Title: TBA

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URL: http://pirsa.org/10040094

Abstract: TBA

There are basically three derivations of this effect:

- Peak Background Split (PBS): objects correspond to $\delta_{\rm lin} > \delta_c$

$$\Delta b_1(k, f_{\rm NL}) = \frac{2 f_{\rm NL}}{M(k)} (b_{10} - 1)\delta_c$$

- Gaussian Field Peaks in high-threshold limit $(\nu \gg 1)$

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- Local Eulerian bias model $(\delta_g = b_1 \delta + \frac{b_2}{2}\delta^2 + \ldots)$

$$\Delta b_1(k, f_{\rm NL}) = \frac{2 f_{\rm NL}}{M(k)} b_2 \sigma^2$$

here M relates the density to the Bardeen potential through the Poisson eqn

$$M(k) = \frac{2c^2k^2T(k)D(z)}{3\Omega_m H_0^2} \sim k^2 \qquad (k \to 0)$$

n local Eulerian models and peaks there is a generic formula (for any type ›rimordial non-Gaussianity) for the low-k power change

$$\Delta P(k) \sim \int B(-\mathbf{k}, \mathbf{q}, \mathbf{k}-\mathbf{q}) d^3q$$

$$= \int M(k) M(q) M(|\mathbf{k}-\mathbf{q}|) B_\Phi(-\mathbf{k}, \mathbf{q}, \mathbf{k}-\mathbf{q}) d^3q$$

n PBS one splits long wavelength from small scale fluctuations,

$$\phi = \phi_\ell + \phi_s$$

$$\delta \sim \delta_\ell + \nabla^2\phi_s + f_{\rm NL}\nabla^2(\phi_\ell + \phi_s)^2 \equiv \delta_\ell + \delta_s$$

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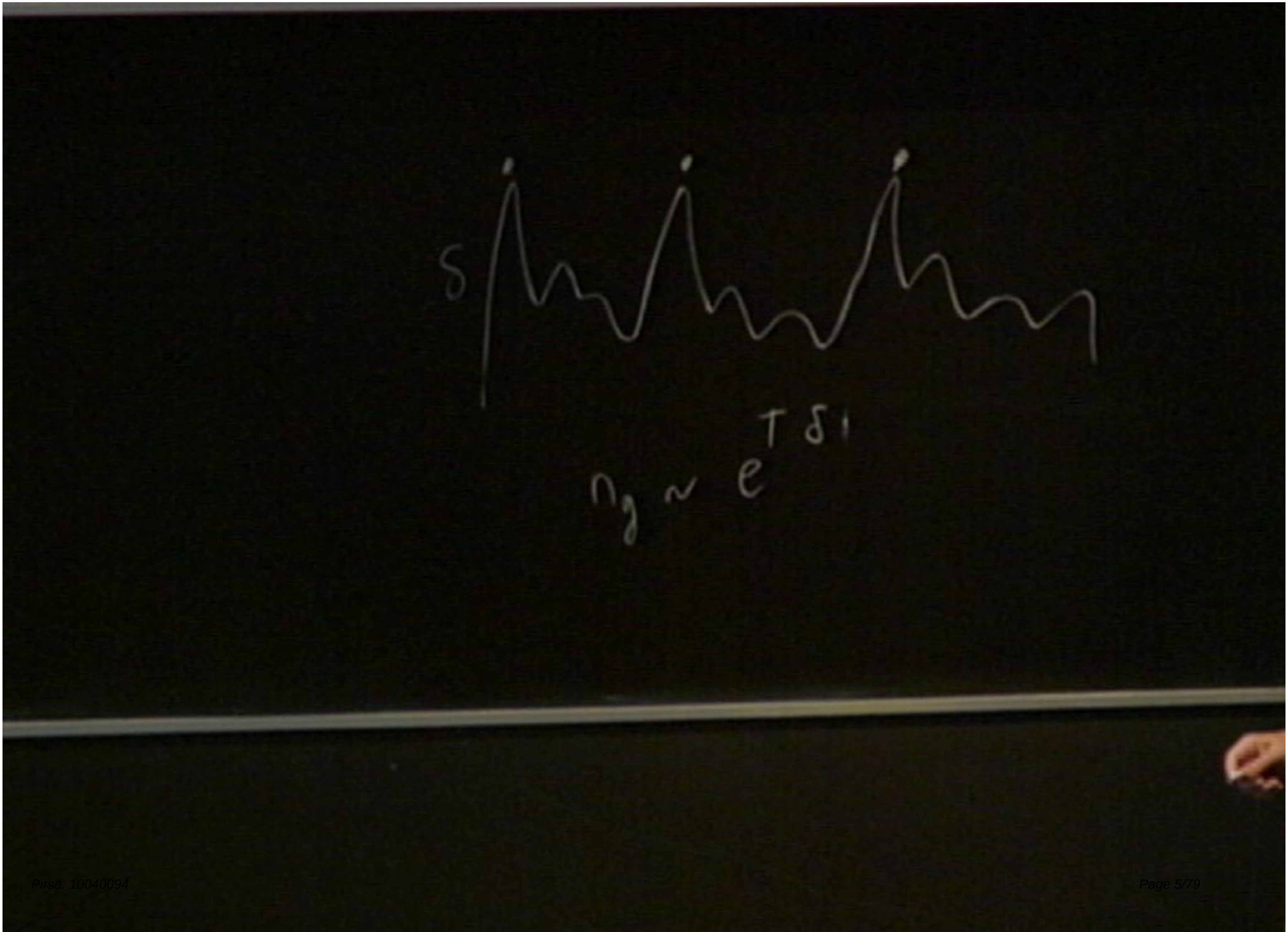
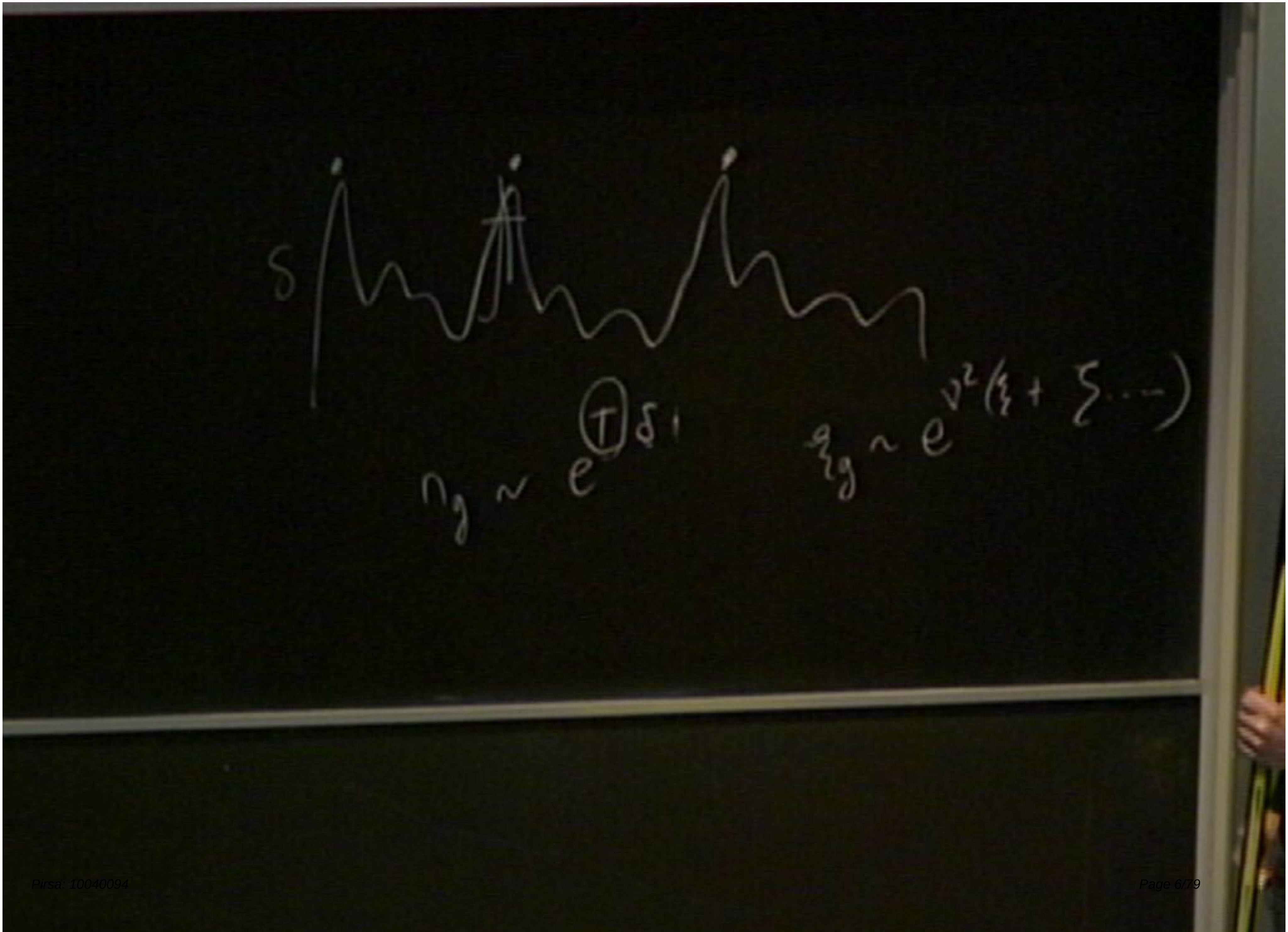

δ
$n_\gamma \sim e^{T\delta}$



$$n_g \sim e^{(T)\delta + \ldots}$$

$$1+\xi_g \sim e^{\nu^2(\xi + \xi \ldots)}$$

$$\approx 1 + \nu^2 \xi +$$

$$\nu^2 \xi(\bar{x}_1, \bar{x}_1, \bar{x}_2)$$

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$$b_2^{\rm peaks}\sigma^2 = 2(1-\nu_2)\frac{\nu^2-1}{\nu^2}\delta_c + (\nu^2-3)$$

all three formulae agree in the high-peak limit!

owever, the nature of bias in these three models is quite different...

