

Comments on Cosmological Predictions

Hubris vs. Humility

Inflationary Predictions?

outcome for generic initial conditions?

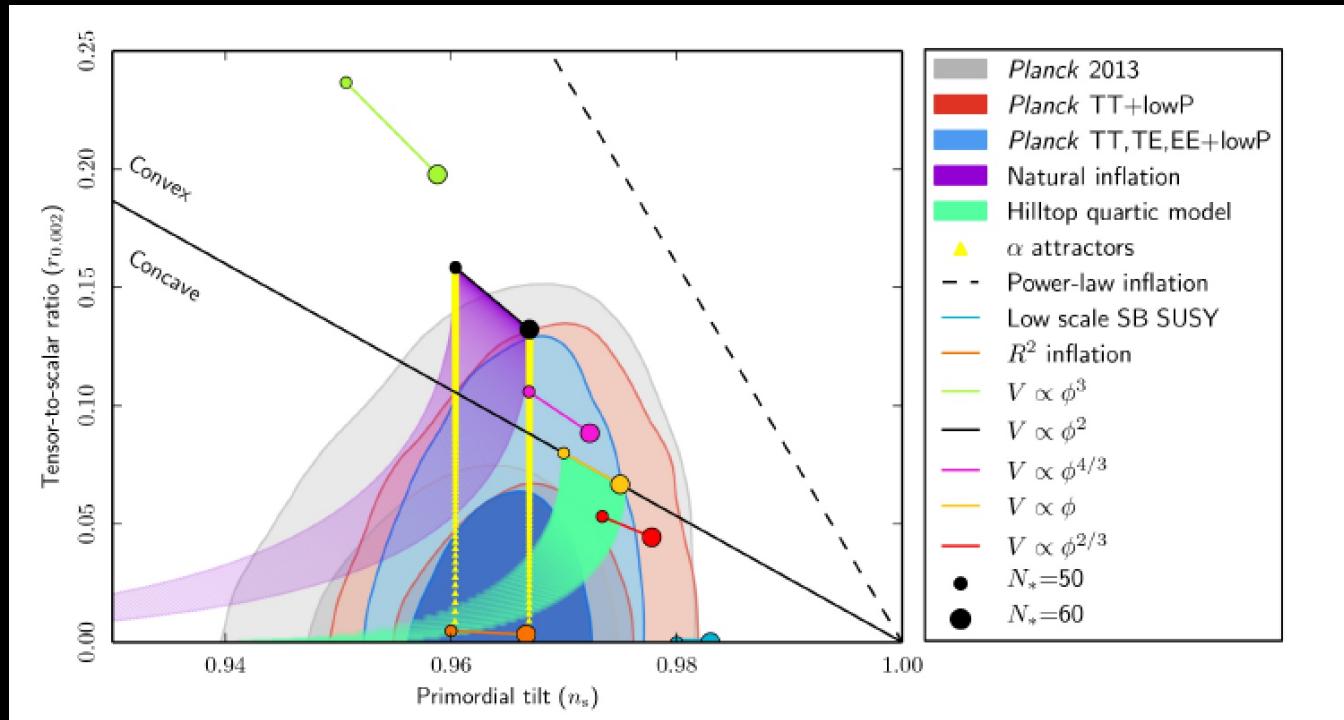
no inflation more likely than inflation

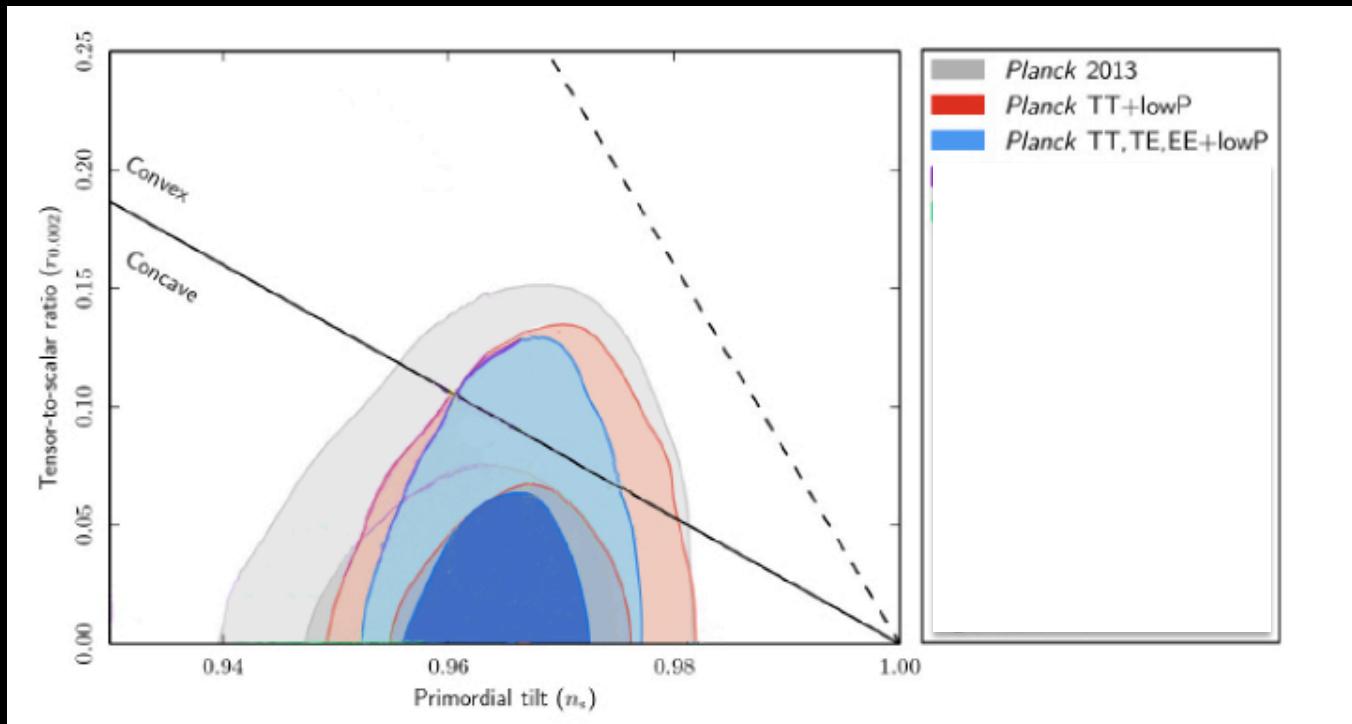
“bad” inflation more likely than “good” inflation



