

# The Cosmological Flow

## of Primordial Correlators

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Based on: [ArXiv:2302.00655](https://arxiv.org/abs/2302.00655) (short paper)

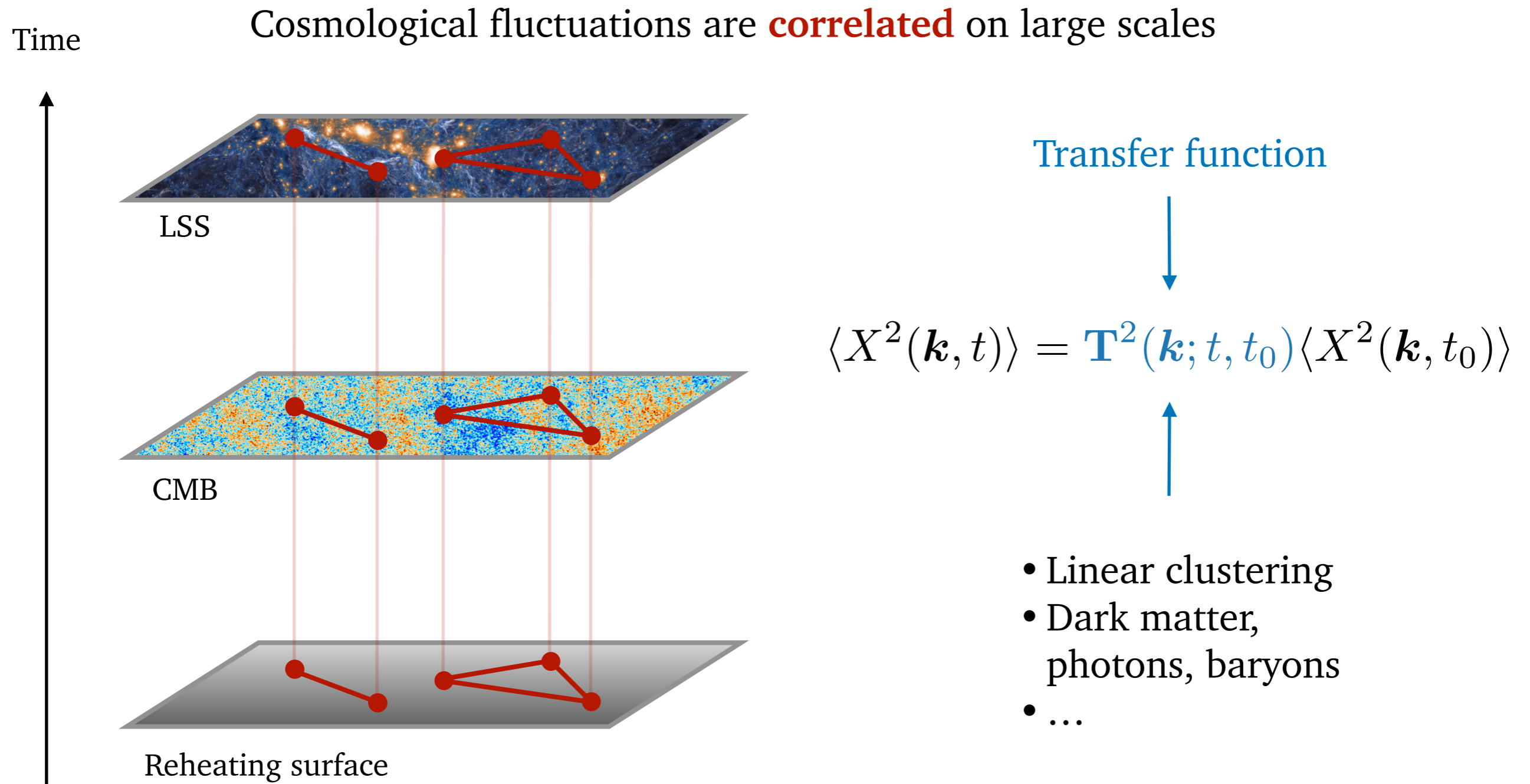
[ArXiv:2305.xxxxx](https://arxiv.org/abs/2305.xxxxx) (long paper)