PBS, to linear order we have:

$$\delta_g = 2f_{\rm NL}(b_1-1)\delta_c\phi + b_1\,\delta$$

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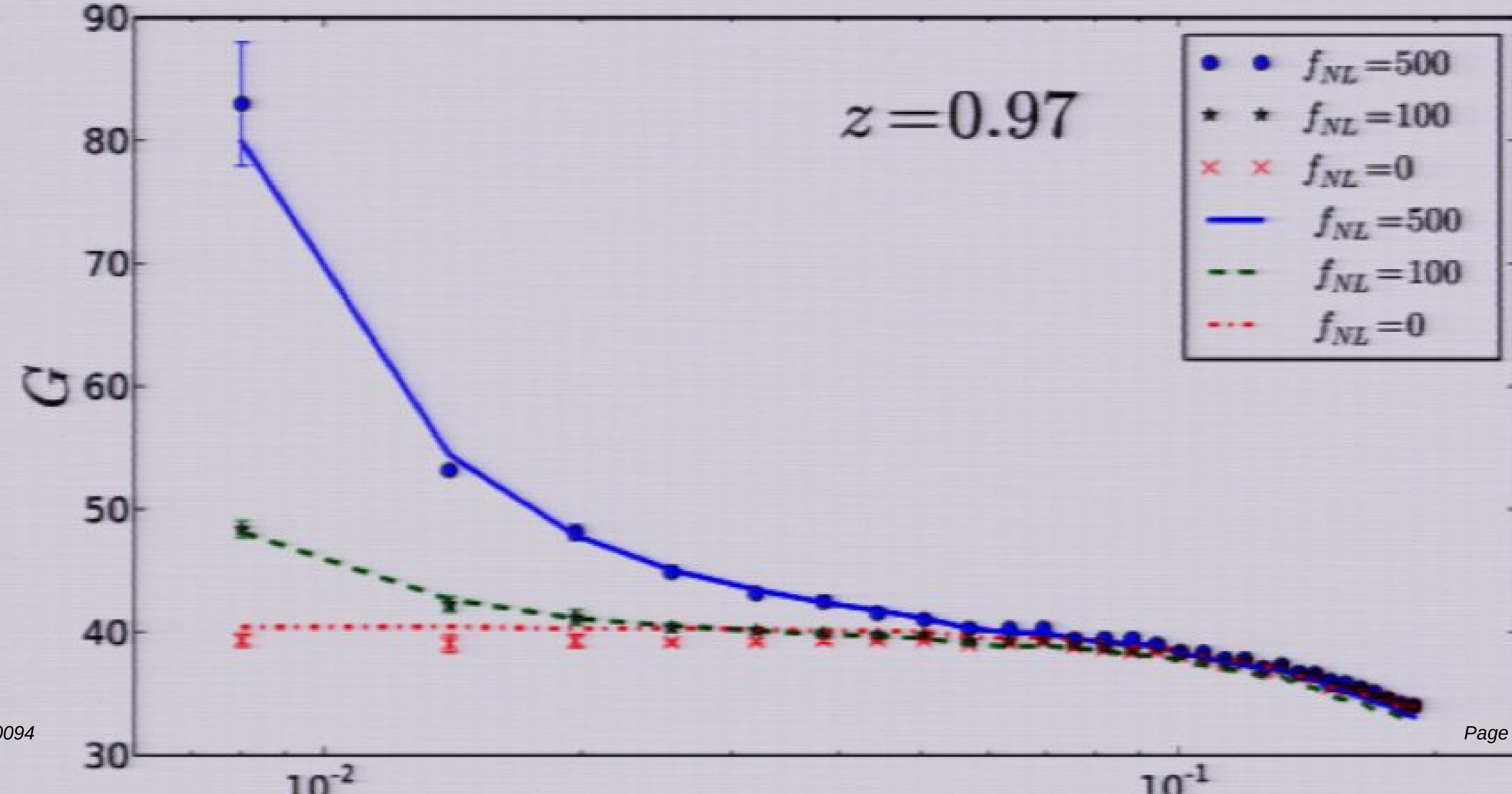
Halo propagator in N-body simulations:

clearly, local models are wrong...



Large-Scale Bias in non-local PNG

In single-field inflationary models, we are instead interested in models that correspond to non-local PNG. For example, the equilateral model has a Bardeen potential bispectrum,

$$(6f_{\rm NL})^{-1}B_{\rm equil} = -P_1P_2 - 2(P_1P_2P_3)^{2/3} + P_1^{1/3}P_2^{2/3}P_3$$

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We are interested in generating such bispectra from quadratic (non-local) models, i.e.

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where K is the appropriate non-local quadratic kernel that generates the desired bispectrum. For simplicity we assume scale-invariance.

Introduce some handy non-local operators

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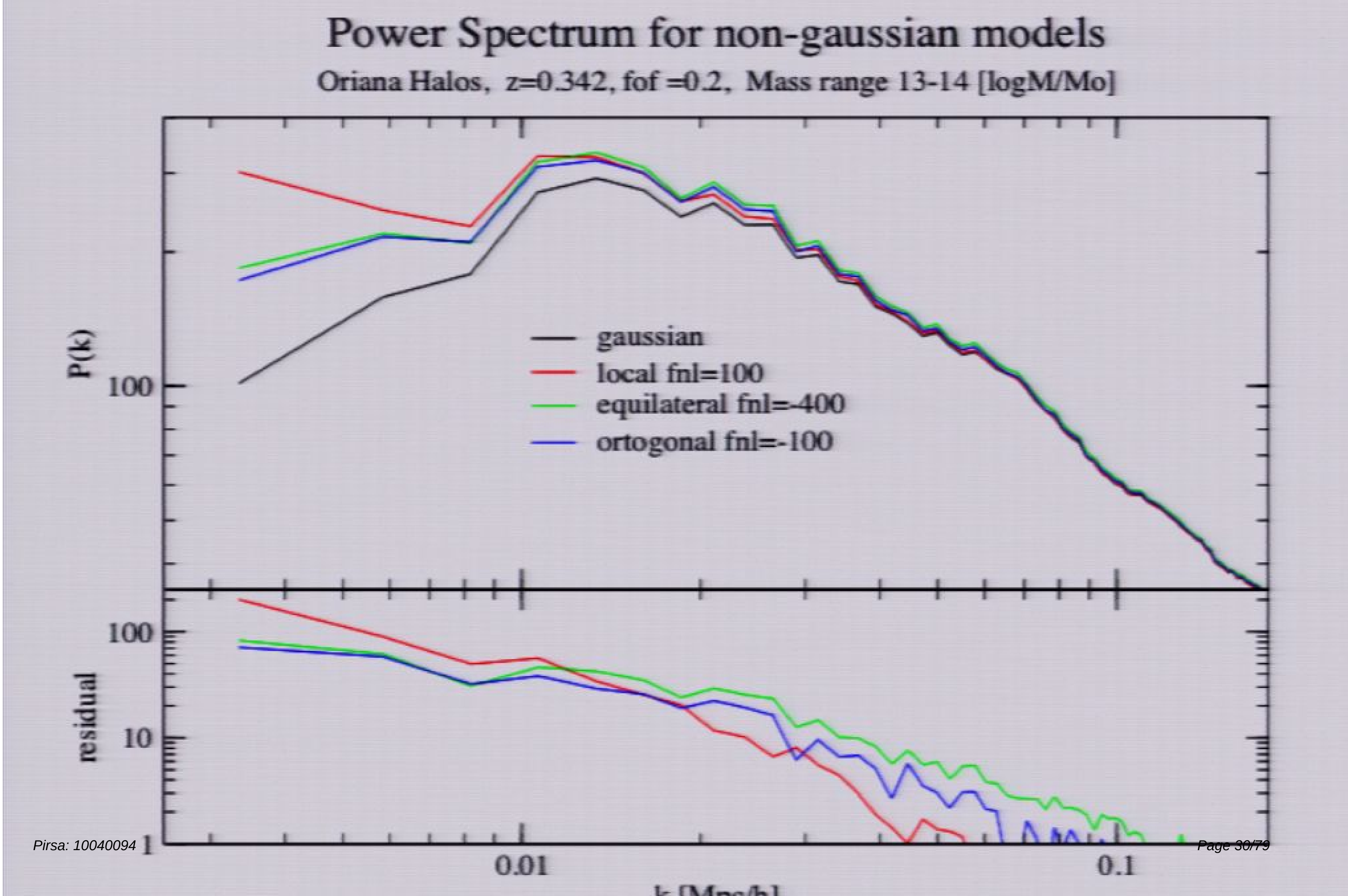
Power Spectrum for non-gaussian models
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P(k)
100
gaussian
local fnl=100
equilateral fnl=-400
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residual
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10
1
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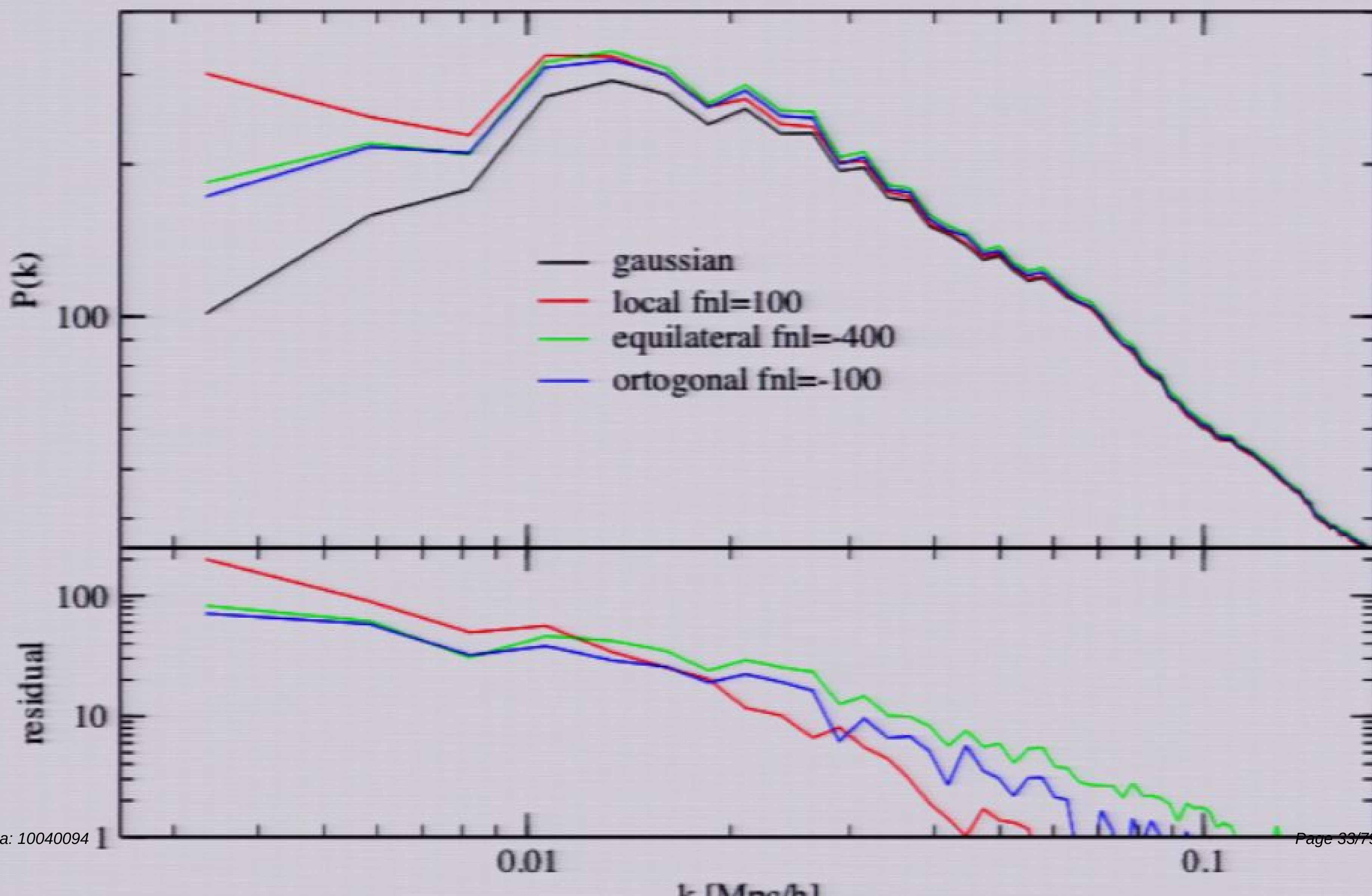

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permutations are understood), whereas the orthogonal model reads

