Day One
subtle, delicate signals

• whence —
  What profundities do they come from?

• wither —
  How do they appear on the sky?
— Day One —

The Elohim (אֱלֹהִים)

subtle, delicate signals

• whence —
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  How do they appear on the sky?

whence  Xingang Chen, Sarah Shandera, Eugene Lim, Daniel Baumann
wither  James Fergusson, Chris Byrnes
non-Gaussianities require strange physics

“standard” Q.F.T. + single field slow roll
+ some pretty standard reheating (?) \equiv Gaussianity in \phi
[ but not necessarily in \zeta — gravitational evolution! ]
non-Gaussianities require
strange physics

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+ some pretty standard reheating (?) \equiv \text{Gaussianity in } \Phi
[ but not necessarily in } \zeta — \text{gravitational evolution! } ]

multifield inflation? } \quad \text{strong non-linearities in messenger}

DBI? \quad p\text{-adic inflation??} \quad \text{strange kinetic terms} —
\text{new propagators,}
\text{new E.O.M. allow for strongly}
\text{non-linear Lagrangians}
\text{while getting acceleration}
\text{with single field}
D.B.I.

for those who dropped out of string-theory class
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branes are like string world-sheets (or soap bubbles):
they like to minimize their area
natural way to form Lagrangian

\[ \int d\tau \sqrt{g_{ab}} \]

induced metric on brane
D.B.I.

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branes are like cosmic defects:
they warp space with conical singularities
(just classical 2+1 gravity!)

\[ ds^2 = -h^{-1/2} dt^2 + h^{1/2} (dr^2 + r^2 d\Omega) \]
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\[ \ldots \text{Lagrangian left as an exercise to the reader} \]
— what does our signal look like?
how can we cram the signal into one or two numbers?
“local”, “equilateral”, factorizable: all pragmatic choices, but
will theory give us unique primordial signatures?

— many sources of non-Gaussianity!
did we get them all? perfection is not yet here.

— computationally difficult: pointy triangles are hard!
“template” forms needed.

one open question:
\[ B(l_1, l_2, l_3) \text{ to } f_{NL} \]

— many sources of non-Gaussianity!
did we get them all? perfection is not yet here.
Sarah & Sav & Daniel & Neil argue about DBI, KKLMMT, $p$, &c.

... call ... Xingang & Eugene who parametrize as E.F.T.s and get us to Exit

... and call...

Chris who takes us from Exit to CMB, adding in new sources

... where James makes templates & Hiranya rules out models!

... supposedly how science is meant to work ...
— Day Two —

Modern Times

the engineers  Roman Scoccimarro, Martin Crocce
the psychiatrists  Olivier Doré, Marilena LoVerde
the ad-man  Asantha Cooray
— Day Two —

Modern Times

plenty of machinery!

the engineers  Roman Scoccimarro, Martin Crocce
the psychiatrists  Olivier Doré, Marilena LoVerde
the ad-man  Asantha Cooray
gravitational amnesia . . .

perturbation theory: the disappearance of initial conditions,
death of the growth function
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perturbation theory: the disappearance of initial conditions, death of the growth function

\[
P(k, z) = G_\delta^2(k, z) \times P_0(k) + P_{\text{Mode Coupling}}(k, z)
\]
recovered memory syndrome?

if there’s a large signal from primordial physics, easy!

the mass function — lowest order probes of “deep physics”
the psychiatrists

characteristic structures in the bispectrum —

can future analyses take advantage?

squeezed triangles (local, gravity) vs. equilaterals

(what if $f_{NL}$ from strings is unity?)

P.S. — beware the halo model!
the ad-man

we will have plenty to look at —
especially early epochs —
let’s include noise, build some filters,
and see what we can do!

the “non-Gaussian Olympics”
Day Three

The Explorers

Leonardo Senatore, Emiliano Sefusatti, Sabino Matarrese, Eiichiro Komatsu, Ben Wandelt, Kendrick Smith
Day Three

The Explorers

many models, much data!

Leonardo Senatore, Emiliano Sefusatti, Sabino Matarrese, Eiichiro Komatsu, Ben Wandelt, Kendrick Smith
fertile plains in the New World

at $k \sim 0.2$ — bispectrum has more information!

ADEPT: can do $f_{NL}$ (local) of order unity, even when being conservative about maximal $k$

$f_{NL}$ will continue to be the *lingua franca* of Fisher matrices
what estimator to use?

\[
\frac{f_{NL} \Phi^2}{\Phi} \approx 0.1\%
\]

editorial point: the rigorous Gaussianity of the CMB has led people to talk in terms of the bispectrum.

the bispectrum is the optimal estimator for the bispectrum.

Minkowski Functionals — alternative, different systematics.
void ellipticities, e.g.

\[ D_{\text{hut}} = \frac{\text{major}}{\text{minor}} - 3 \]

depending on the properties of the noise, other non-Gaussian foregrounds, strange mode coupling from geometry, or a strange kind of “bias” —

may want to come up with alternative techniques — something we haven’t discussed much here

(also consider the many non-Gaussian fields in “ordinary” cosmology! — reionization, e.g.)