with Lucas Pinol and Sébastien Renaux-Petel



**GEODESI**

# Cosmology: A History of Time

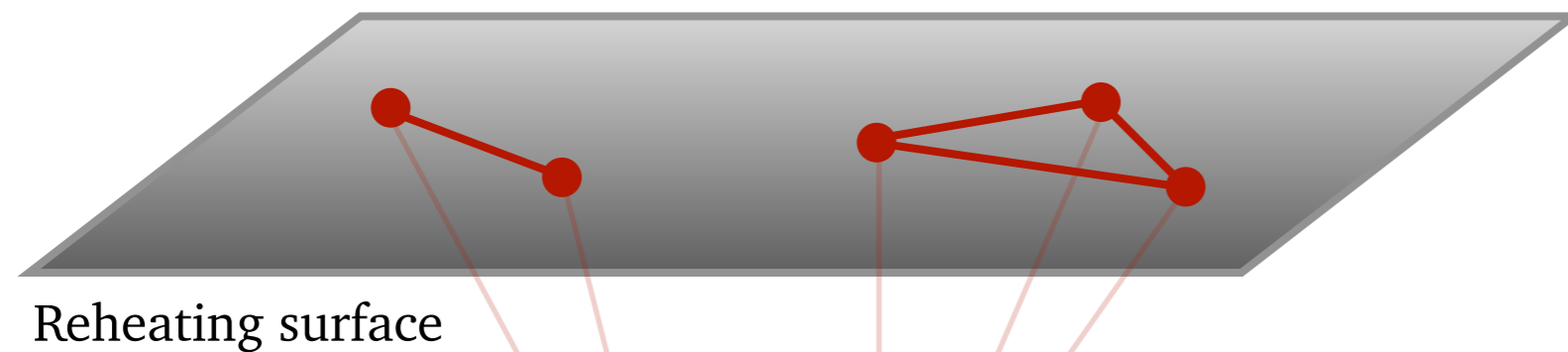


The physics is encoded in the **time evolution** of these fluctuations

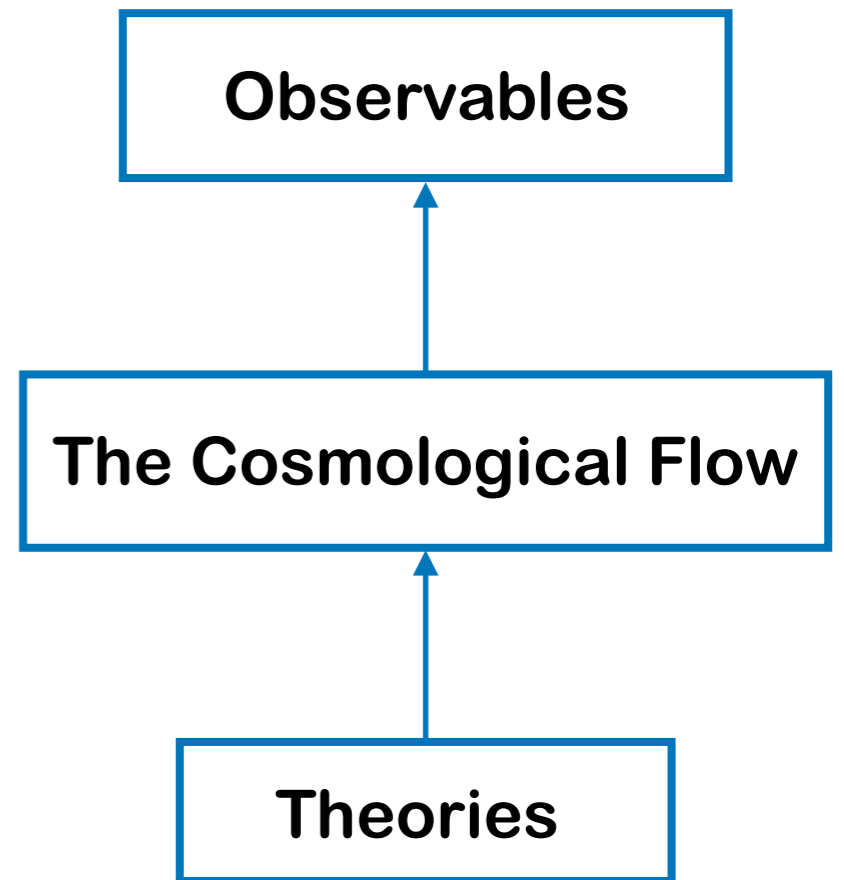
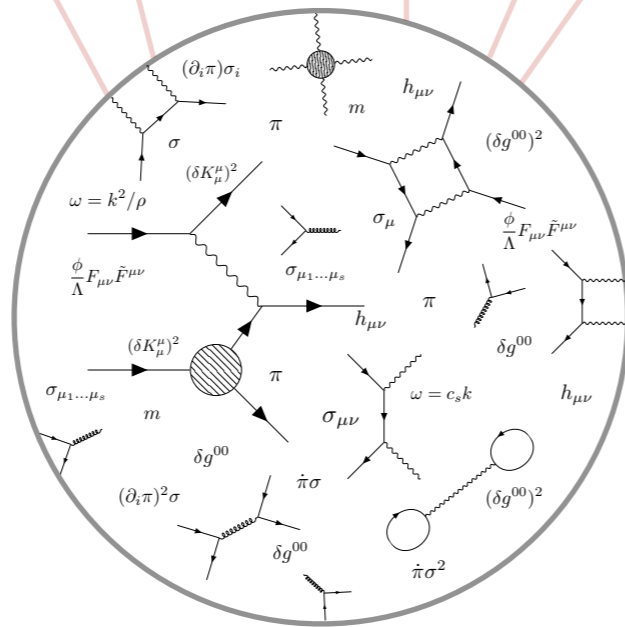
# The Cosmological Flow Philosophy

