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Pre-big-bang in string cosmology

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Scale factor duality for classical and quantum strings

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Isotropic string cosmology solutions can be classified into two duality related branches: one can be connected smoothly to an expanding Friedman-Robertson-Walker Universe, the other describes accelerated inflation or contraction. We show that, if the dilaton potential has certain generic properties, the two branches can evolve smoothly into each other.

Now I'm back to thinking about the idea

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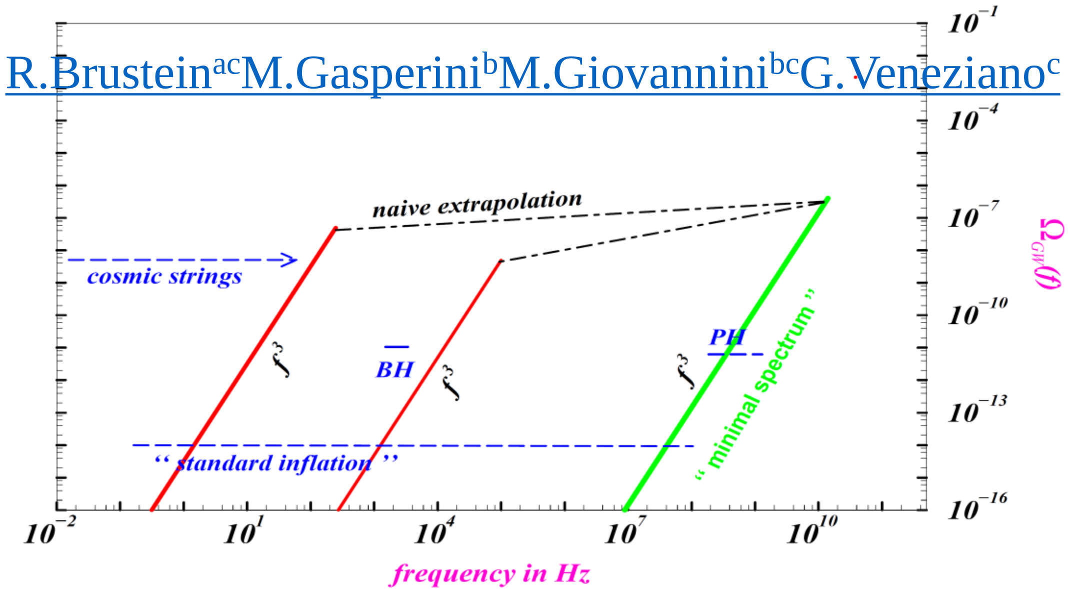

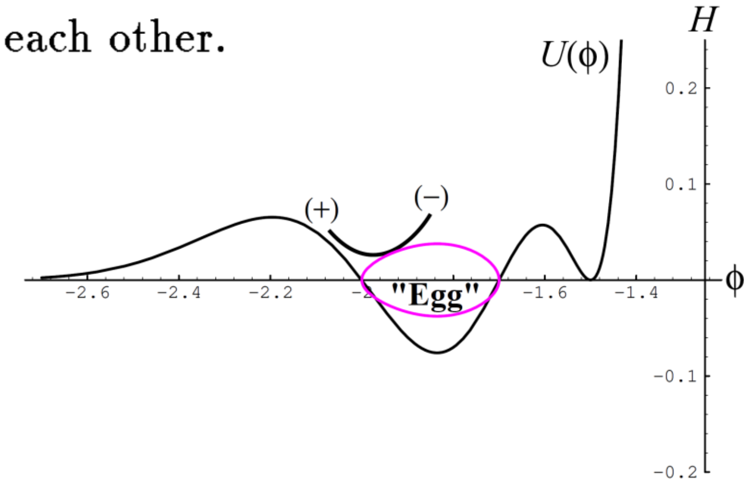

Figure 2. The dilaton potential and corresponding "Egg". A branch change induced by negative potential.

Entropy Bounds

CEB : $S_{\sigma<0} \leq S_{CEB}$

Maximal entropy

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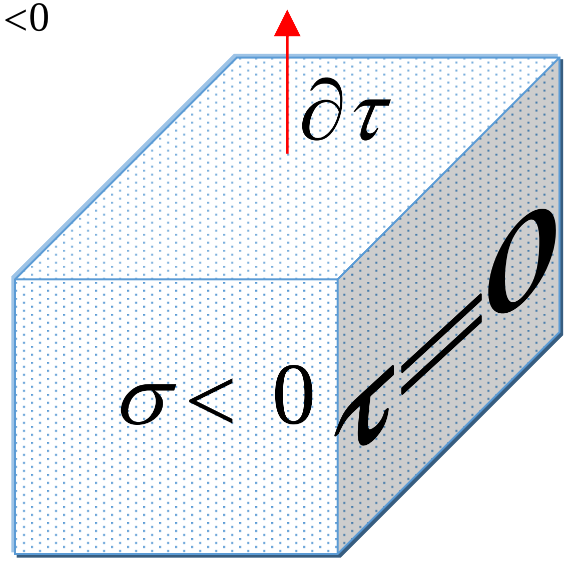
$$S_{CEB} = \frac{1}{l_P^2} \int_{\sigma<0} d^4x \sqrt{-g}\,\delta(\tau) \sqrt{\mathrm{Max}_{\pm}\left[\left(R_{\mu\nu} \pm R_{\mu\nu} - \tfrac{1}{2} g_{\mu\nu} R\right) \partial^{\mu}\tau \partial^{\nu}\tau\right]}$$

$$= \frac{1}{l_P \sqrt{\hbar}} \int_{\sigma<0} d^4x \sqrt{-g}\,\delta(\tau) \sqrt{\mathrm{Max}_{\pm}\left[\left(T_{\mu\nu} \pm T_{\mu\nu} \mp \tfrac{1}{2} g_{\mu\nu} T\right) \partial^{\mu}\tau \partial^{\nu}\tau\right]}$$



$$\frac{S}{V} \leq \sqrt{\frac{E}{VG}} \Rightarrow S \leq \sqrt{\frac{EV}{G}}$$

Conclusions

א Holography modified by causality

ב Singularity thms. modified by entropy bounds

ג Hint: shortest length scale $\frac{M_P}{\sqrt{N}}$ (Now called species scale)