Roulette Inflation `hep-th/0612197`

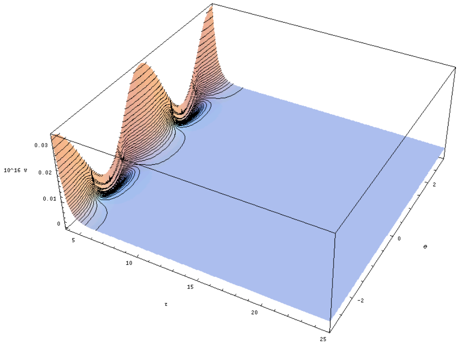
J. Richard Bond   Lev Kofman   Sergey Prokushkin
Pascal M. Vaudrevange

CITA ICAT Canadian Institute for Theoretical Astrophysics L'institut canadien d'astrophysique theorique

VELUT ARBOR ÆVO

24.08.2007

Outline



- $W = W_0 + \sum_i A_i e^{-a_i T_i}, \;\; T_i = \tau_i + i\theta_i$
- $K = -2\ln(\mathcal{V} + \frac{\xi}{2}), \;\; \mathcal{V} = \alpha\left(\tau_1^{3/2} - \sum_{i=2}^{n} \lambda_i \tau_i^{3/2}\right)$

Calculating the potential

$$V = e^K \left(K^{i\bar{j}} D_i W D_{\bar{j}} \bar{W} - 3|W|^2 \right) \quad , \quad D_i = \partial_i + K_i,\ K_i = \frac{\partial K}{\partial T^i},\ K_{i\bar{j}} = \frac{\partial^2 K}{\partial T^i \partial \bar{T}^{\bar{j}}}$$

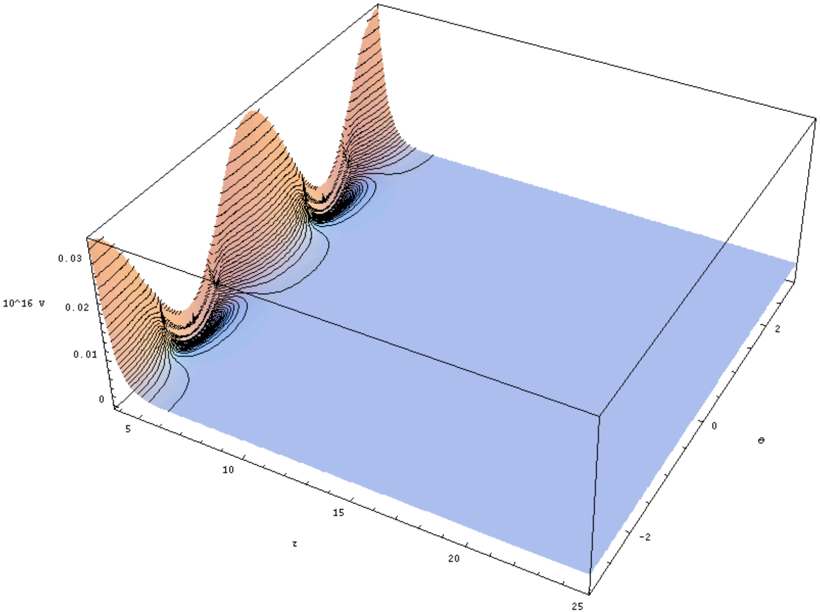
$$\begin{aligned} V(T_1, ..., T_n) = \\ & \frac{12 W_0^2 \xi}{(4\mathcal{V} - \xi)(2\mathcal{V} + \xi)^2} + \sum_{i=2}^{n} \frac{12 e^{-2a_i\tau_i} \xi A_i^2}{(4\mathcal{V} - \xi)(2\mathcal{V} + \xi)^2} + \frac{16 (a_i A_i)^2 \sqrt{\tau_i} e^{-2a_i\tau_i}}{3\alpha\lambda_2 (2\mathcal{V} + \xi)} \\ & + \frac{32 e^{-2a_i\tau_i} a_i A_i^2 \tau_i (1 + a_i\tau_i)}{(4\mathcal{V} - \xi)(2\mathcal{V} + \xi)} + \frac{8 W_0 A_i e^{-a_i\tau_i} \cos(a_i\theta_i)}{(4\mathcal{V} - \xi)(2\mathcal{V} + \xi)} \left(\frac{3\xi}{(2\mathcal{V} + \xi)} + 4a_i\tau_i \right) \\ & + \sum_{\substack{i,j=2 \\ i<j}}^{n} \frac{A_i A_j \cos(a_i\theta_i - a_j\theta_j)}{(4\mathcal{V} - \xi)(2\mathcal{V} + \xi)^2} e^{-(a_i\tau_i + a_j\tau_j)} \left[32(2\mathcal{V} + \xi)(a_i\tau_i + a_j\tau_j \right. \\ & \left. + 2a_i a_j \tau_i \tau_j) + 24\xi \right] \end{aligned}$$

