

From 'nothing' to inflation and back again

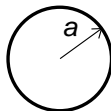
Vladimír Balek

Comenius University, Bratislava

Relativity and Gravitation, *100 years after Einstein in Prague*
Prague, 25-29th June 2012

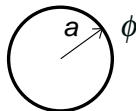
playground

- closed universe



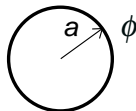
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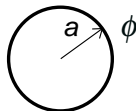


tunneling in a -direction

ϕ in false vacuum (min/max of V) $\stackrel{eff}{=}$ pure gravity with Λ

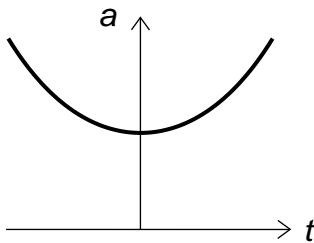
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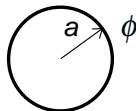
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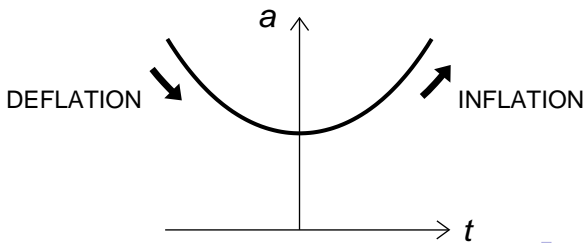
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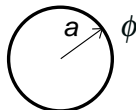
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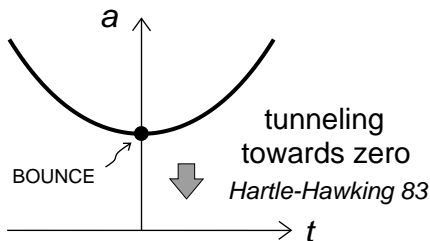
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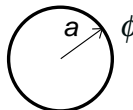
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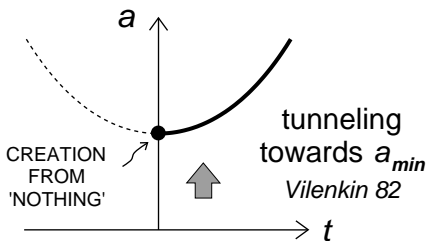
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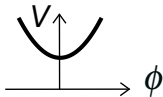
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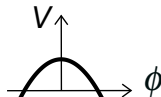
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$(a, \phi) = \text{Lorentzian}(r, \varphi) \rightarrow$ constraint on V (to have finite $\Delta\phi$):

BOUNCE:

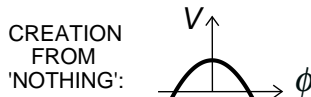
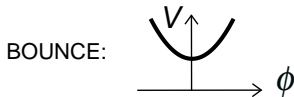


CREATION
FROM
'NOTHING':



smearing in ϕ -direction

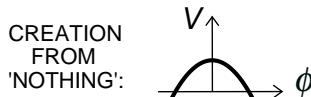
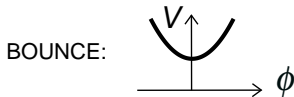
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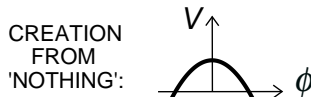
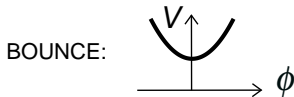


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- bounce (*Hawking 84*): analysis without Λ & brief remark on cutoff induced on ψ by small nonzero Λ ; **BUT** "we live in a lorentzian geometry, therefore we are interested really only in the oscillatory part of the wave function"
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aim of present work: **to supply this bit of theory**

first try: WKB in both directions

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separate **longitudinal WKB part** out of ψ , and then get rid of ϕ^2 terms by introducing **lateral cutoff factor** $\exp[-f(a_r)\phi_r^2]$ ('r' = rescaling out Λ); $f \leftrightarrow$ latitudinal mode on S^4 with noninteger l

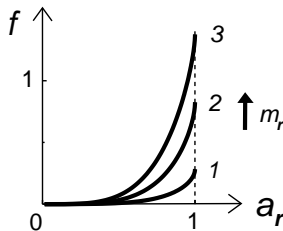
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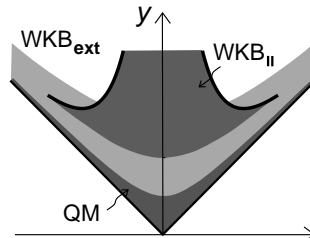
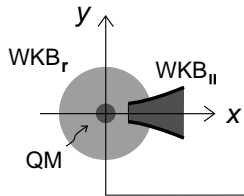
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possible extensions: description of HM/CdL instanton; as for now:
mathematics works, solution looks as expected

THANK YOU