QUANTUM RUNAWAY → MULTIVERSE

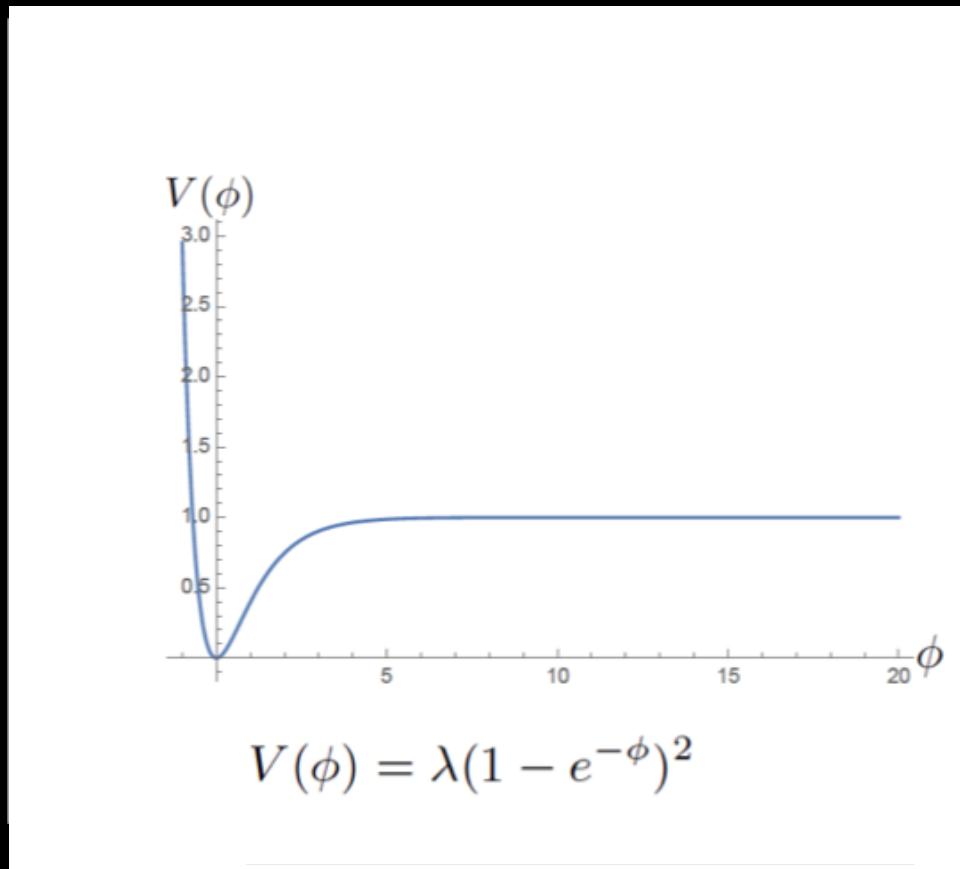
Planck2015 + ACT + WMAP +



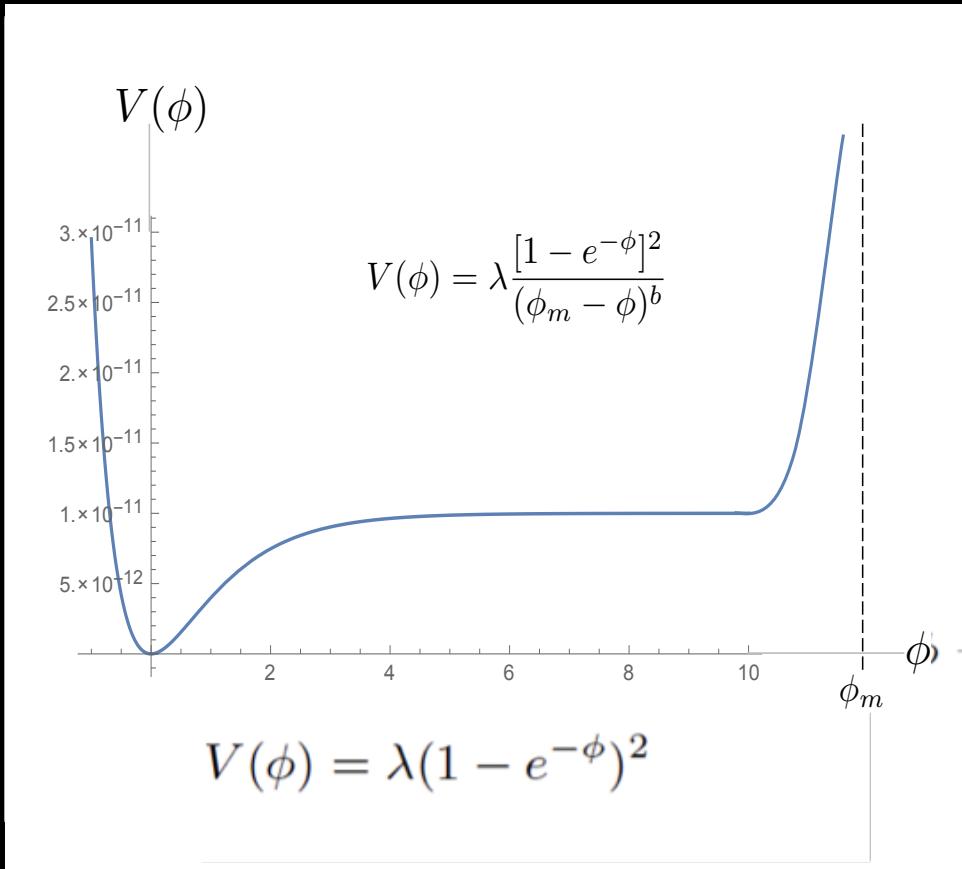


The Great Escape: Mukhanov (2015)