Inflation is a unique probe of the physics at the highest reachable energies

Time



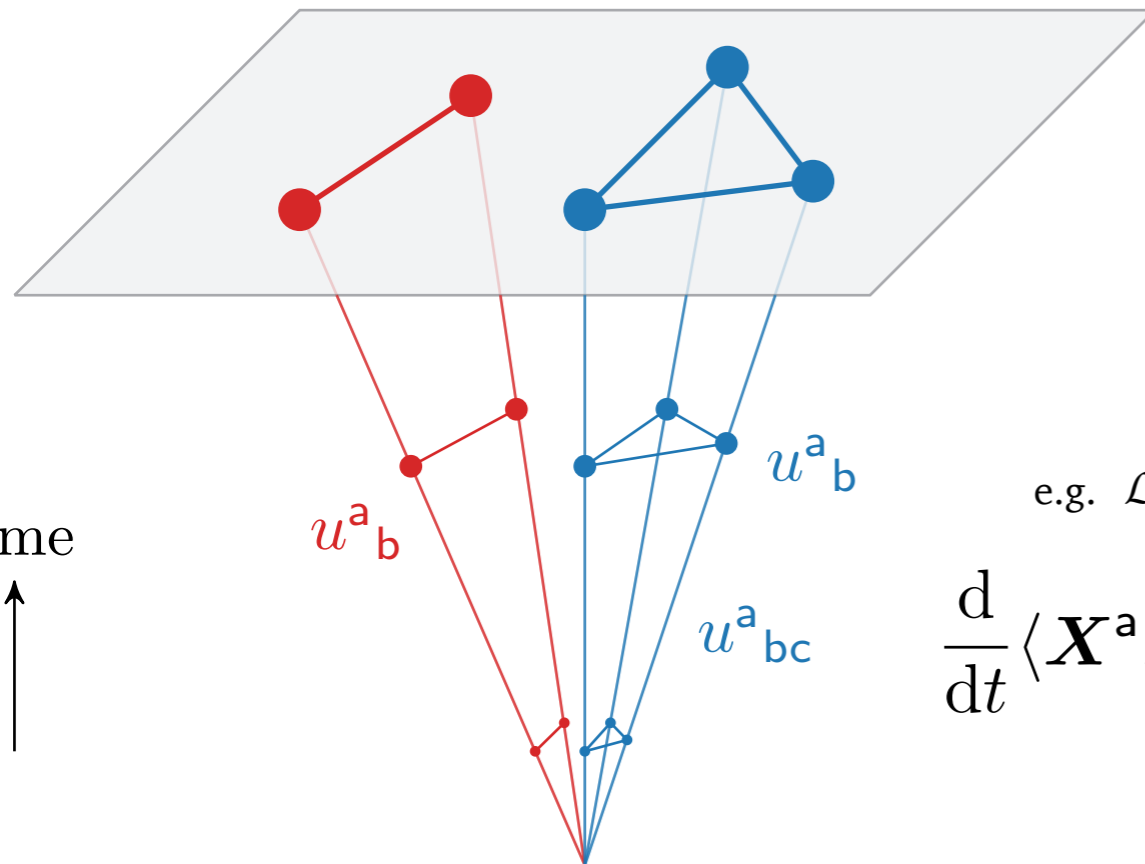
$$E \lesssim 10^{14} \text{ GeV}$$



Follow the **time evolution** of primordial fluctuations from their origin as **quantum vacuum fluctuations** to the reheating surface

