The Galaxy Bispectrum as a Probe of Primordial non-Gaussianity

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Goals

- study bispectrum as a measure of interactions between short and long modes
- compare the constraints on f_{NL} to the power spectrum analysis

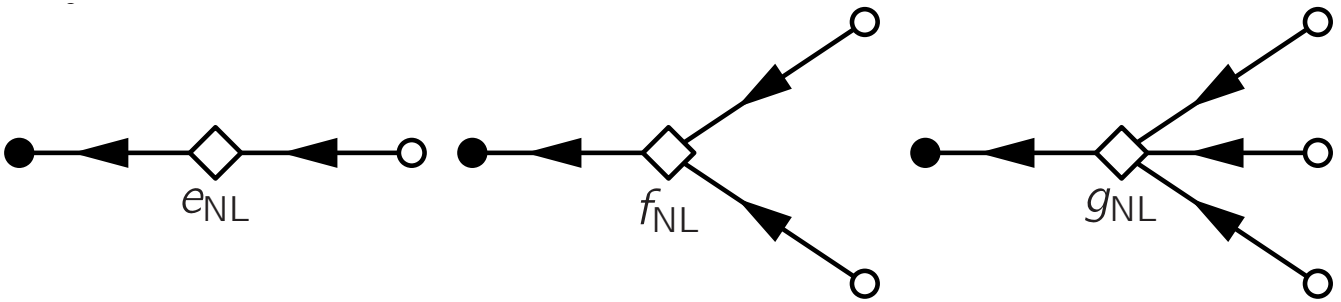
Approach

- consistent modeling of
  - non-Gaussianity
  - non-linear clustering
  - biased tracers

Local non-Gaussianity

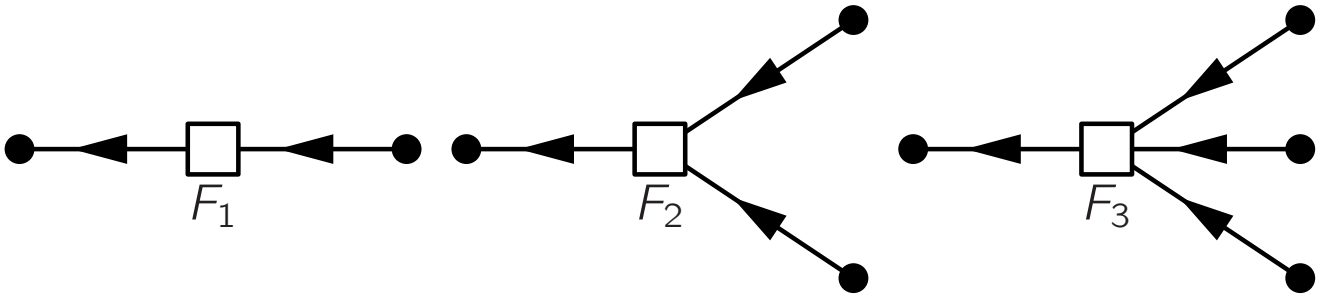
$$\Phi_{\mathrm{nG}}(\mathbf{x}) = \varphi(\mathbf{x}) + f_{\mathrm{NL}}\left(\varphi^2(\mathbf{x}) - \left\langle\varphi^2\right\rangle\right)$$

$$\delta(\mathbf{k}) = \alpha(k)\varphi(\mathbf{k}) + \alpha(k) f_{\mathrm{NL}} \int \mathrm{d}^3 q_1 \int \mathrm{d}^3 q_2\, \delta^{(\mathrm{D})}(\mathbf{k}-\mathbf{q})\varphi(\mathbf{q}_1)\varphi(\mathbf{q}_2) + \ldots$$