Stabilization and Uplift

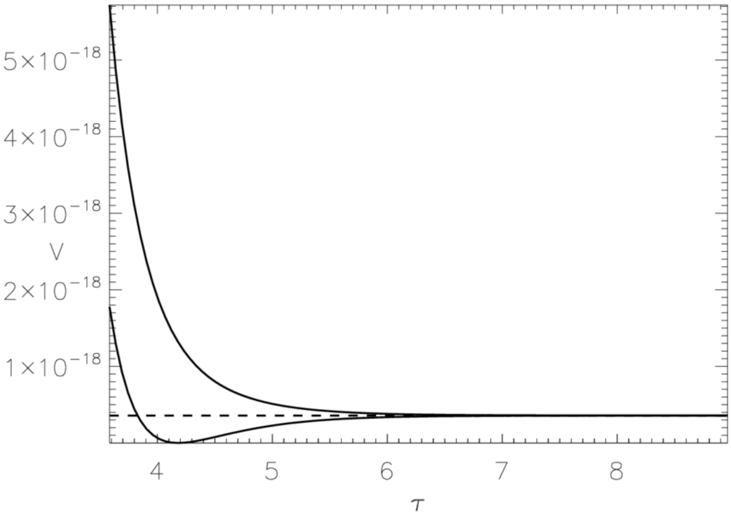
- At least 3 complex fields $(T_1, T_2, T_3) \Leftrightarrow (\mathcal{V}, T_2, T_3)$
- inflaton T_2
- Stabilization through extra fields $T_3 \ldots T_n$: $\sum_{i=2}^{n} \frac{\lambda_i}{a_i^{3/2}} \gg \frac{\lambda_2}{a_2^{3/2}}$
- self-consistent uplift procedure
- inflaton $T_2 \equiv \tau + i\theta$

$$V(\tau, \theta) = \frac{8(a_2 A_2)^2 \sqrt{\tau} e^{-2a_2\tau}}{3\alpha\lambda_2\mathcal{V}_m} - \frac{4 W_0 a_2 A_2 \tau e^{-a_2\tau} \cos(a_2\theta)}{\mathcal{V}_m^2} + \Delta V$$

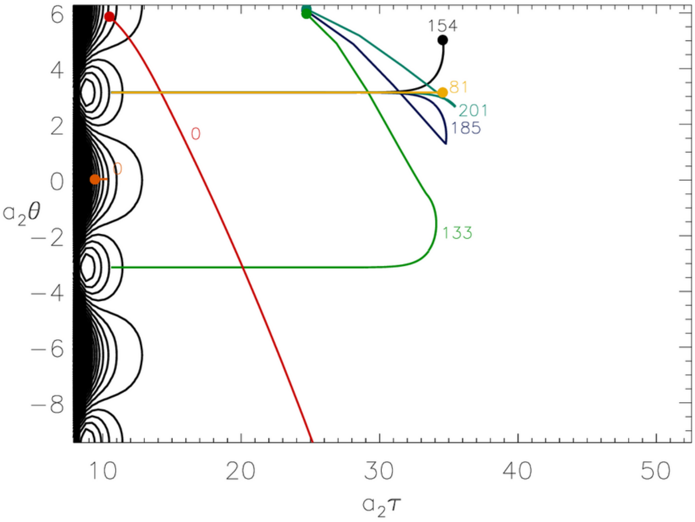
The Roulette Wheel...