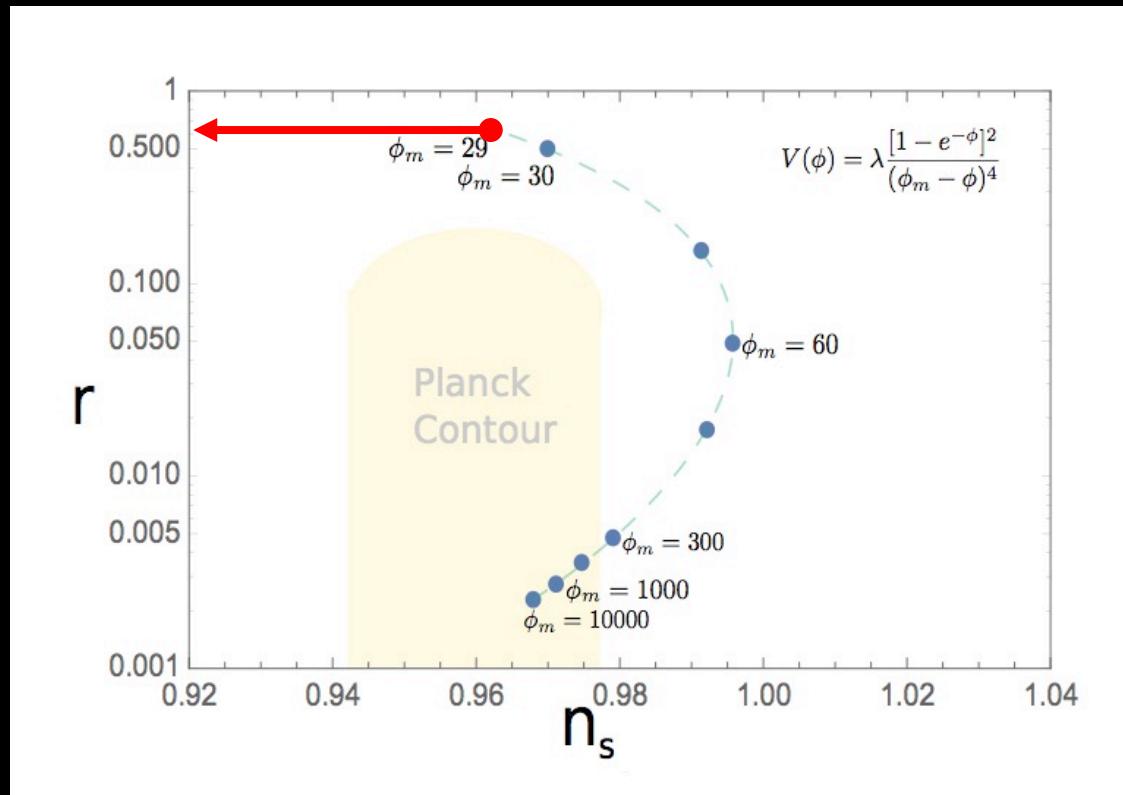
Constraints of tilt and tensor-to-scalar ratio → Plateau models (Ijjas et al, 2013):



The Great Escape: Mukhanov (2015)