Non-linear Clustering

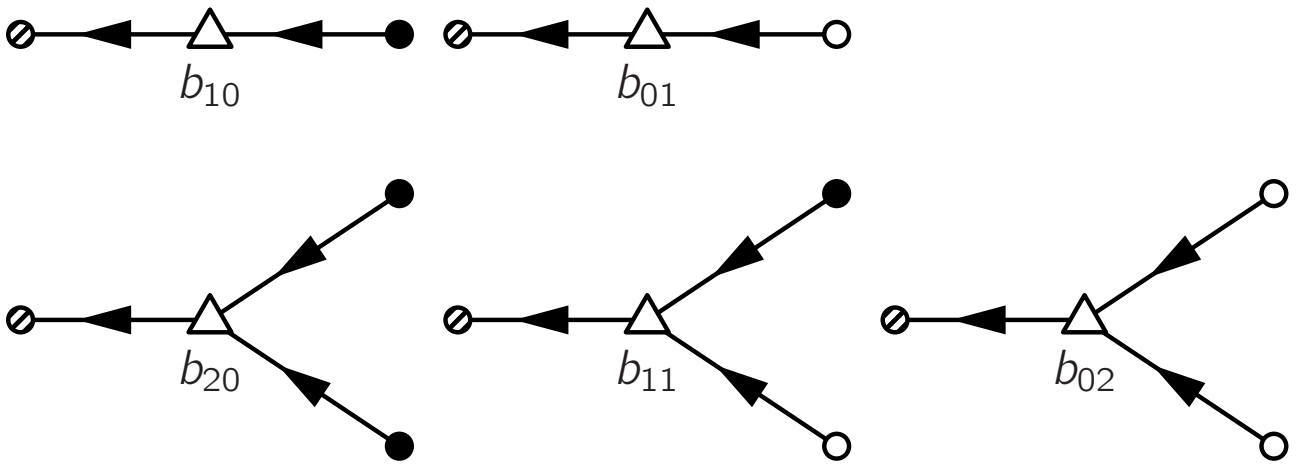
$$\delta^{(n)}(\mathbf{k}) = \int \mathrm{d}^3 q_1 \ldots \int \mathrm{d}^3 q_n \, \delta^{(\mathrm{D})}(\mathbf{k} - \mathbf{q}) \, F_n(\mathbf{q}_1, \ldots, \mathbf{q}_n) \delta^{(1)}(\mathbf{q}_1) \ldots \delta^{(1)}(\mathbf{q}_n)$$



Multivariate Biasing[1]

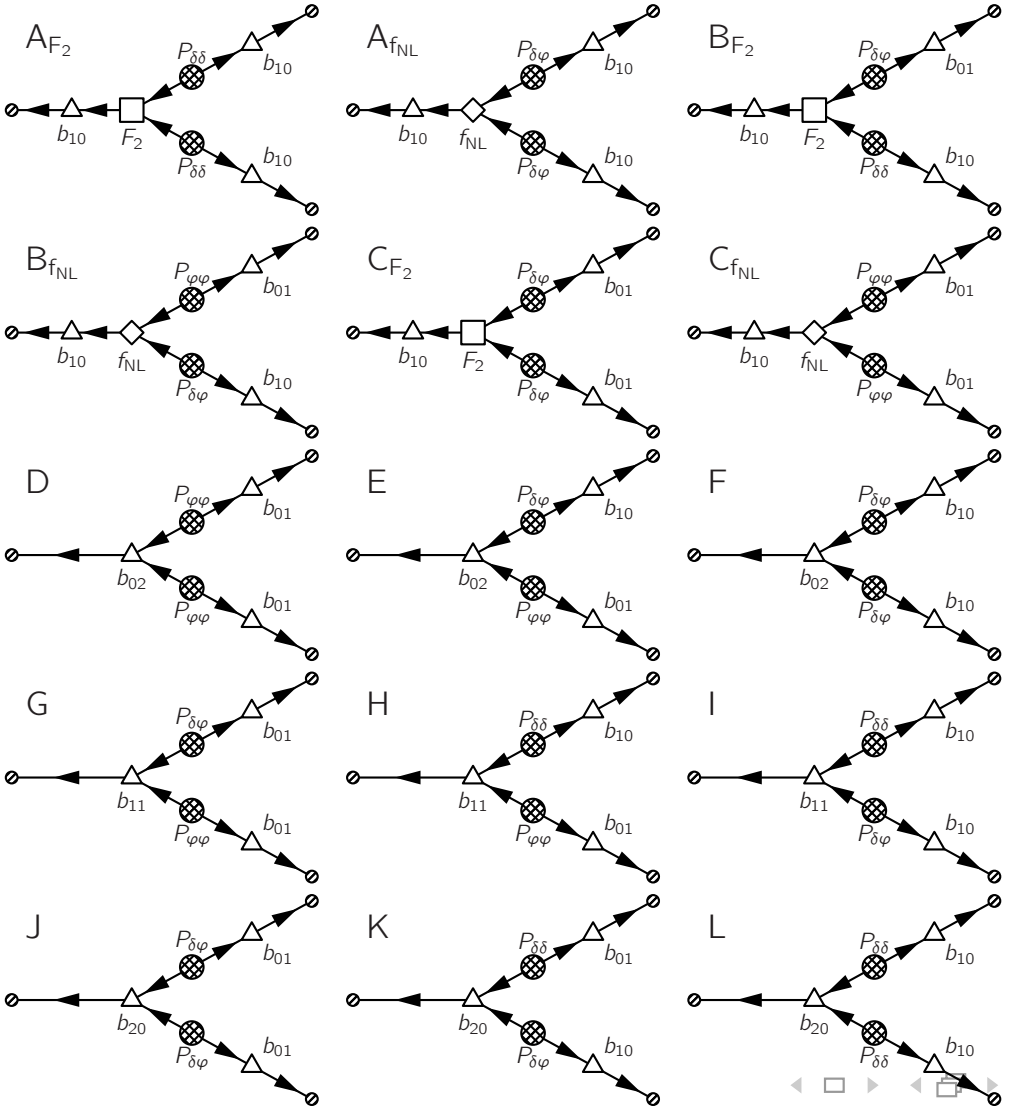
$$\delta_{\mathrm{g}}(\mathbf{x}) = \sum_{i,j} b_{ij} \delta^i(\mathbf{x}) \varphi^j(\mathbf{x})$$