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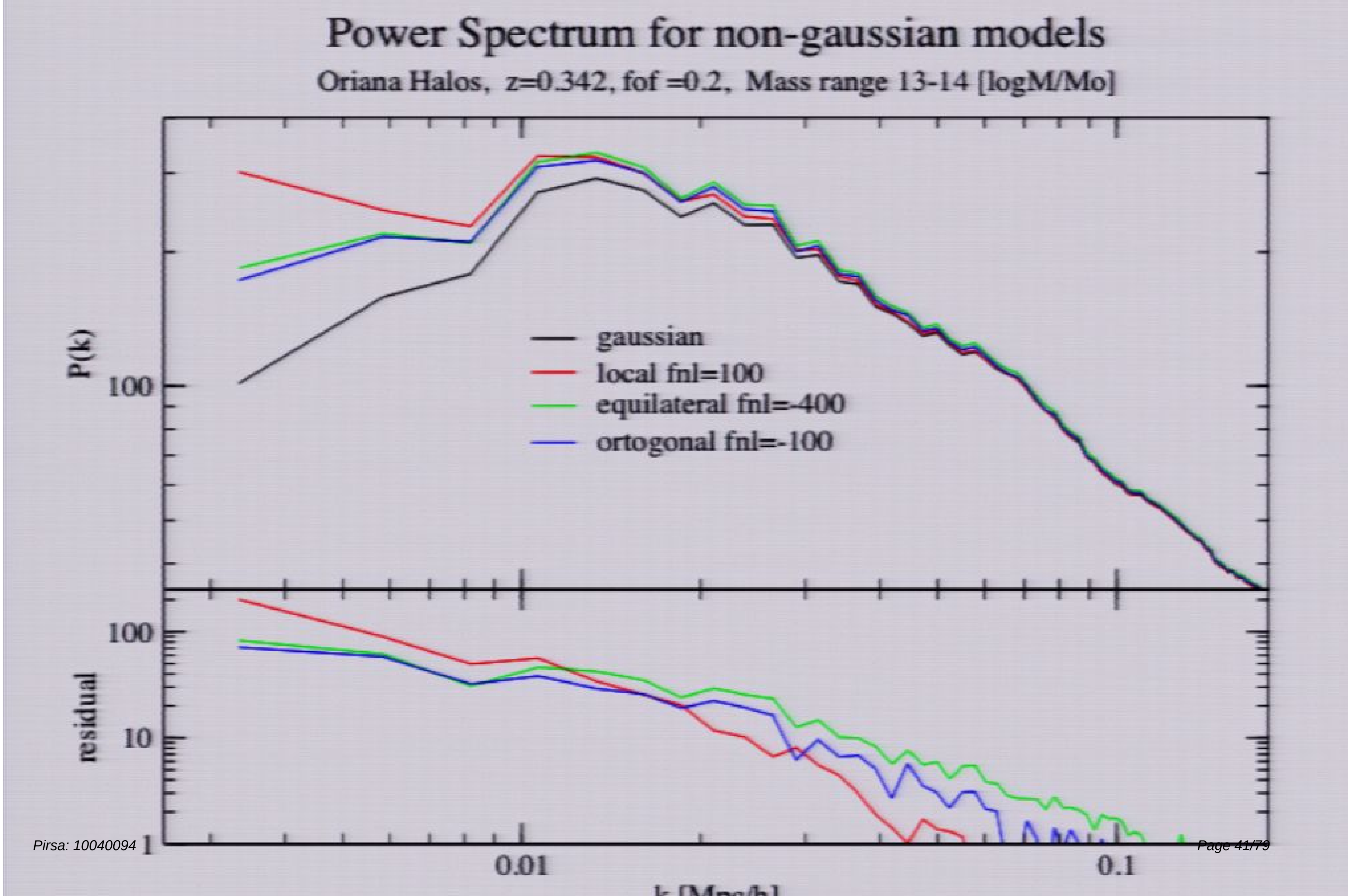

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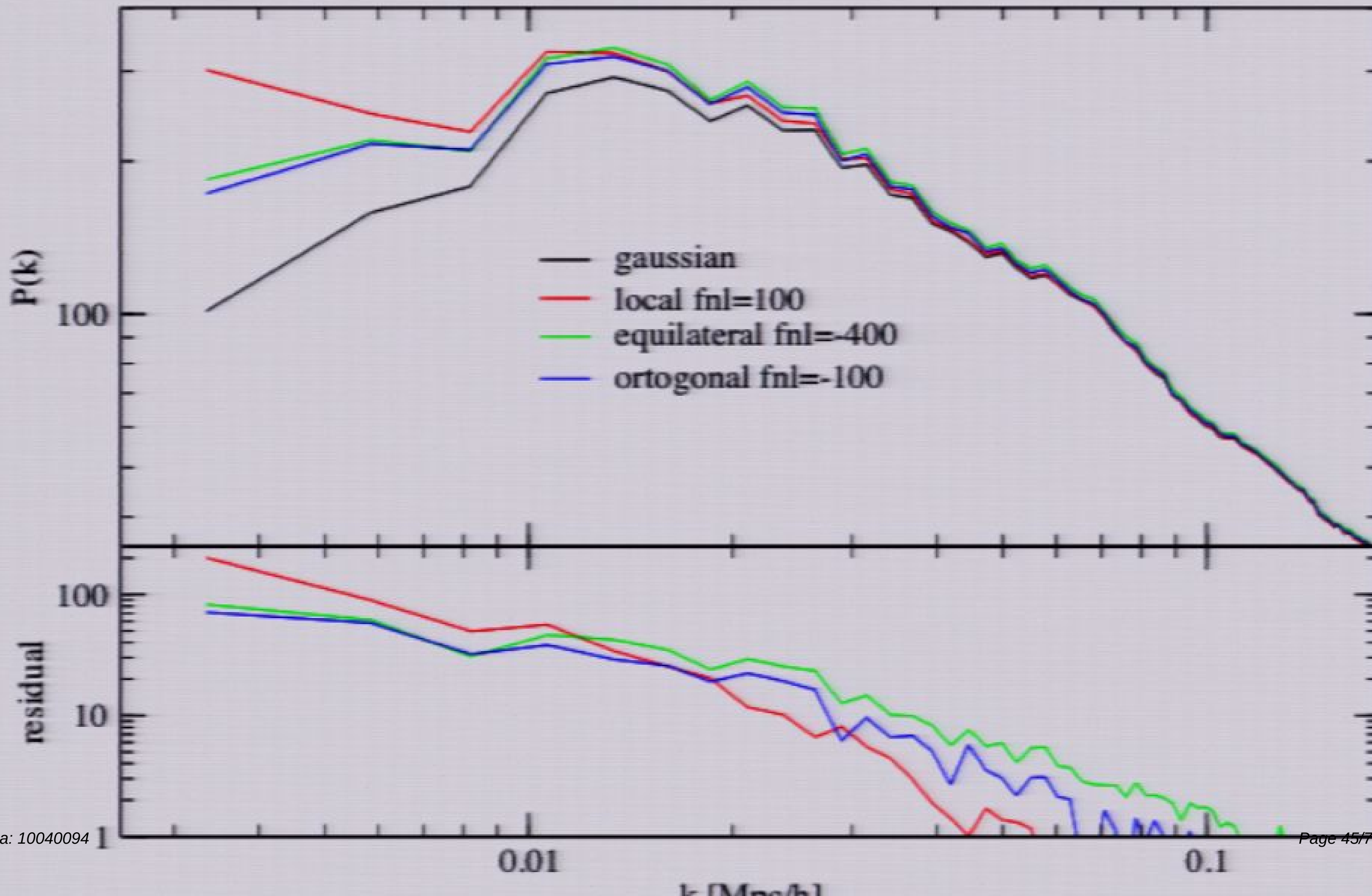