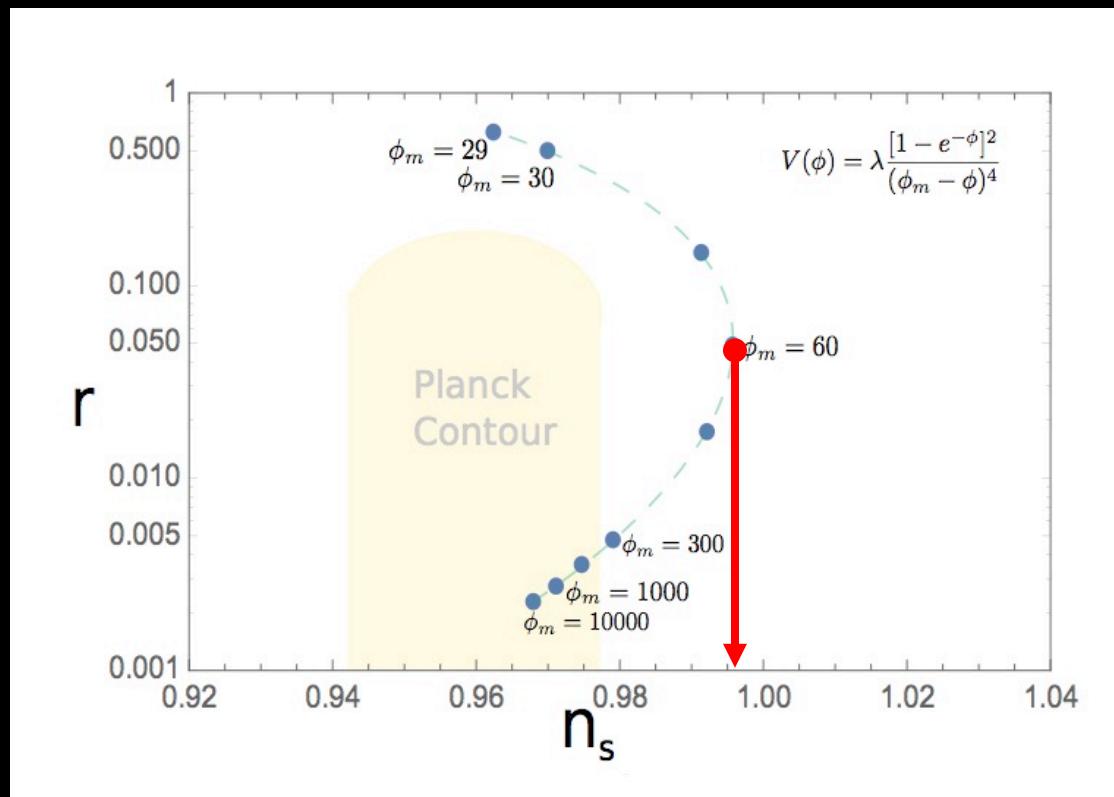


The Great Escape: Mukhanov (2015)

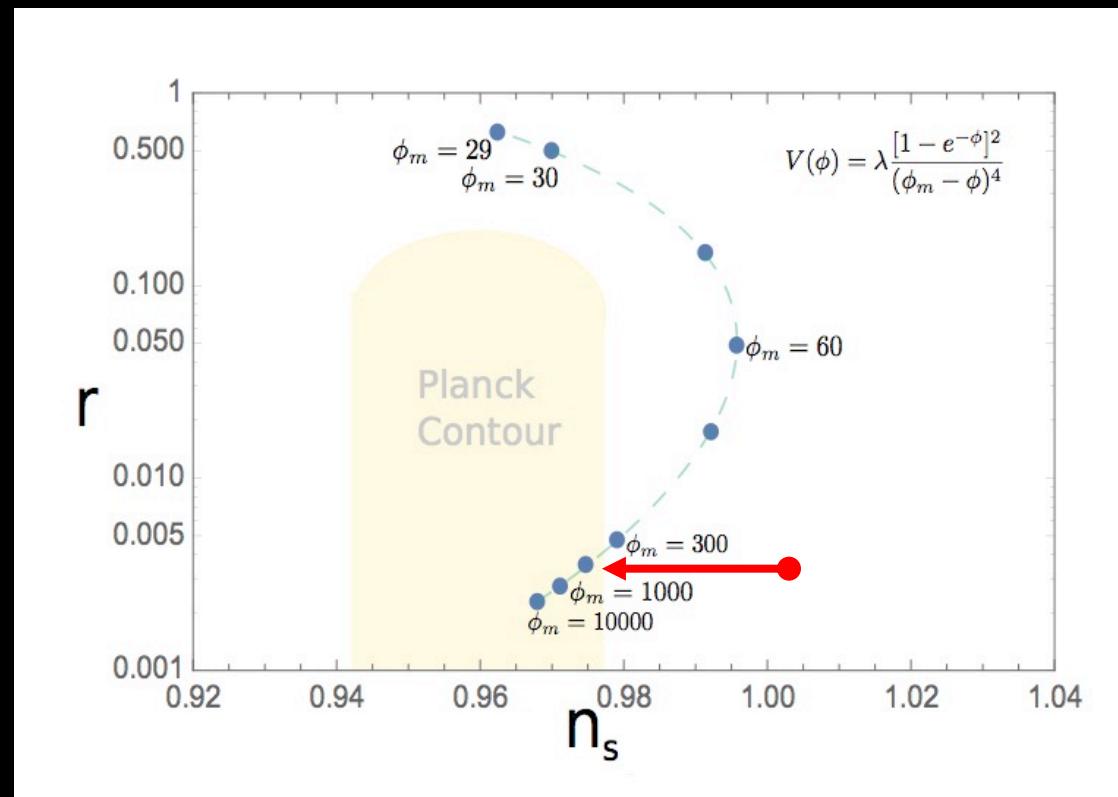


N. Panithanpaisal
M. Pressley
PJS

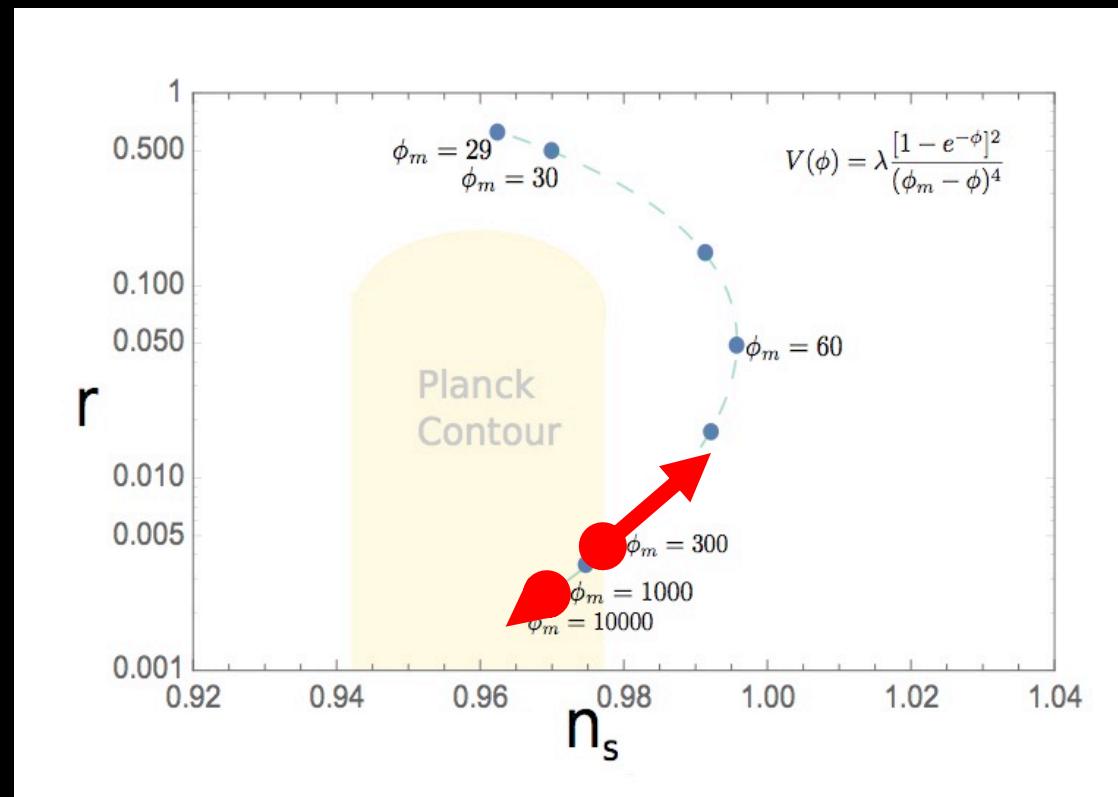
The Great Escape: Mukhanov (2015)