$$\delta_{\mathrm{g},ij}(\mathbf{k}) = b_{ij} \int \mathrm{d}^3 q_1 \ldots \int \mathrm{d}^3 q_{i+j}\, \delta^{(\mathrm{D})}(\mathbf{k} - \mathbf{q})\, \delta(\mathbf{q}_1) \ldots \varphi(\mathbf{q}_{i+j})$$

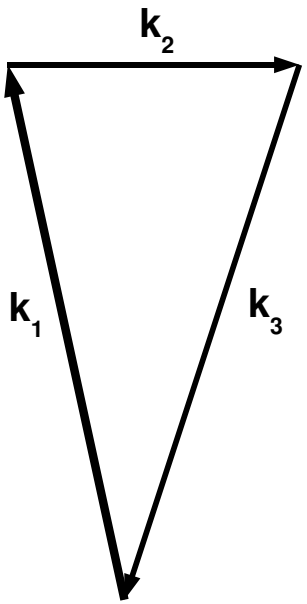


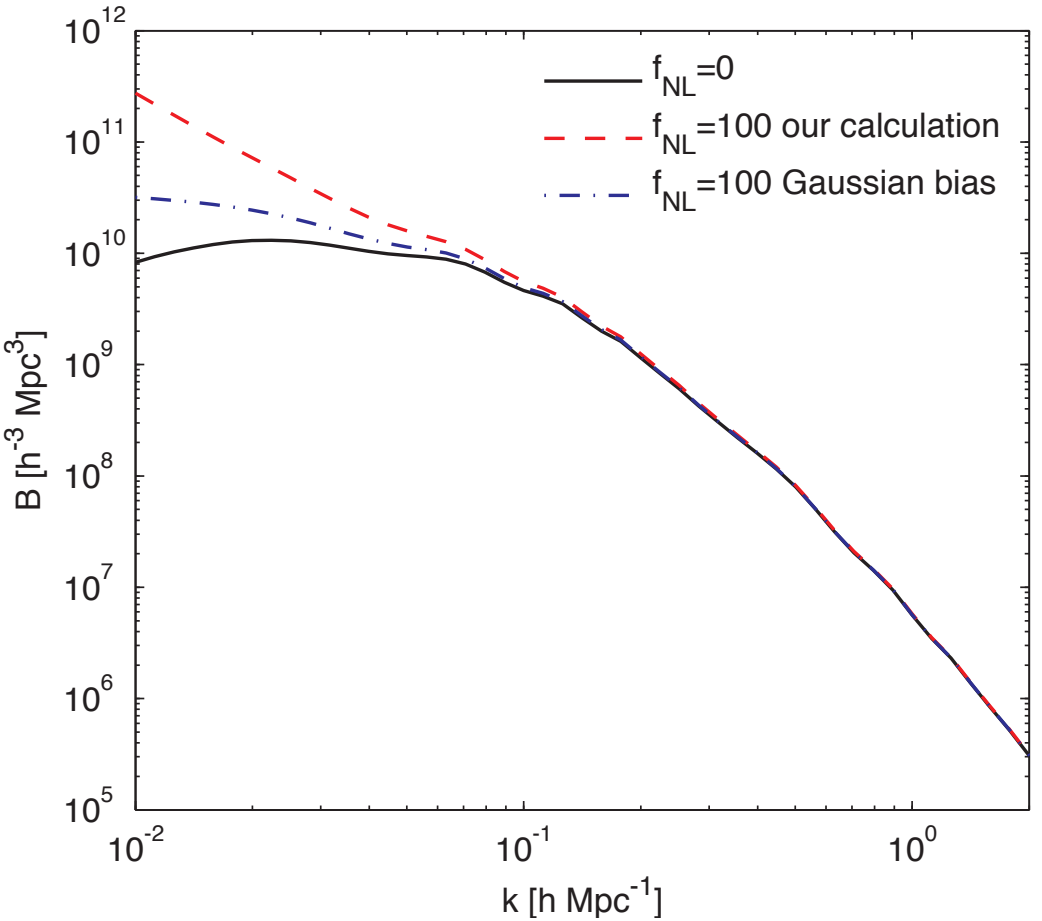
[1] [Giannantonio & Porciani 2010]