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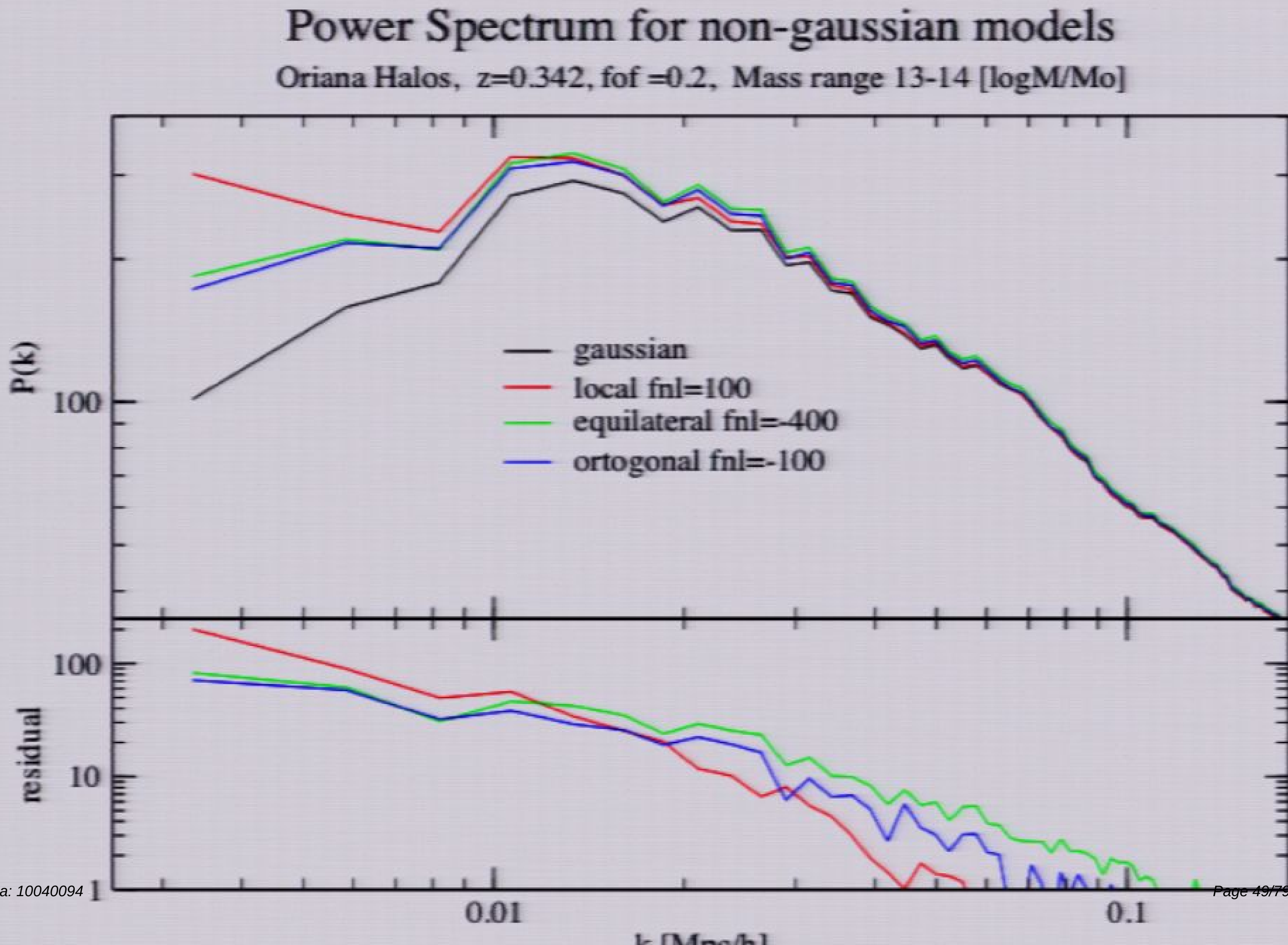
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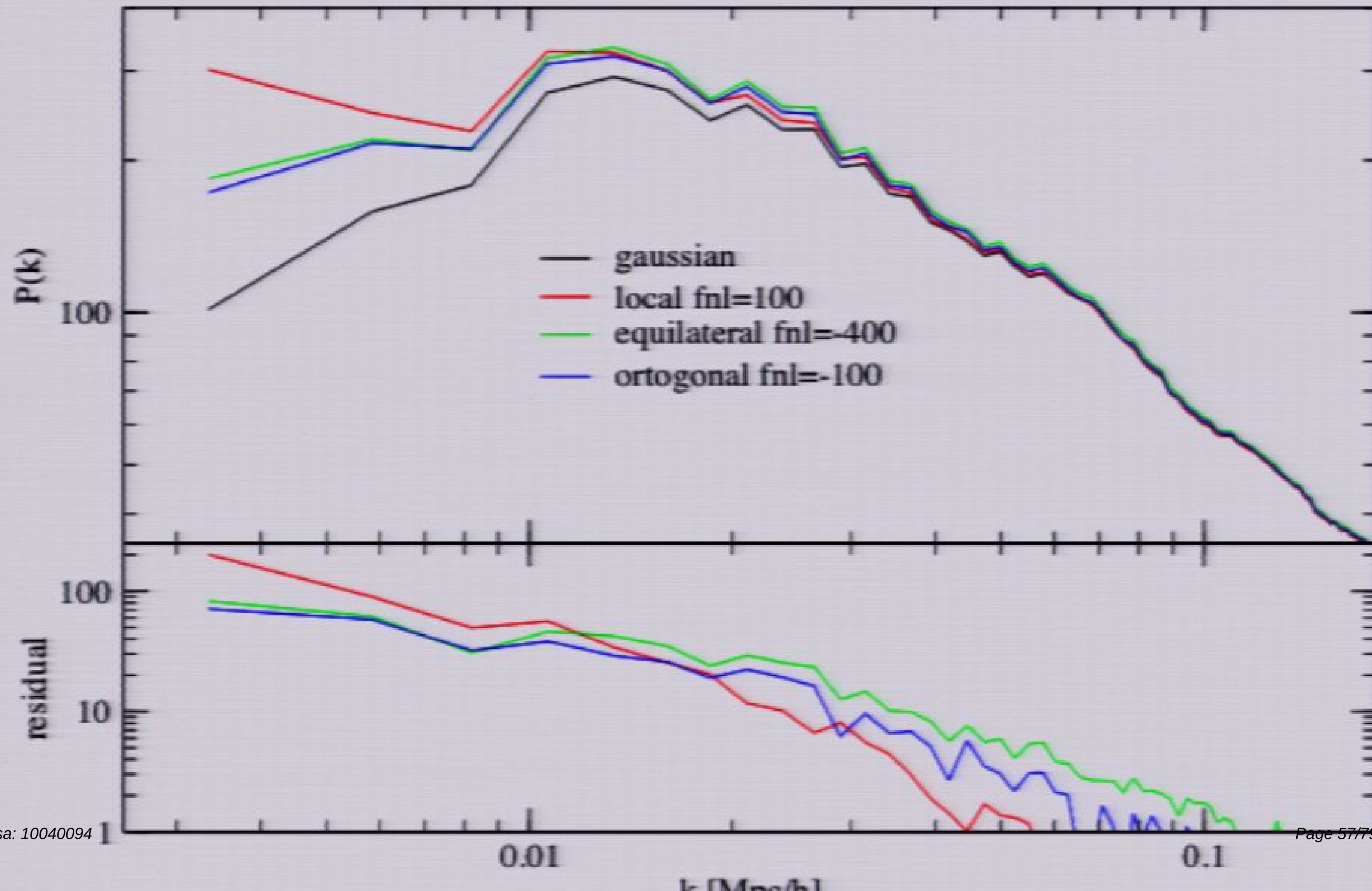
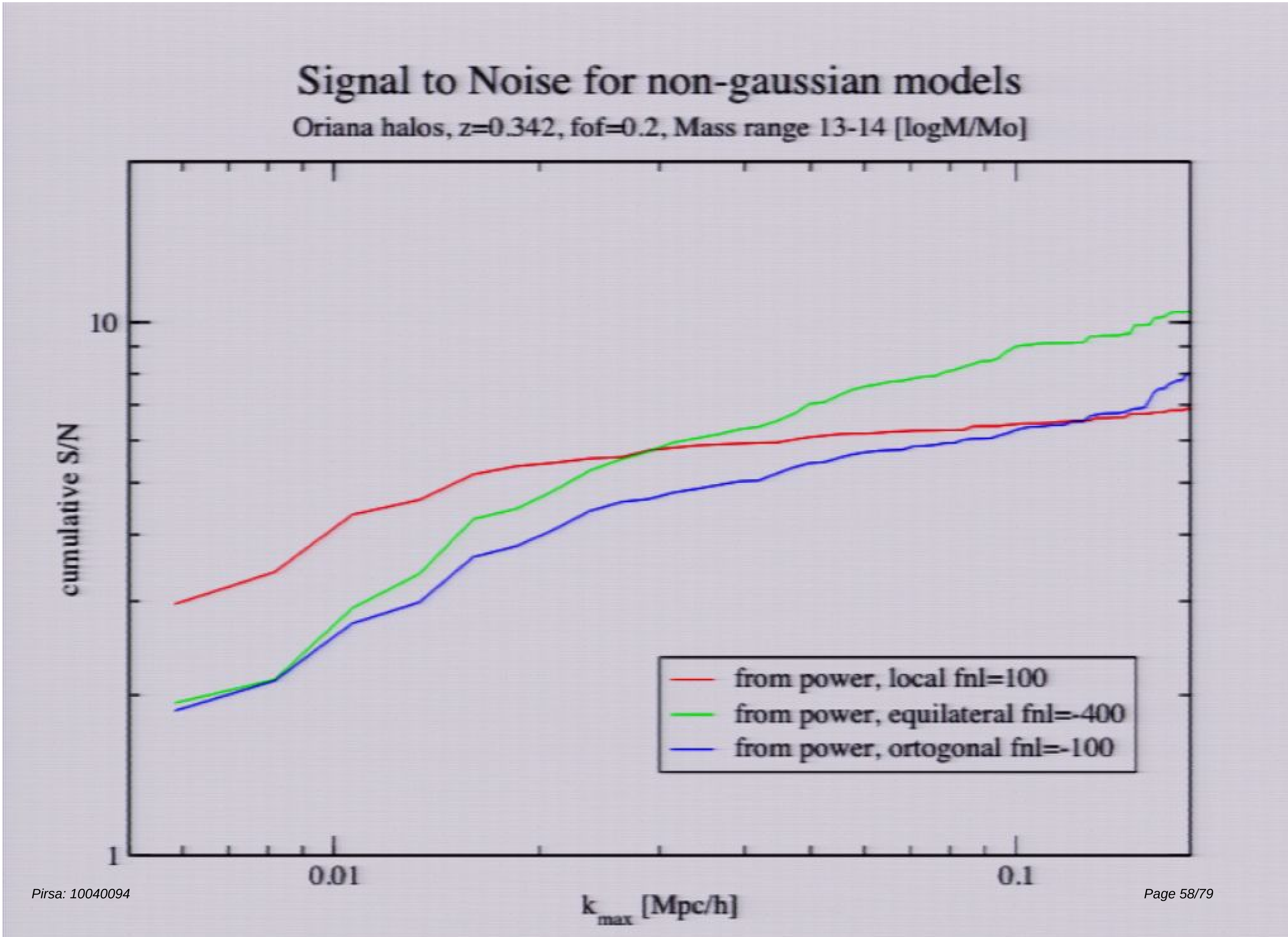
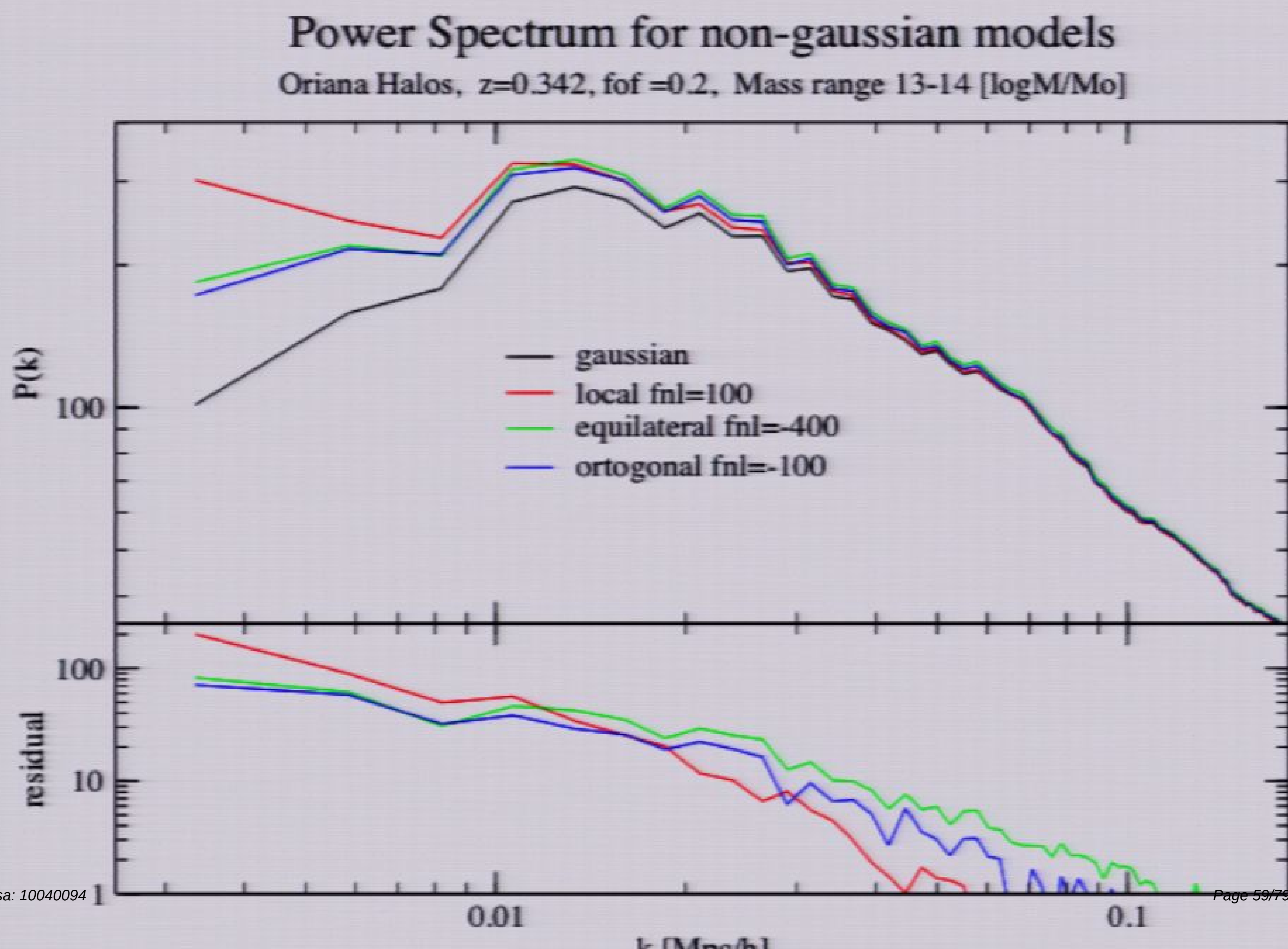