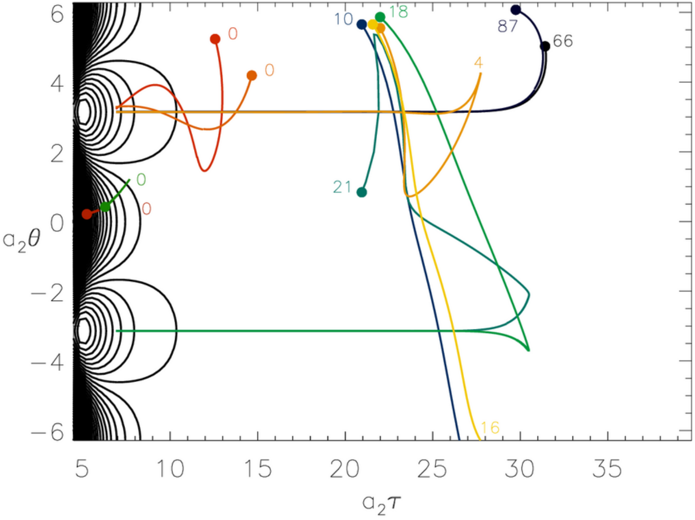
... is only a little rigged



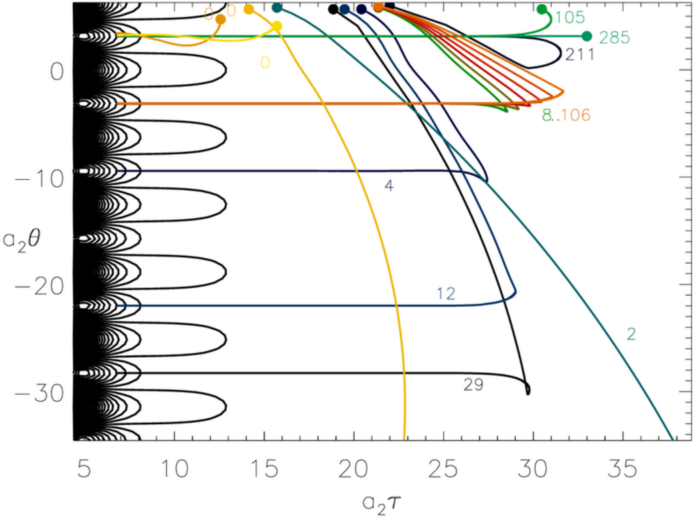
Viable trajectories



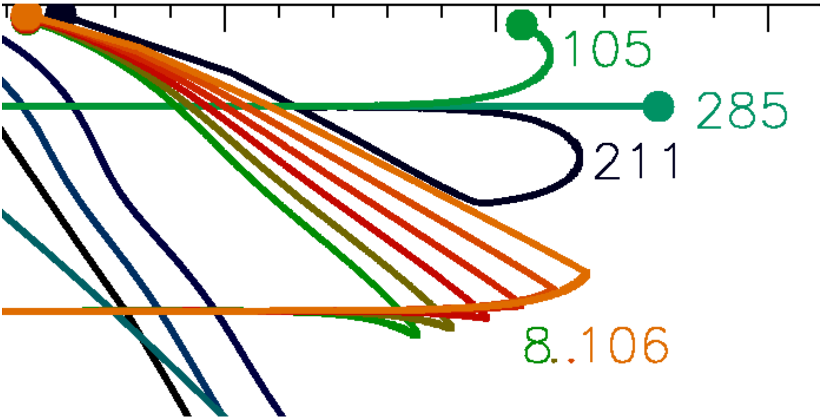
Viable trajectories



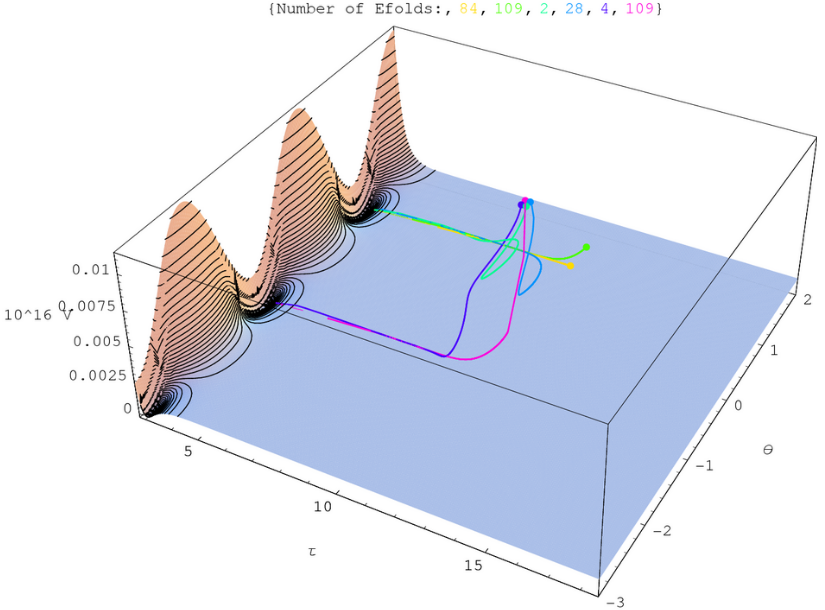
Viable trajectories



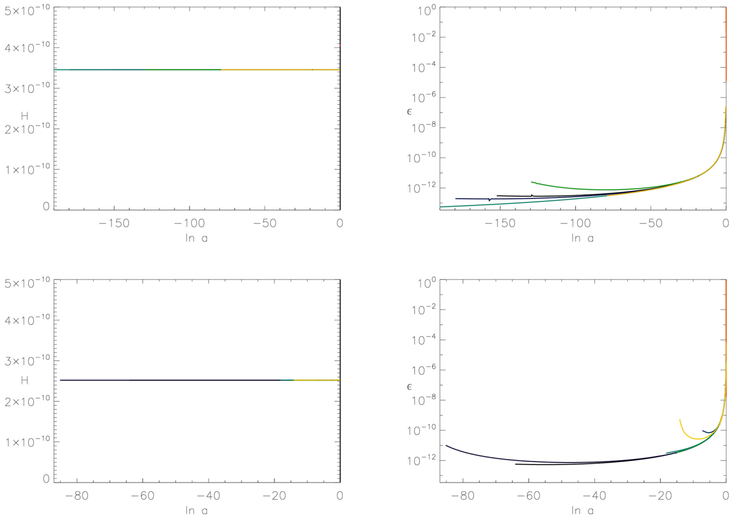
Importance of Initial conditions



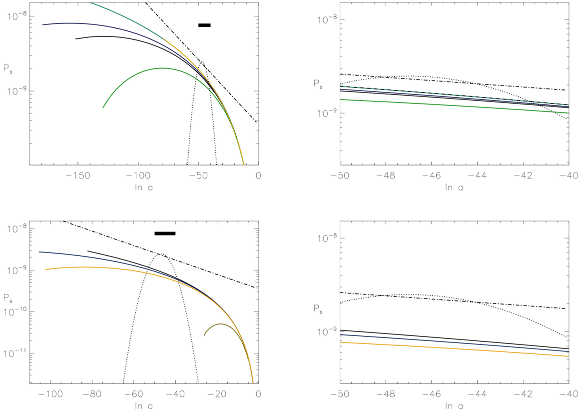
Trajectories on the wheel



Hubble and ϵ



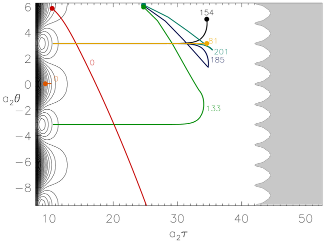
Scalar and tensor power spectra



Template $P_S \propto k^{n_s - 1}$ with a) dash-dot: $n_s = 0.95, \ n_{\rm run} = 0$
b) dotted: $n_s = 0.95, \ n_{\rm run} = -0.055$, pivot point $N = 45$

Initial conditions

- Stabilization from $3^{\mathrm{rd}} \ldots n^{\mathrm{th}}$ field $T_3 \ldots T_n$
- $\Rightarrow$ uniform (?) distribution of initial values of (τ, θ)
- maybe existence of region of eternal inflation? $\Rightarrow$ YES!



Conclusions

- Trajectories determined by
  - Parameters
  - Initial conditioins
- Axionic direction
- Bifurcation points
- Lots of efolds
- Stochastic regime