Galaxy Bispectrum

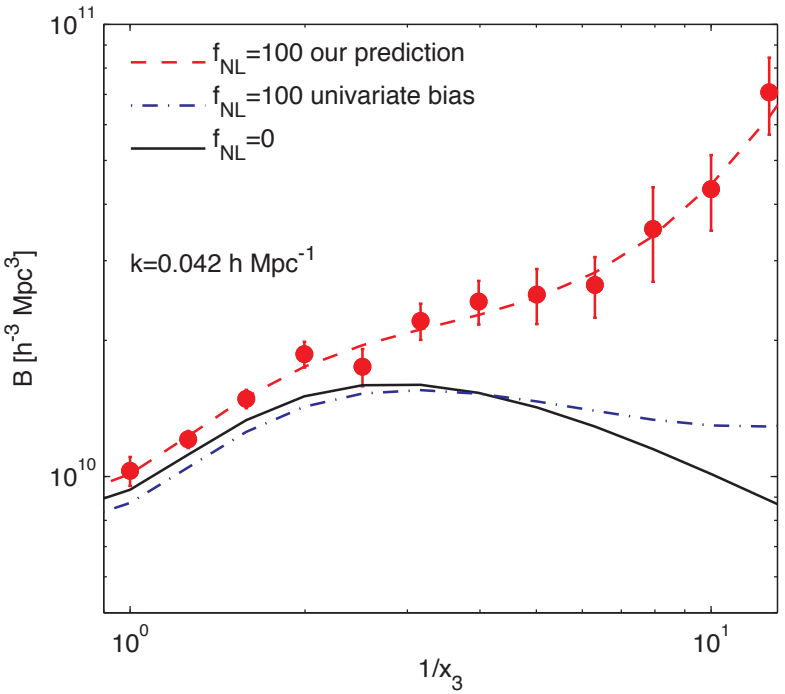


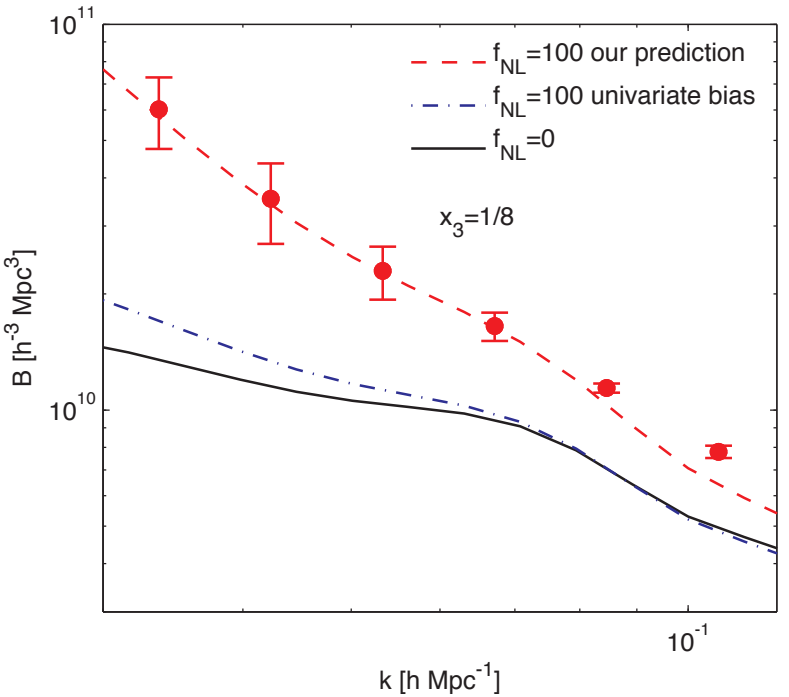
Galaxy Bispectrum - Squeezed Configuration