Signal to Noise for non-gaussian models
Oriana halos, z=0.342, fof=0.2, Mass range 13-14 [logM/Mo]
cumulative S/N
10
1
0.01
0.1
k max [Mpc/h]
from power, local fnl=100
from power, equilateral fnl=-400
from power, ortogonal fnl=-100



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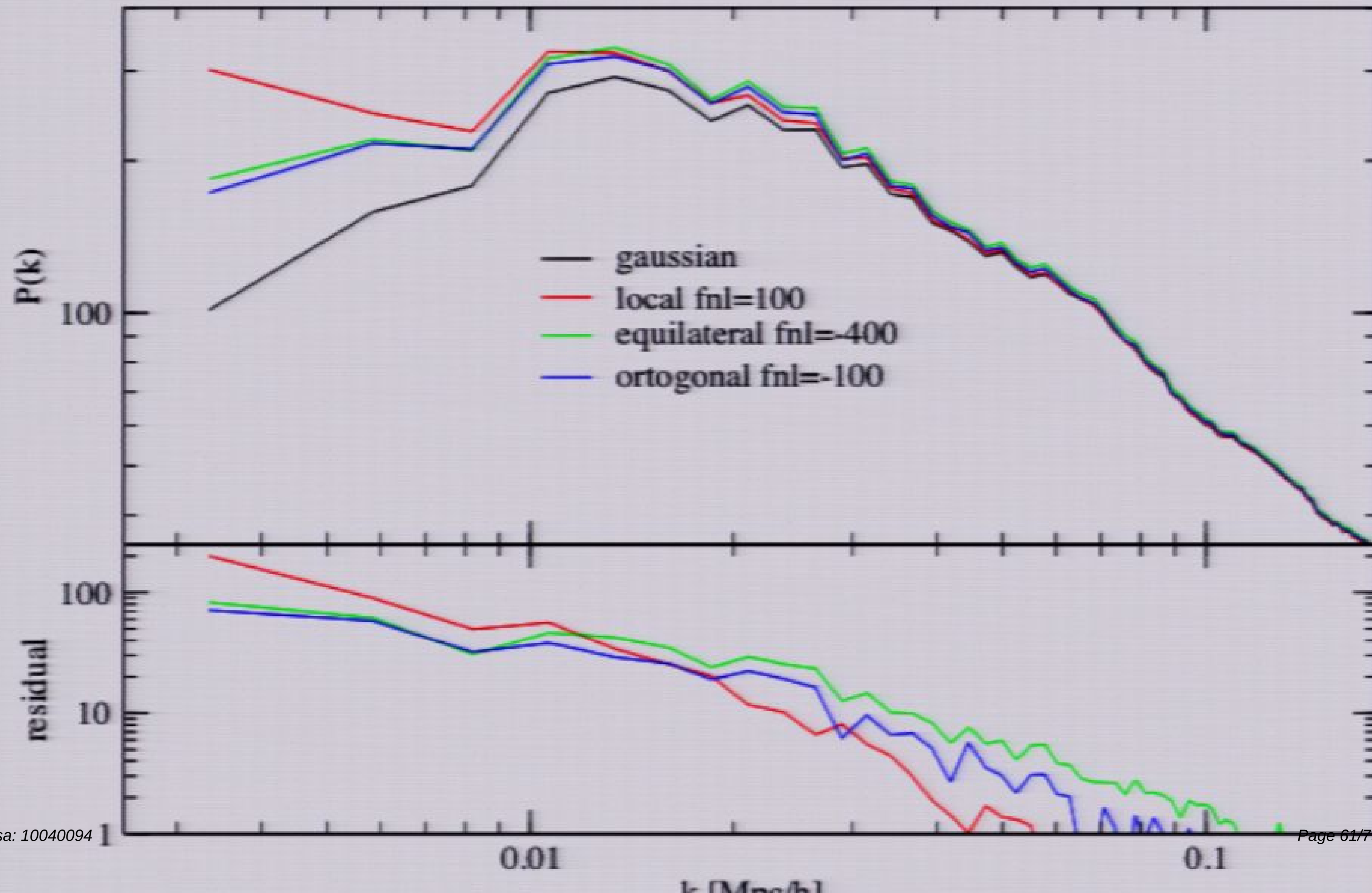

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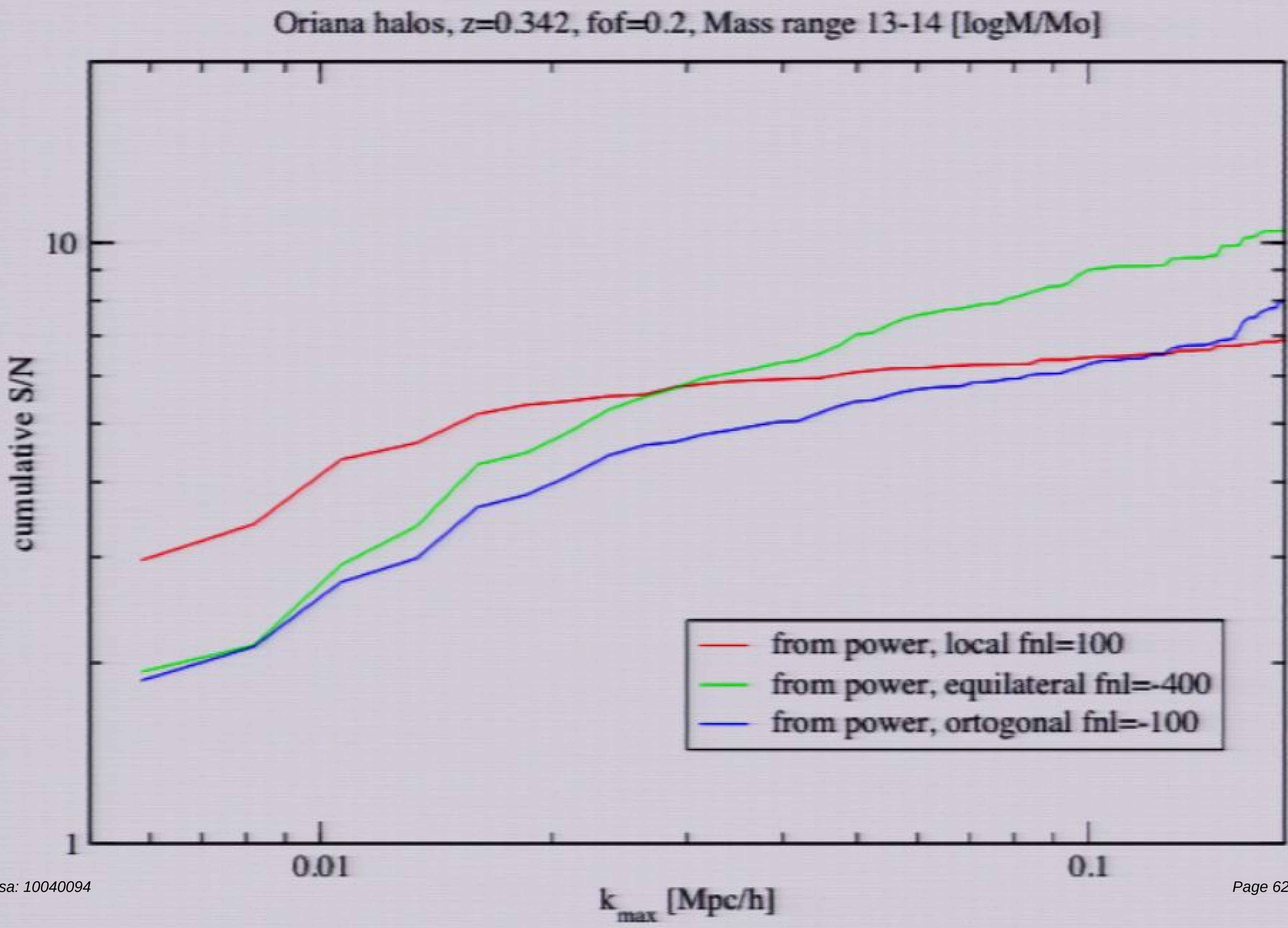
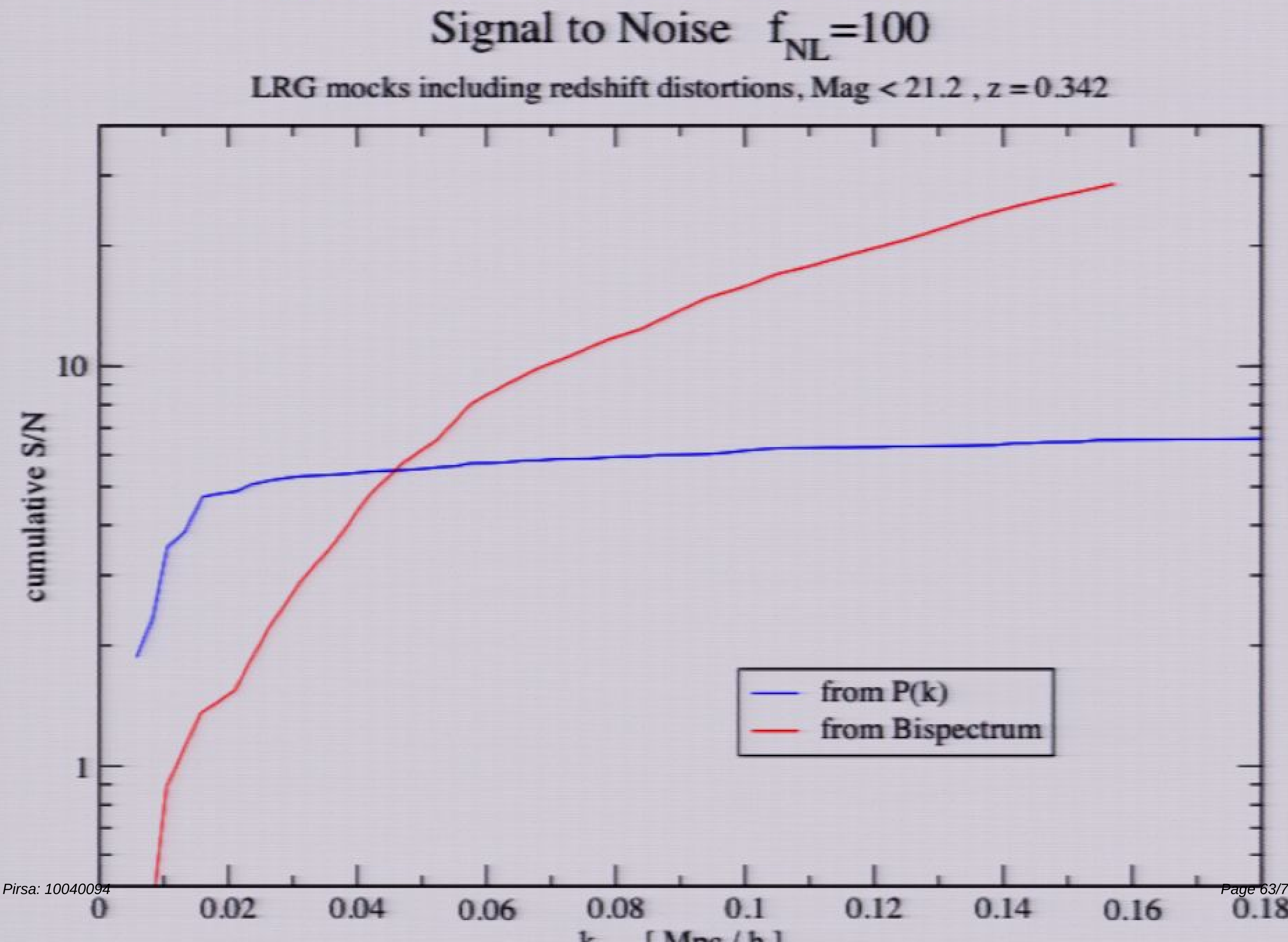
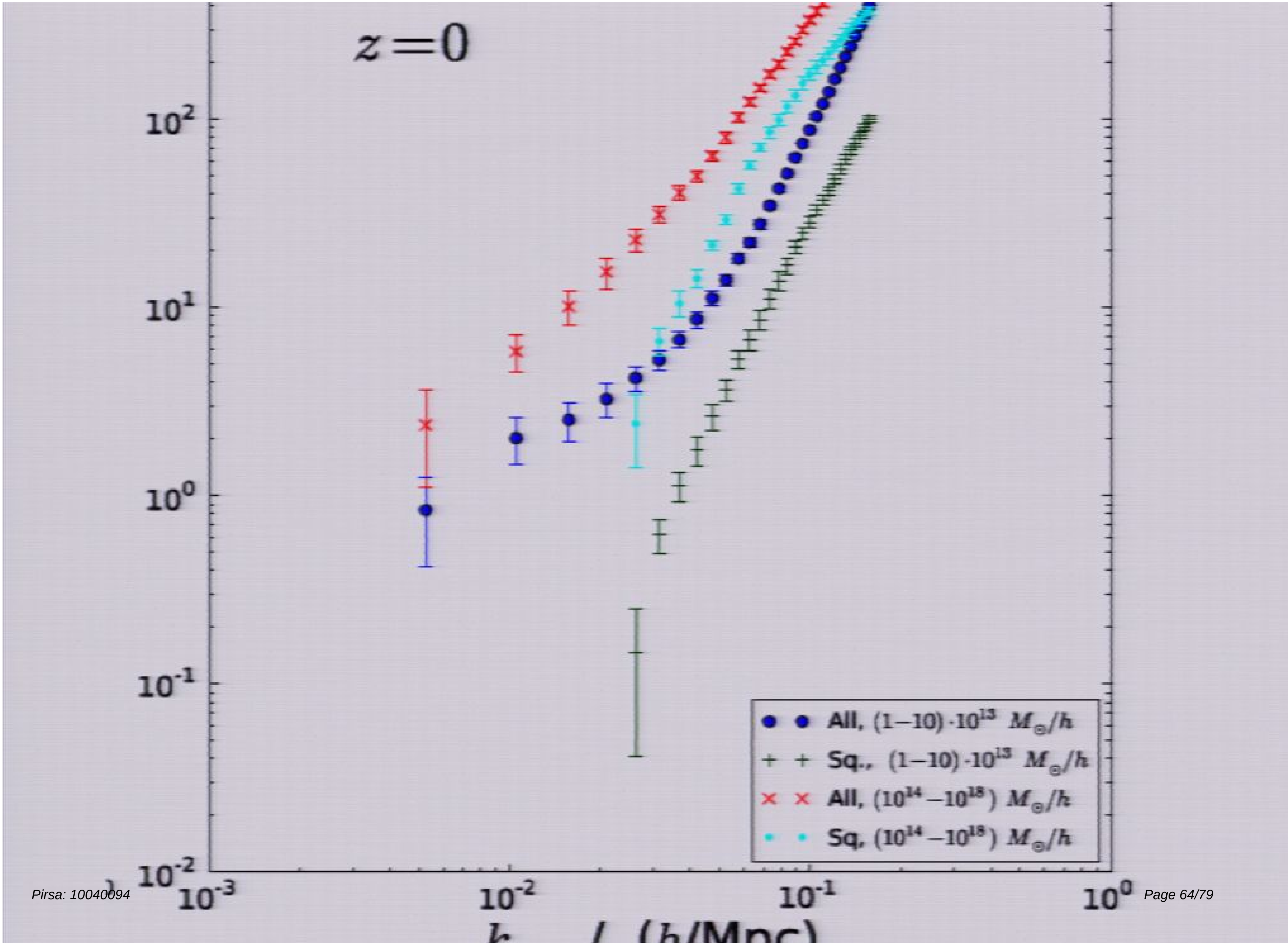


