of Lifshitz scalar,
the higher order terms are as important as the second order term.

$$S = \tfrac{1}{2} \int d\eta d^3 x \left(a^2 (\partial_\eta \phi)^2 + M^{-4} a^{-2} \phi \frac{\Delta^3}{M^4} \phi \right)$$

$$S_{\alpha 1} = \int dt d^3 x M^{-5} a^{-3}(t) \alpha_1 \phi^2 \Delta^3 \phi$$

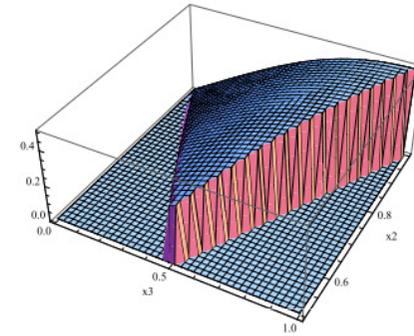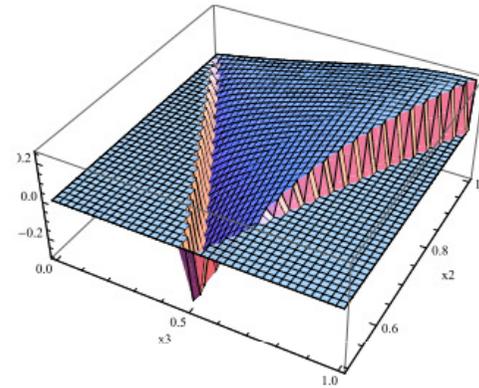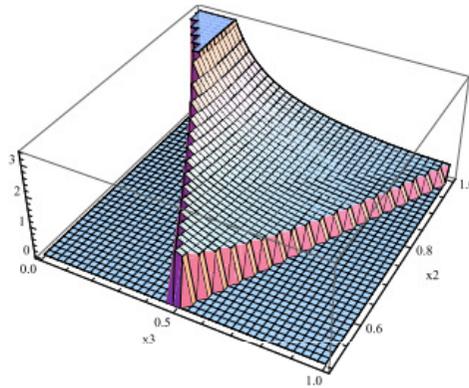Therefore, we expect naively that the non-linear parameter "f_{nl}" is 10^5 α.

However, "f_{nl}" obtained by concrete calculation is actually 10^3 α.
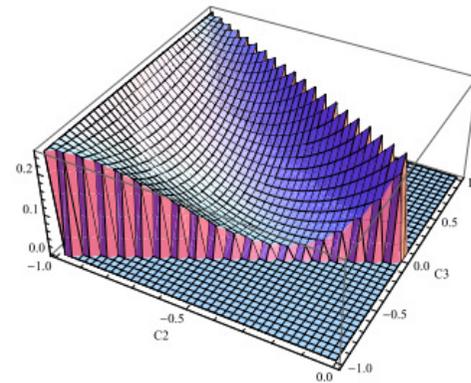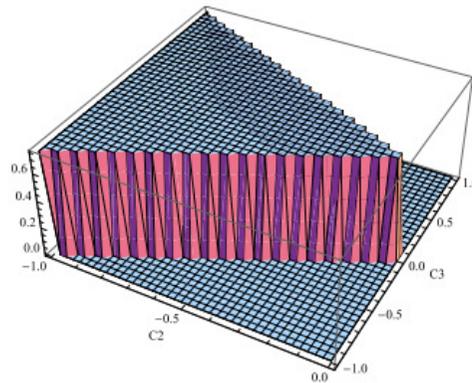From constraint of the WMAP, α must be smaller than 10^-1.
As a result, α is not so strongly restricted.

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We show the shape of momentum dependence of bispectrum and trispectrum.

bispectrim

trispectrim

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