Hi, my name is Philip Clarke, and I'm going to be talking about inflation, the most popular theory we have for the first instants of the universe.

I'm going to mention a couple of possible models, and ways they could be experimentally constrained. But first, some context & motivation.

(1) $G_{\mu\nu} = 8\pi G T_{\mu\nu}$

$r = a\,d$ (phys = scale × coord)

(2) (BBN) (Structure formation)

(??)	Rad	Matter	(??)
$a \propto e^{Ht}$	$a \propto t^{1/2}$	$a \propto t^{2/3}$	$a \propto e^{Ht}$

47,000 yrs — 10 billion yrs

(3)

(Weirdness) ⇑ ⇑ (Modern surveys)

(4) Why does there have to be a before?

(5) What could drive e^{Ht}?

Context: (6) (i) Have access to ? universe (are we somewhere special?)
(ii) I.C.'s unknown, theories are flexible.

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(1) Single scalar field? ϕ

(Matter: $P=0$, Rad: $P=\frac{1}{3}\rho$)

We need $P=-\rho$ to get $a \propto e^{Ht}$

$\rho = \frac{1}{2}\dot\phi^2 + V$

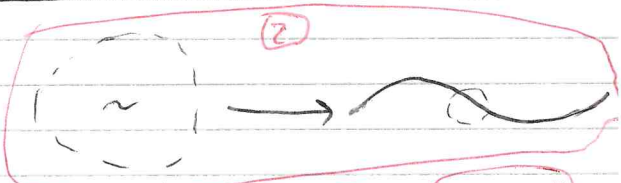
$P = \frac{1}{2}\dot\phi^2 - V$

$\Rightarrow k \ll V$

↓ Slow Roll

(There are other ways, but this makes solid predictions)

(2)



(3) QM → LSS

(4) 2 types of fluctuation: Scalar $\sim A_s k^{n_s}$; tensor $\sim A_t k^{n_t}$

(5) Approx scale inv $\Rightarrow$ ($n_t \approx 0$, $n_s \approx 1$)

Consis $\Rightarrow$ $\frac{A_t}{A_s} = -8 n_t$ < 0.77 (95% CL)

(6) (pass soon) (Needs multiple scales)

$(2.075)(\eta + n_s) = 0.9667 \pm 0.0040$

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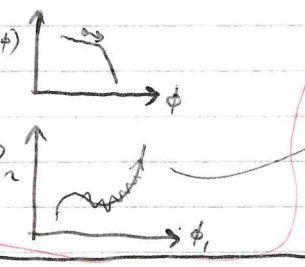
(1) Two scalar fields?

$\rho = k_1 + k_2 + V(\phi_1, \phi_2)$

$P = k_1 + k_2 - V(\phi_1, \phi_2)$



(2) Curvature & Isocurvature fluctuations

Don't affect total density

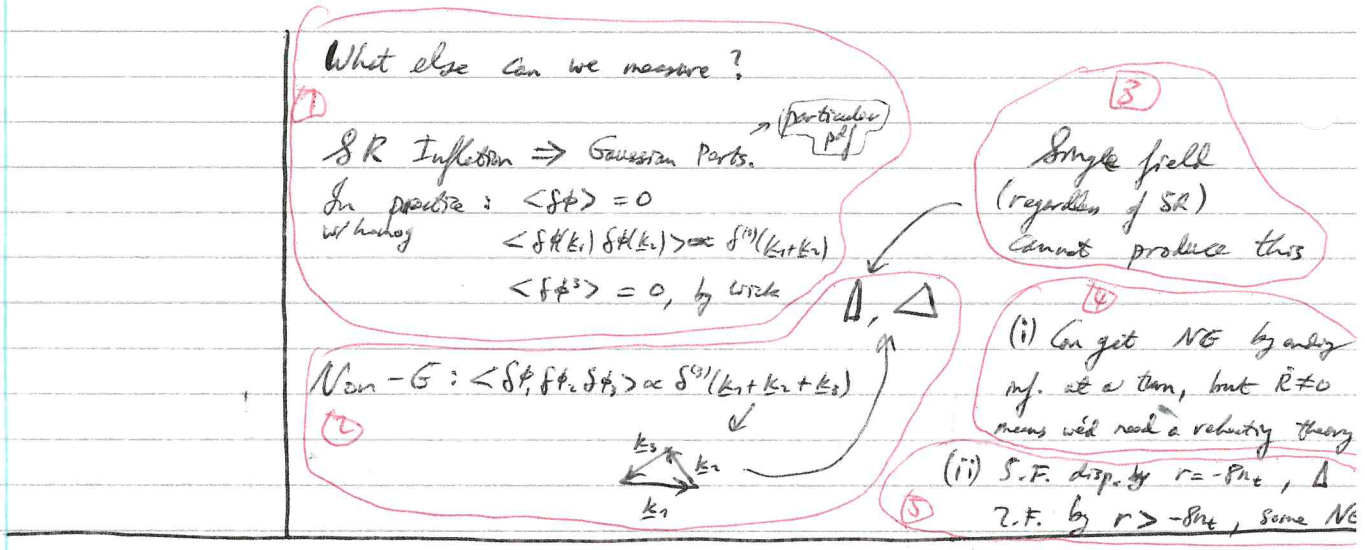
(3) $\frac{A_t}{A_s} = -8 n_t \mathcal{M}^2 \Delta$

↳ measure of cor. between CDI

We don't know inf. ends

$\frac{d}{dt}$ (large scale curvature) $\propto \dot\theta$

$\frac{A_t}{A_s} = -8 n_t \mathcal{M}^2 \Delta$, $\dot R \neq 0$



Some other points:

① Problems w/ Λ CDM → ENTROPY (Consolidating --)

② Other data in LSS 1980s ~ 5000 galaxy redshifts
Now ~ 7,000,000
"end of greatness"
Galaxy bias — different.

③ Alternatives: (i) String gas → 3D, but not entropy / flatness
(ii) Bounce → torsion-fermion coupling @ high density?

Conclusion: We have no idea what happened at the start of the universe. We have lots of ideas though, some of which are testable, and considering we're talking about a 10^{-35} s event 14 bn years ago, I guess that's pretty good.