Adding Bispectrum information helps a lot...





z=0
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-2
10^-1
10^0
All, (1–10)·10^13 M⊙/h
Sq., (1–10)·10^13 M⊙/h
All, (10^14–10^16) M⊙/h
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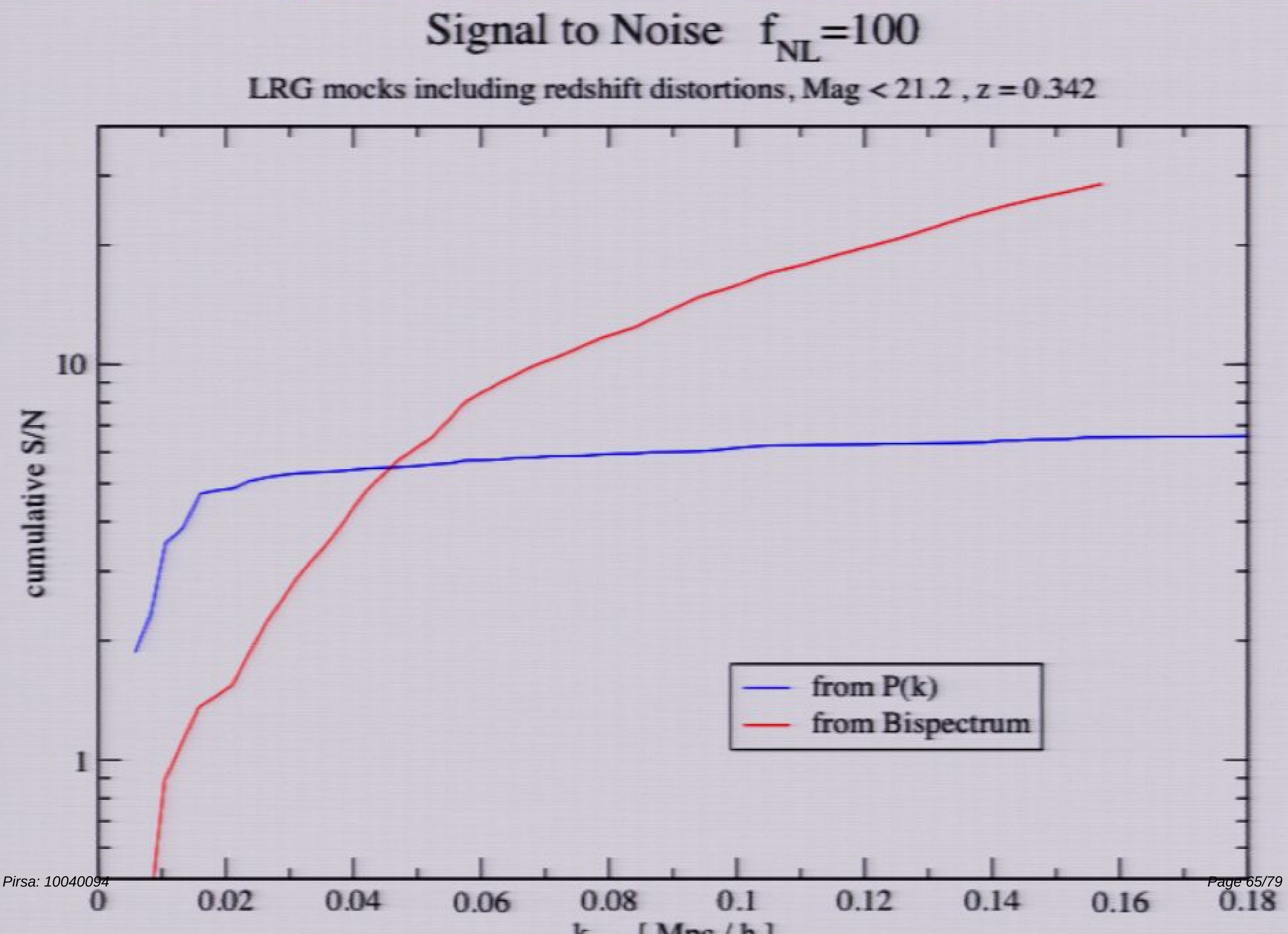