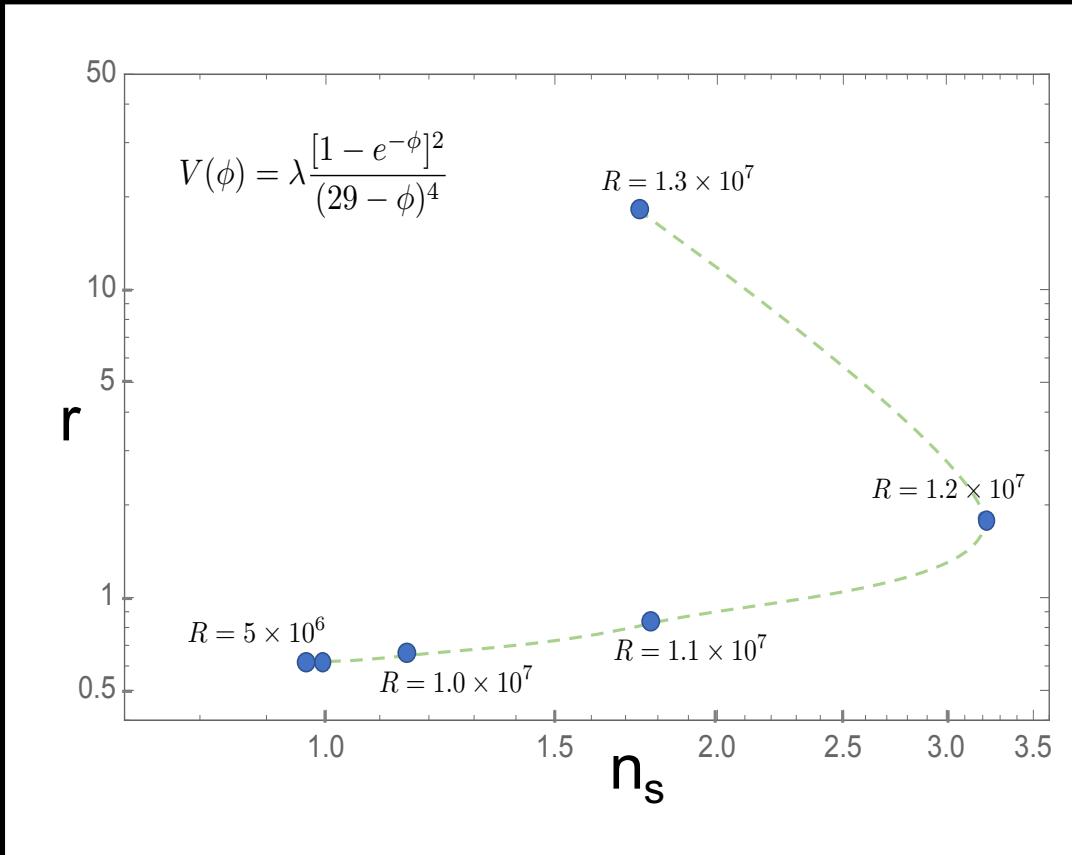
The Great Escape: Mukhanov (2015)



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The Great Escape: Mukhanov (2015)



WHAT LESSONS CAN WE DRAW FROM THIS?