From first principles and at tree-level, the time evolution of primordial correlators is encoded in the **flow equations** (Ehrenfest theorem)

$$\langle X^a X^b \rangle \quad \langle X^a X^b X^c \rangle$$



$$\frac{d}{dt} \langle X^a X^b \rangle = u^a_c \langle X^c X^b \rangle + u^b_c \langle X^a X^c \rangle$$



**Theory dependence** (any time/momentum dependence)

e.g.  $\mathcal{L} = g(t)(\partial_i \phi)^2 \sigma$  implies  $u_{\phi\phi}^\sigma = g(t) \mathbf{k}_\phi \cdot \mathbf{k}_\phi$



$$\frac{d}{dt} \langle X^a X^b X^c \rangle = u^a_d \langle X^d X^b X^c \rangle + u^a_{de} \langle X^b X^d \rangle \langle X^c X^e \rangle$$

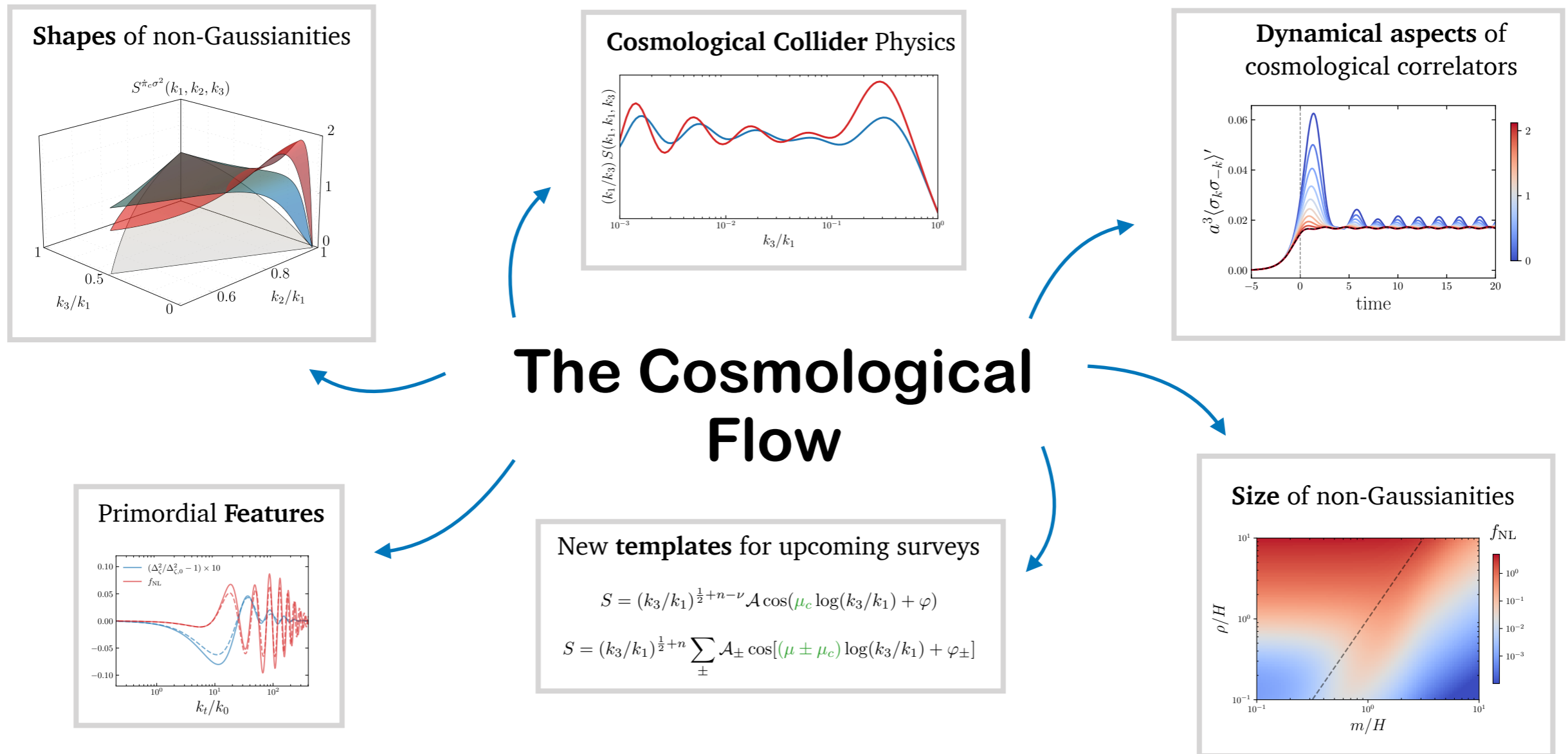
**Initial conditions automatically known for Bunch-Davis** (or make your own choice)