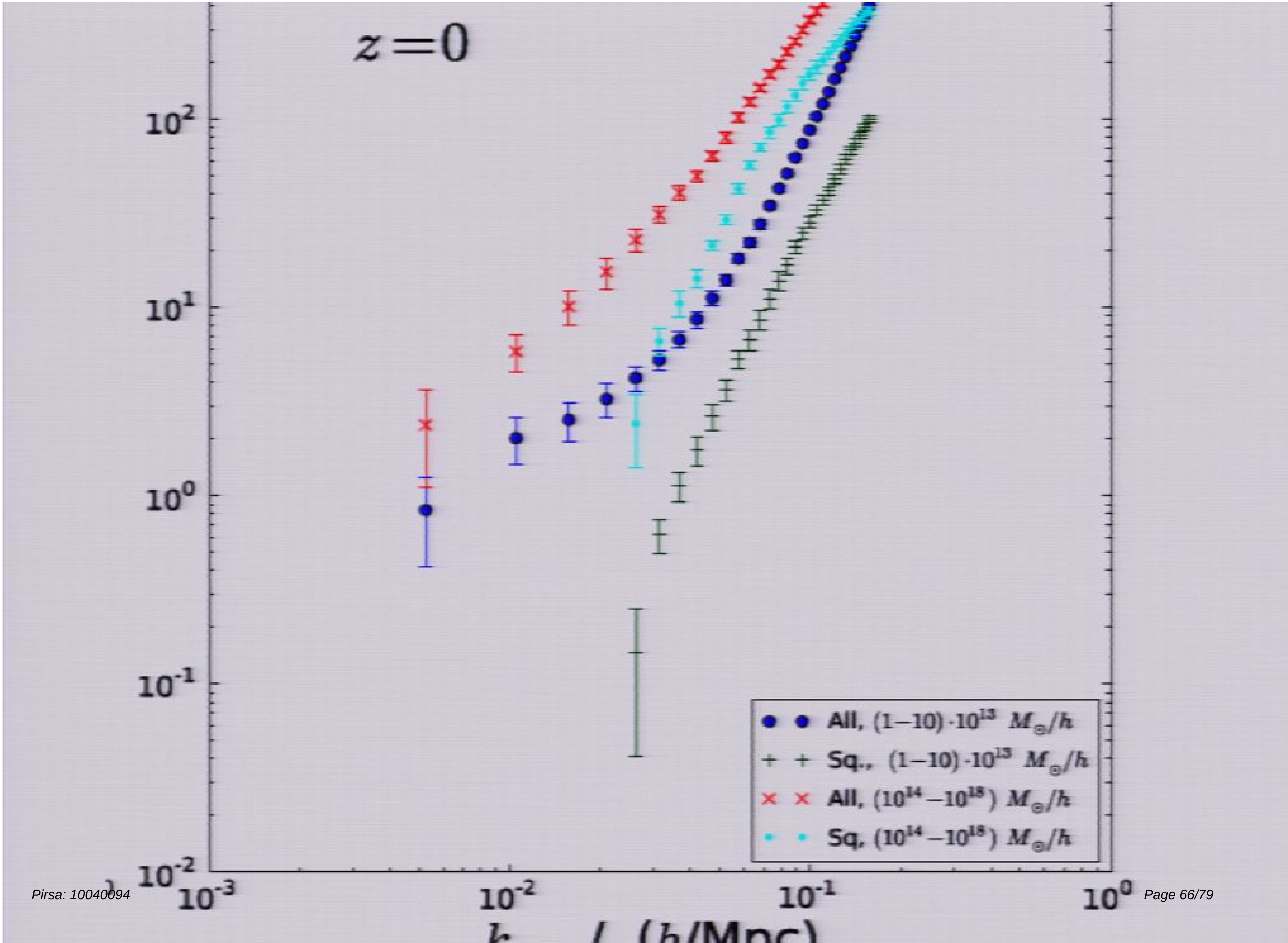
$z=0$
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-2}
10^{-1}
10^0
All, $(1-10)\cdot 10^{13}\ M_\odot/h$
Sq., $(1-10)\cdot 10^{13}\ M_\odot/h$
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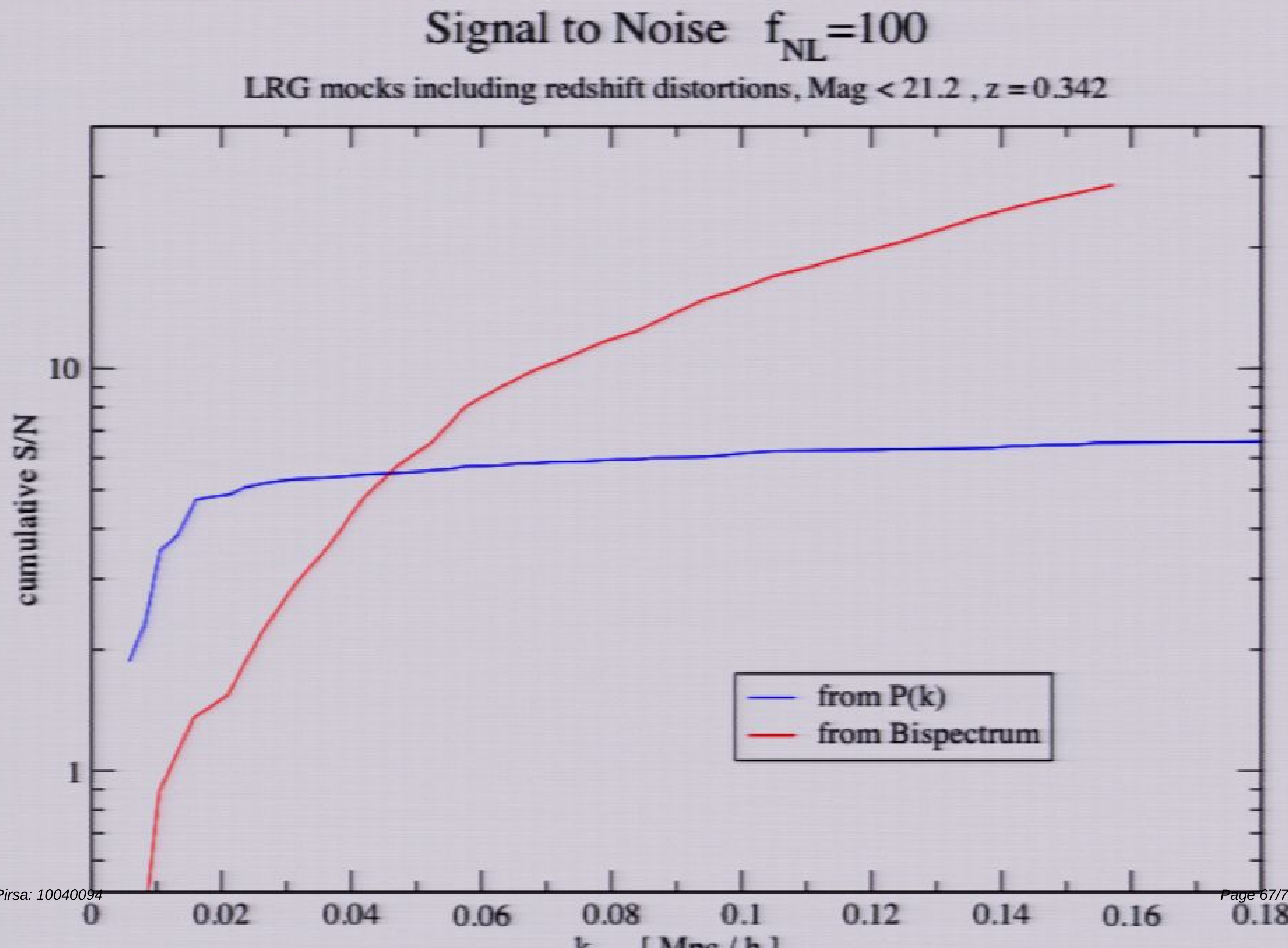

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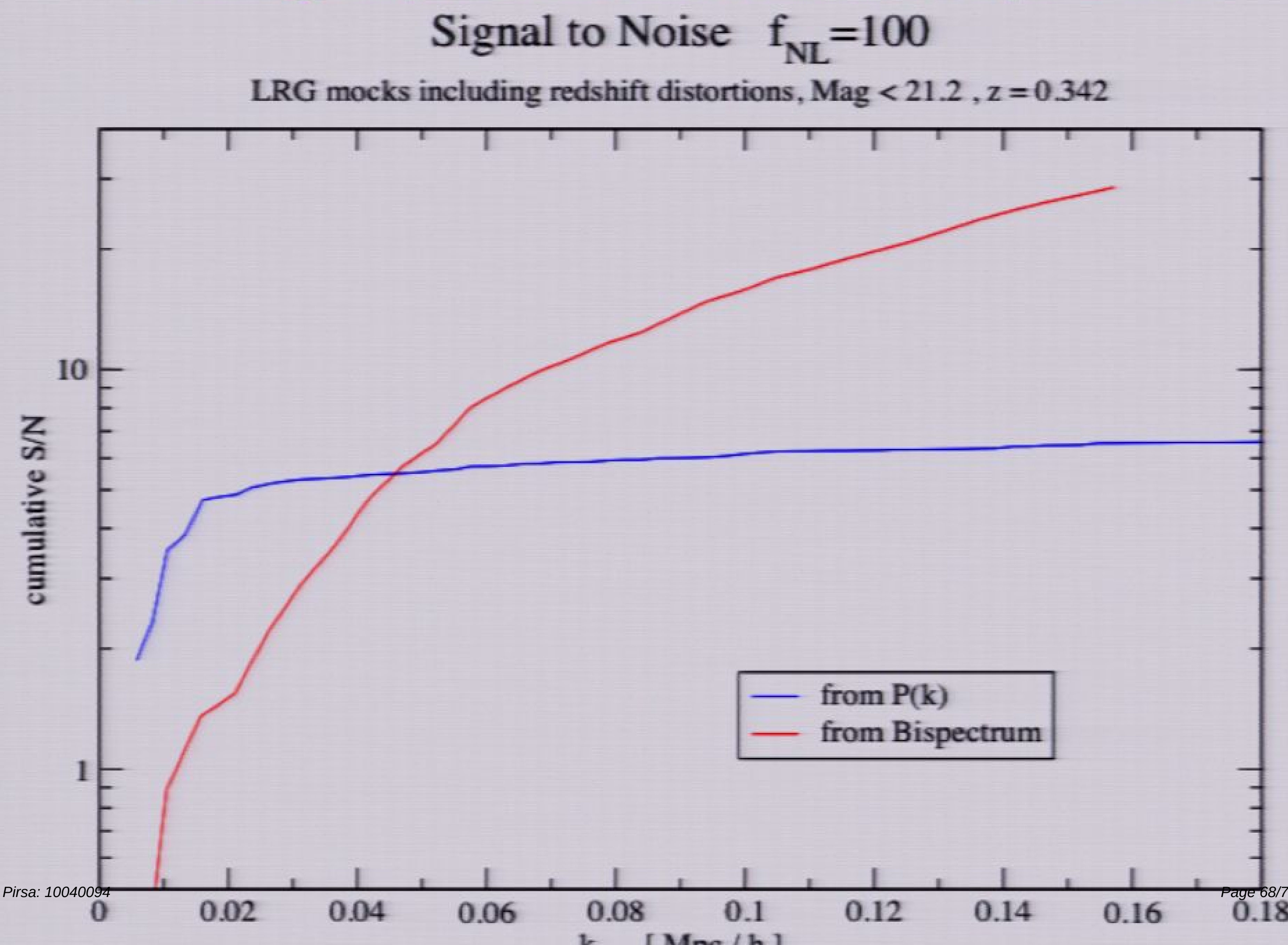

