Prediction of Dark Flow from Landscape Multiverse

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Presentation Outline

Landscape Multiverse

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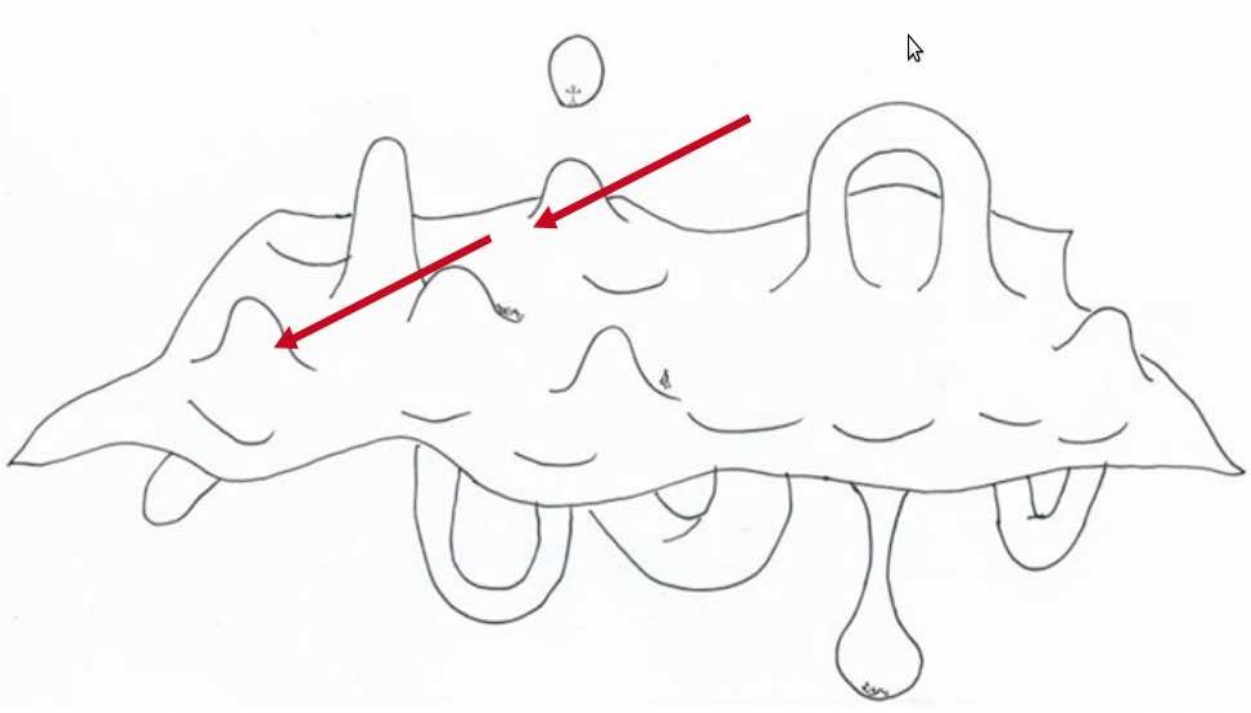
- There can be 10^{500} to 10^{600} possible birth places
- Quantum Mechanics is the fundamental theory of nature

How does the landscape looks like??



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- Parametrized by the scale factor $a(t)$ of the universes with spatially flat 3-D geometry and moduli field ϕ of the landscape with energy $V(\phi)$
- The wave function propagates over the landscape

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$$\hat{H} = \frac{1}{2\exp(3\alpha)}\left[\frac{4\pi}{3M_P^2}\frac{\partial^2}{\partial\alpha^2} - \frac{\partial^2}{\partial\phi^2} + \exp(6\alpha)V(\phi)\right]$$

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- $P = ||\psi(a,\phi)||^2$, Most probable universe sits on minimum non-negative energy(!!)

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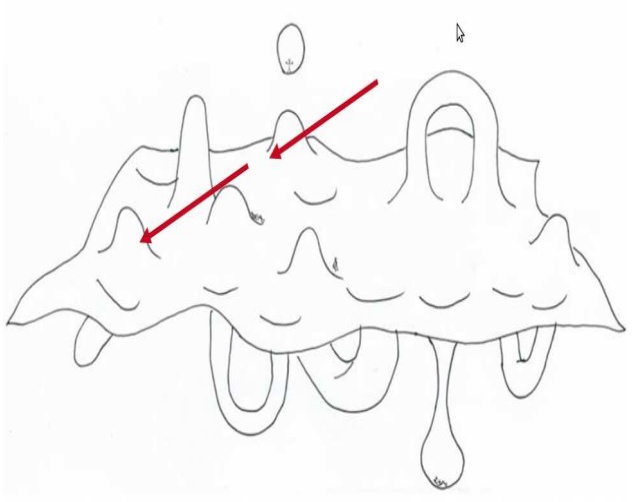
- Bath $\rightarrow$ Superhorizon size pertubations
- System $\rightarrow$ wavepacket sitting at the landscape vaccua (the womb)

Multiverse



Then the master equation looks like:

$$\hat{H}_0\psi[a,\phi] = -\sum \hat{H}_n\psi[a,\phi]$$

$$\hat{H}_n = -\frac{\partial^2}{\partial f_n^2} + U_n f_n^2 \text{ [arXiv: 0809-36203v1]}$$

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- The characteristic length scale is given by,

$$L_1^2 = \frac{a}{H}(\frac{m^2}{3H} + H)\ln(b/H) - \frac{m^2H}{6}(\frac{1}{b^2} - \frac{1}{H^2})$$

[arXiv:hep-th/0612142v1]

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- The dipole anisotropy induced:

$$\frac{\Delta T}{T}|_{dip} \simeq \frac{4\Pi}{15}(\frac{r_H}{L_1})(\frac{V(\phi)F(b,V)}{18M_p^4})$$

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- $V(\phi) = exp(-\lambda\phi/M_p) \Rightarrow$ 650-750km/s [arXiv:0810.5388v1]

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- Since there is a dependence on $V(\phi)$, i.e. the inflaton potential we started to look at the different possible potentials to calculate the range of peculiar velocities
- With different potentials we (with my advisor Dr. Grant Mathews) are getting velocity in much lower range than the previously mentioned range
- If there is any dark flow present then it must be detected without any controversy (hopefully!!) in near future and if it is there knowing the precise range we can get an idea about the inflaton potential working in the Landscape scenario