The **Cosmological Flow** is an **efficient** and **systematic** approach to compute primordial correlators

# Probing High-Energy Aspects of Inflation

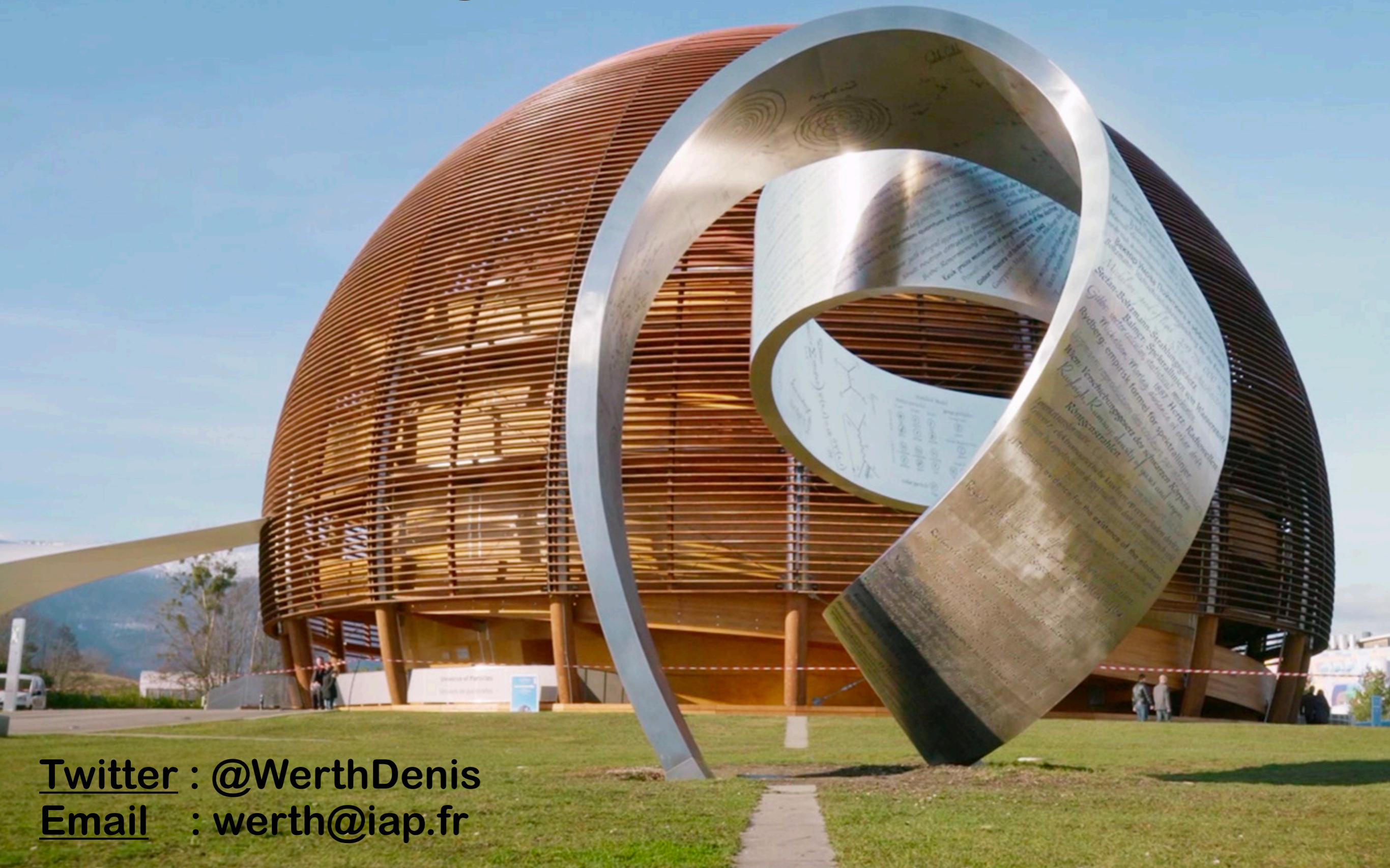
Numerical code **CosmoFlow** soon available

The Cosmological Flow offers new possibilities for **studying**, **exploring** and **understanding** inflationary physics



We have only scratched the tip of the iceberg ...

# Thank you



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