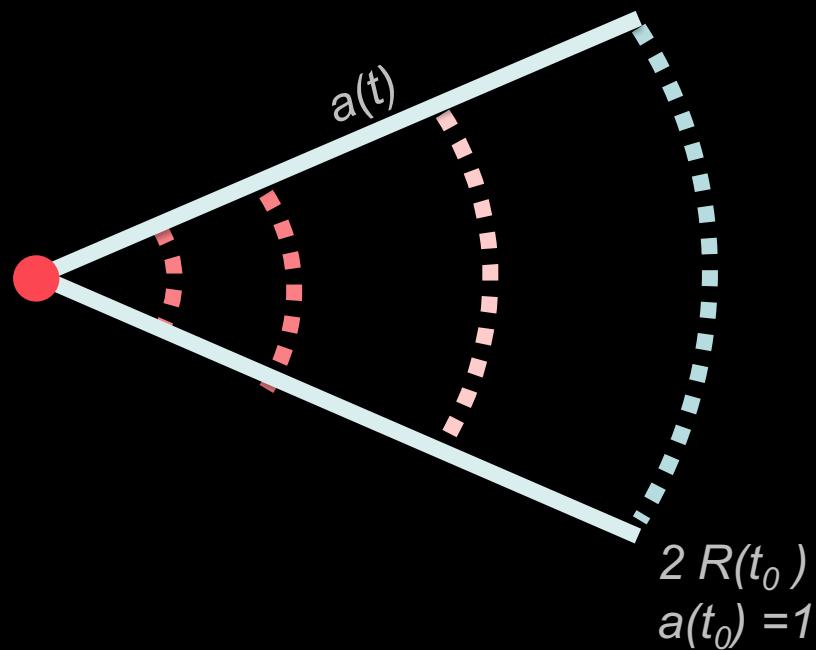
CLASSICAL (NON-SINGULAR) BOUNCING COSMOLOGY

Anna Ijjas & PJS

Wedge Diagram

arXiv:1803.01961

patch size $\sim a(t)$



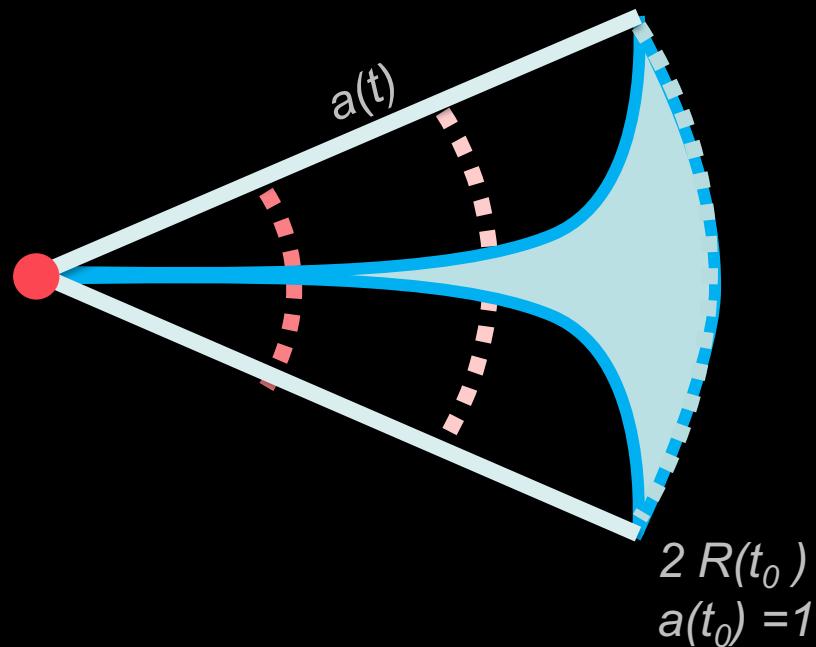
*Singularity
Problem*

Wedge Diagram

arXiv:1803.01961

patch size $\sim a(t)$

horizon size (H^1) $\sim a(t)^{\mathcal{E}}$



*Singularity
Problem*

*Horizon
Problem*

*SuperHorizon
Hot & Cold Spots*

Wedge Diagram

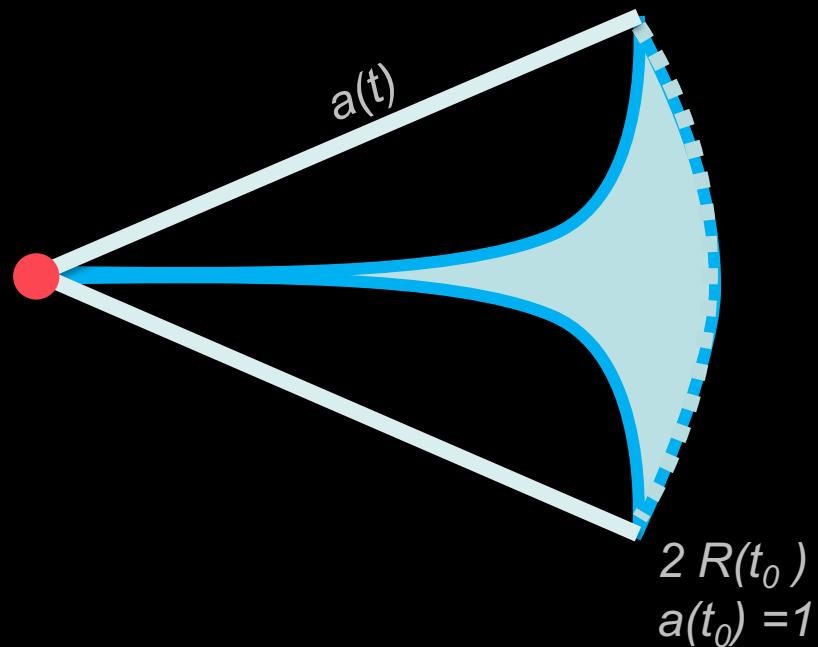
arXiv:1803.01961

patch size $\sim a(t)$

horizon size (H^{-1}) $\sim a(t)^{\varepsilon}$

“*cosmic curvature*”

$\frac{\text{horizon size}}{\text{curvature radius}} \sim \frac{a(t)^{\varepsilon}}{a(t)}$



*Singularity
Problem*

*Horizon
Problem*

*SuperHorizon
Hot & Cold Spots*

*Flatness
Problem*

patch size $\sim a(t)$

horizon size (H^{-1}) $\sim a(t)^{\varepsilon}$

$a(t)$

*Singularity
Problem*

*Horizon
Problem*

*SuperHorizon
Hot & Cold Spots*

*Flatness
Problem*

$$\varepsilon \equiv \frac{3 KE}{KE + PE} > 3$$

e.g., free scalar field with $PE < 0$

“cosmic curvature”

$$\frac{\text{horizon size}}{\text{curvature radius}} \sim \frac{a(t)^\varepsilon}{a(t)}$$