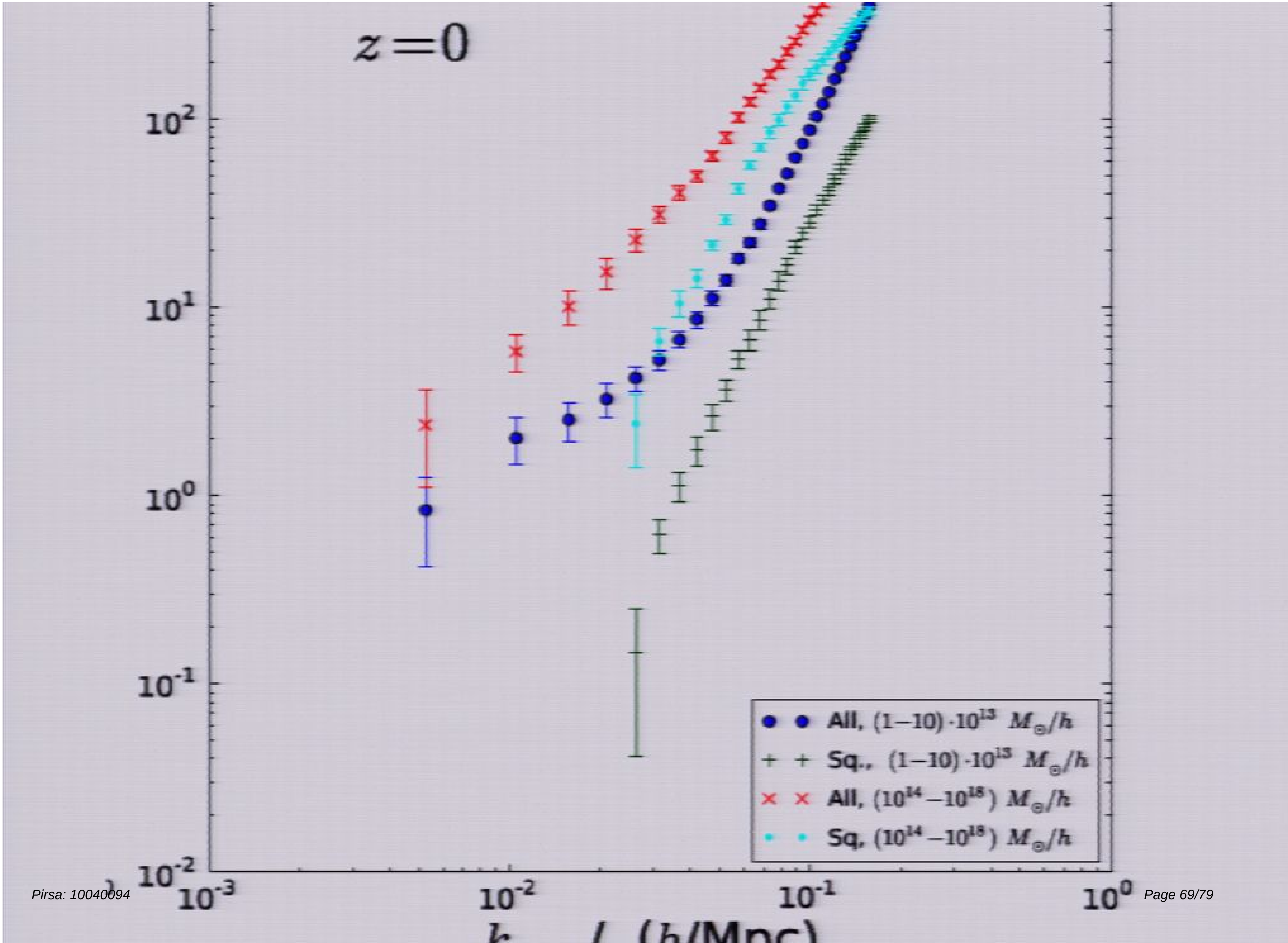

z=0
10^2
10^1
10^0
10^-1
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10^-3
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Conclusions

Beware of Gaussian peaks in high-nu limit calculations of PNG...

PBS calculations can be generalized to non-local PNG models. Currently testi
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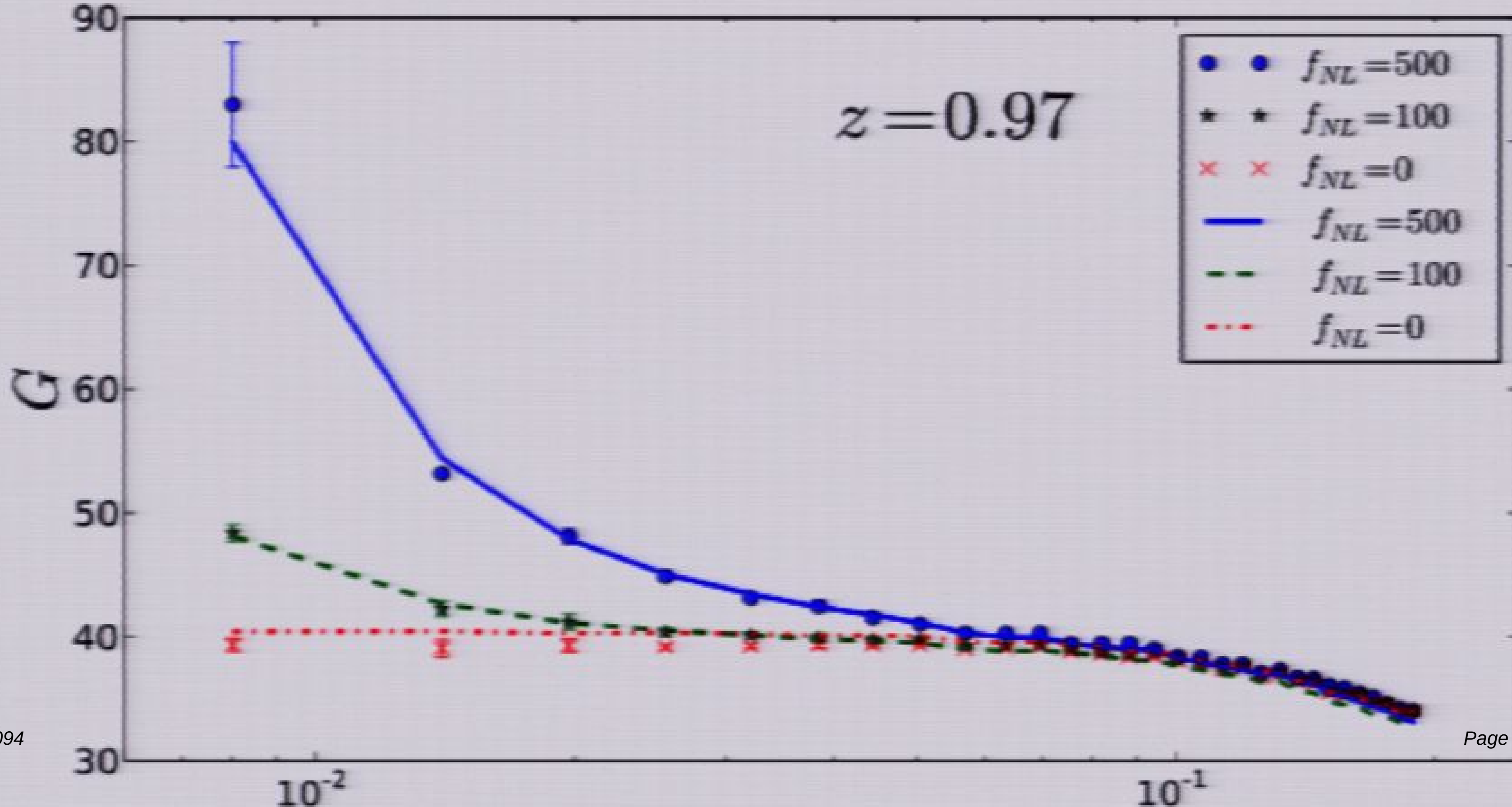
Bispectrum adds significant StoN, all configurations needed. Extension to non-
cal models in progress.

Halo propagator in N-body simulations:

clearly, local models are wrong...



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- In local models of primordial non-Gaussianity (PNG) we have for the Bardeen potential,

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which implies for it a bispectrum,

$$B = 2 f_{\rm NL} P_1 P_2 + \text{cyc.}$$

- For biased tracers (galaxies, halos), this model leads to a scale-dependent bia at large scales (Dalal et al 2008),

$$b_1(k) = b_{10} + \Delta b_1(k, f_{\rm NL})$$

where b~1/k^2 at low-k.

There are basically three derivations of this effect:

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vhile for local models we get:

$$G(k) = b_1 G_{\rm dm}(k) + b_2\,\langle\,\delta\frac{\partial\delta_g}{\partial\delta_I}\,\rangle$$

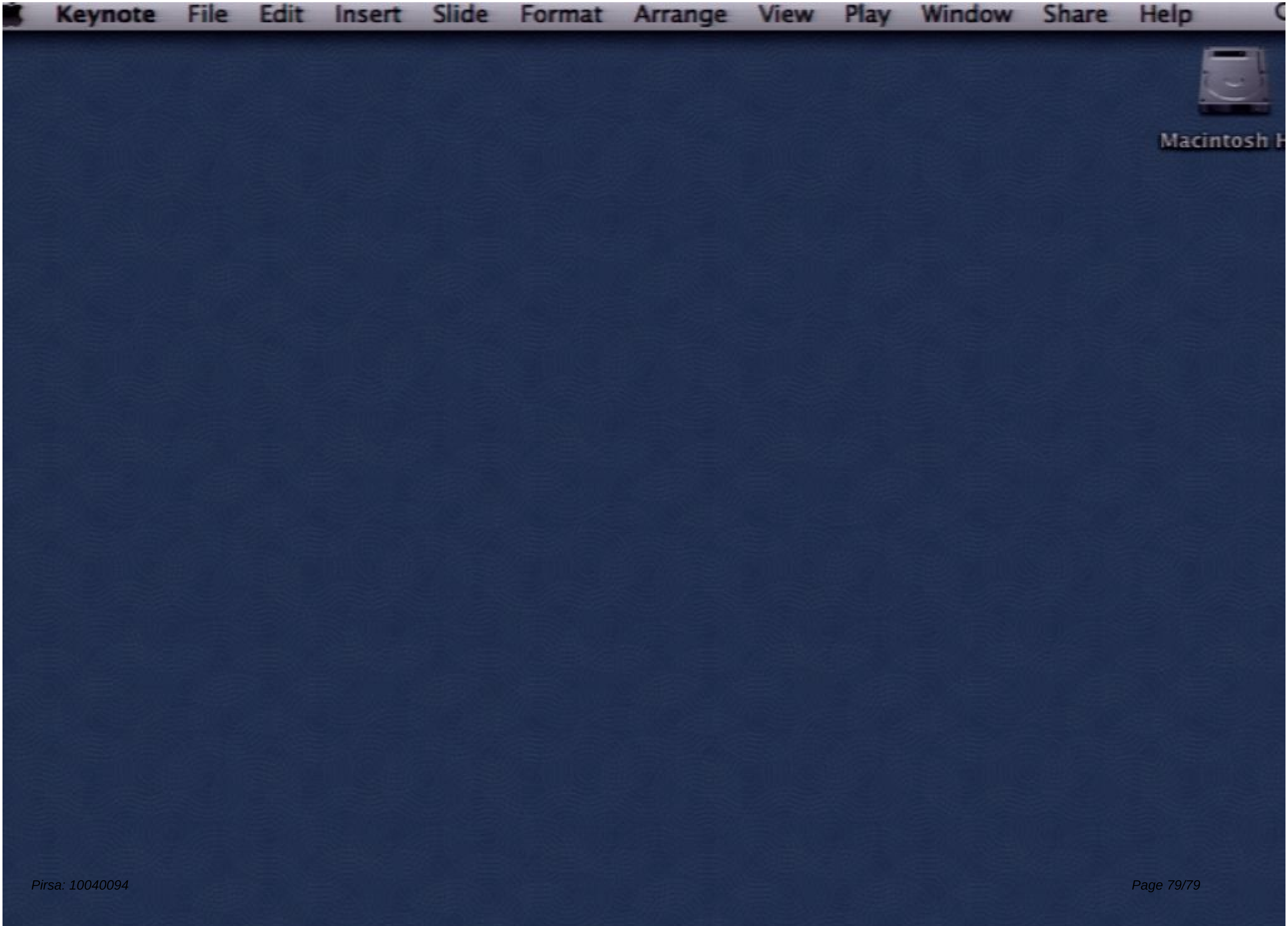
$$G(k) = b_1 G_{\rm dm}(k) + 4b_2\int P(\mathbf{k}-\mathbf{q})F_2(\mathbf{k}-\mathbf{q},\mathbf{q})d^3q \to b_1 D_+ \qquad (k\to 0)$$

Conclusions

Beware of Gaussian peaks in high-nu limit calculations of PNG...

PBS calculations can be generalized to non-local PNG models. Currently testi
ese in detail.

Bispectrum adds significant StoN, all configurations needed. Extension to non-
cal models in progress.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