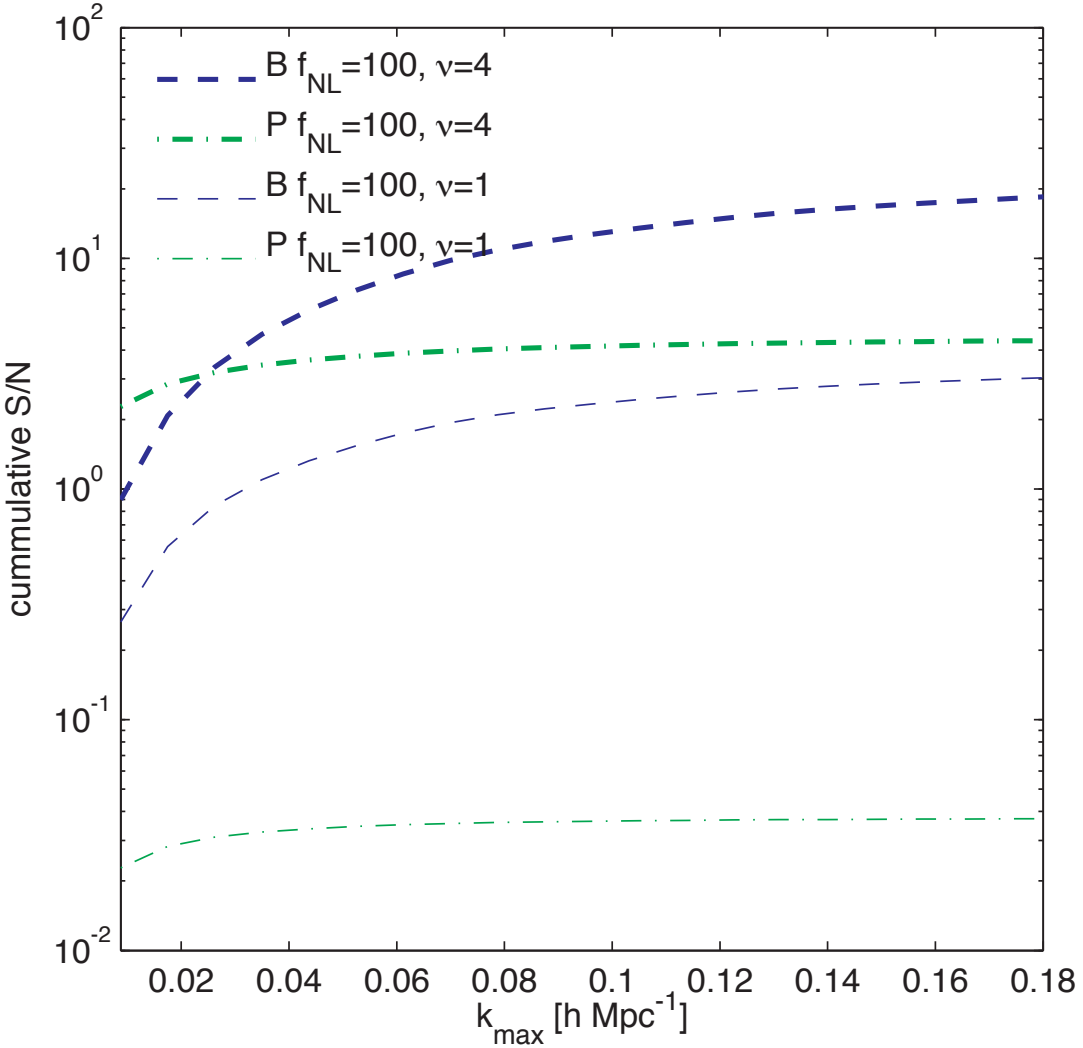
Comparison to Simulations[2]





[2] [Nishimichi et al. 2010]

Galaxy Bispectrum - Signal-to-Noise



Summary

Achievements

- diagrammatic prescription including effects of
  - clustering
  - biasing
  - non-Gaussianity
- corrections to existing Bispectrum calculations at tree level
- bispectrum information on nG exceeding power spectrum analysis