$a(t)$

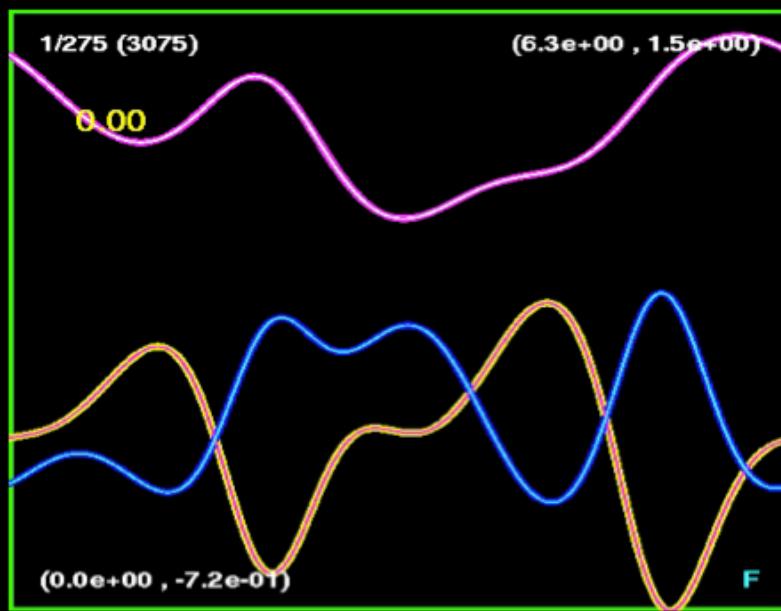
*Singularity
Problem*

*Horizon
Problem*

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Hot & Cold Spots*

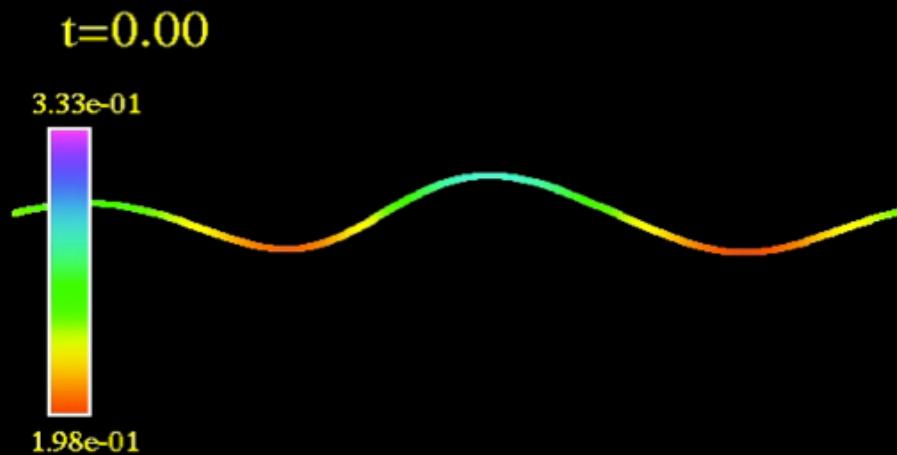
*Flatness
Problem*

Powerful smoothing/flattening mechanism



Yellow: Matter
Purple: Shear
Blue: Spatial Curvature

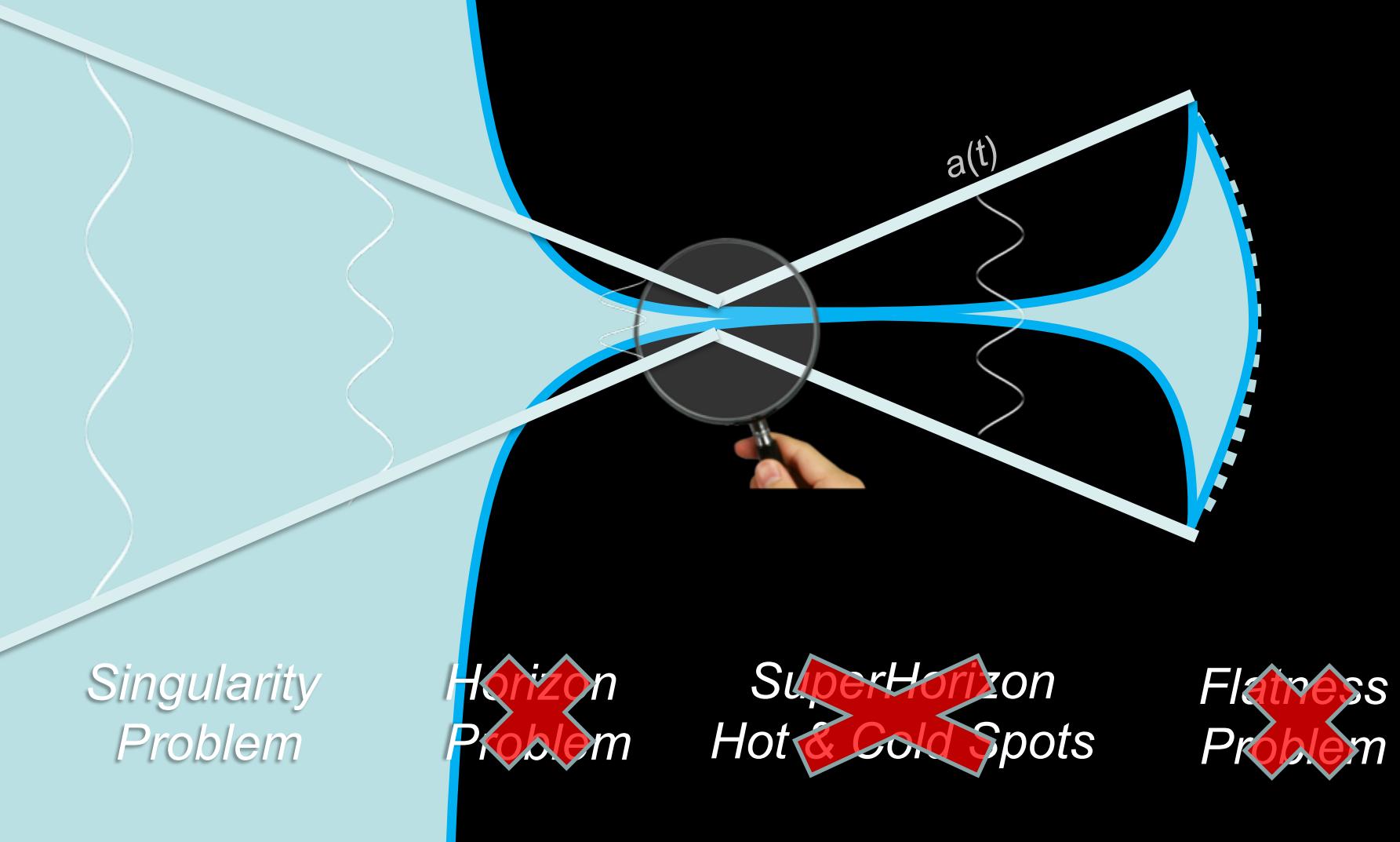
D. Garfinkle, W-C Lim, F. Pretorius, PJS



Large lapse (small Volume)

Small lapse (large volume)

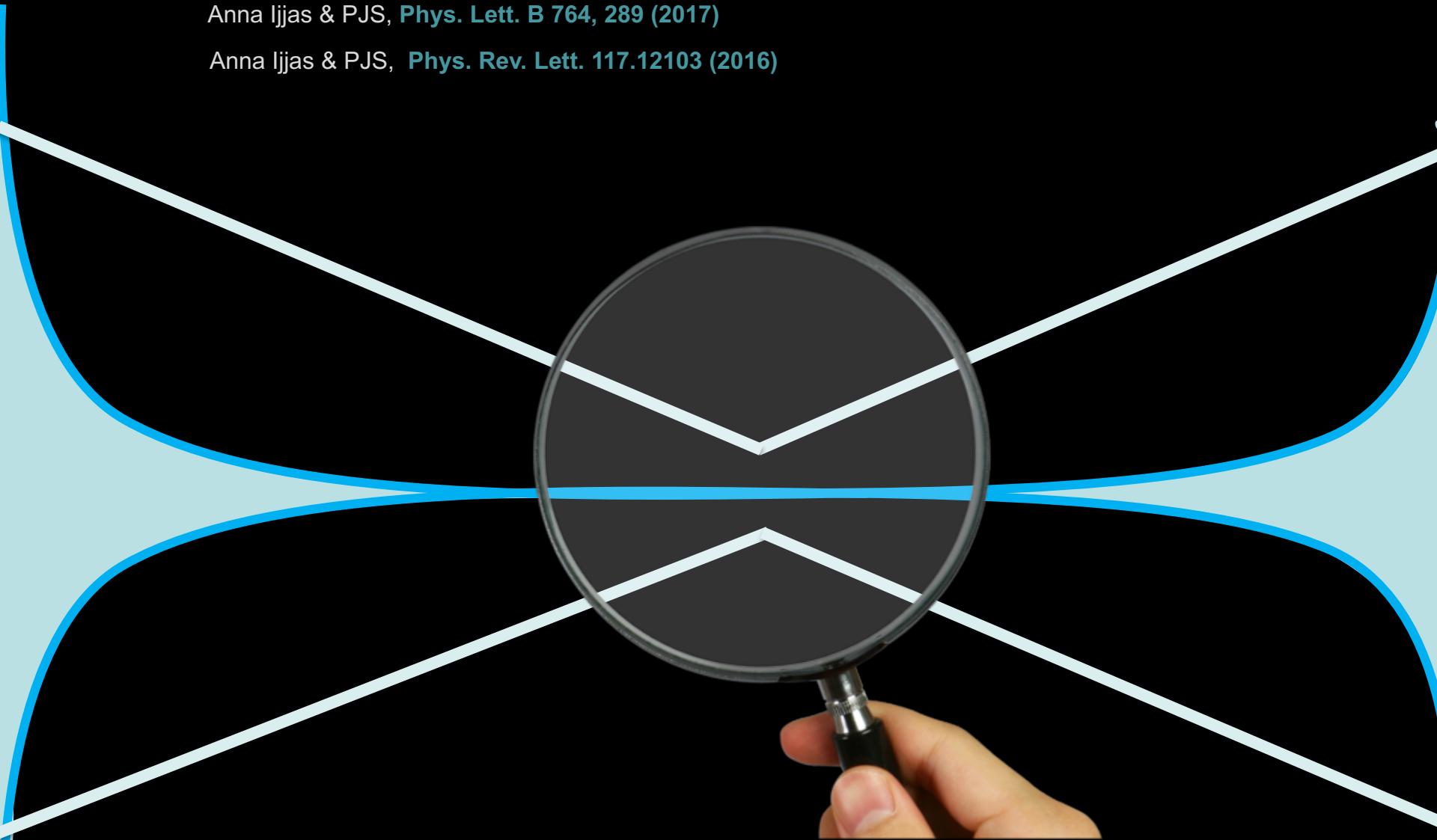
See talk by A. Ijjas
at 5:30 pm TODAY



Anna Ilijas, [arXiv:1710.05990](https://arxiv.org/abs/1710.05990)

Anna Ilijas & PJS, **Phys. Lett. B** 764, 289 (2017)

Anna Ilijas & PJS, **Phys. Rev. Lett.** 117.12103 (2016)



What are the predictions?

Hubris vs. Humility

*no observable tensor/B-modes?
no isocurvature perturbations?
gaussian?*

See talk by A. Ijjas
at 5:30 pm TODAY