Aligned Natural (Axion) Inflation Manifold

Trajectories with suppressed tensor-to-scalar ratio in Aligned Natural Inflation

Marco Peloso & Caner Unal : JCAP 06 (2015) 040 arXiv: 1504.02784

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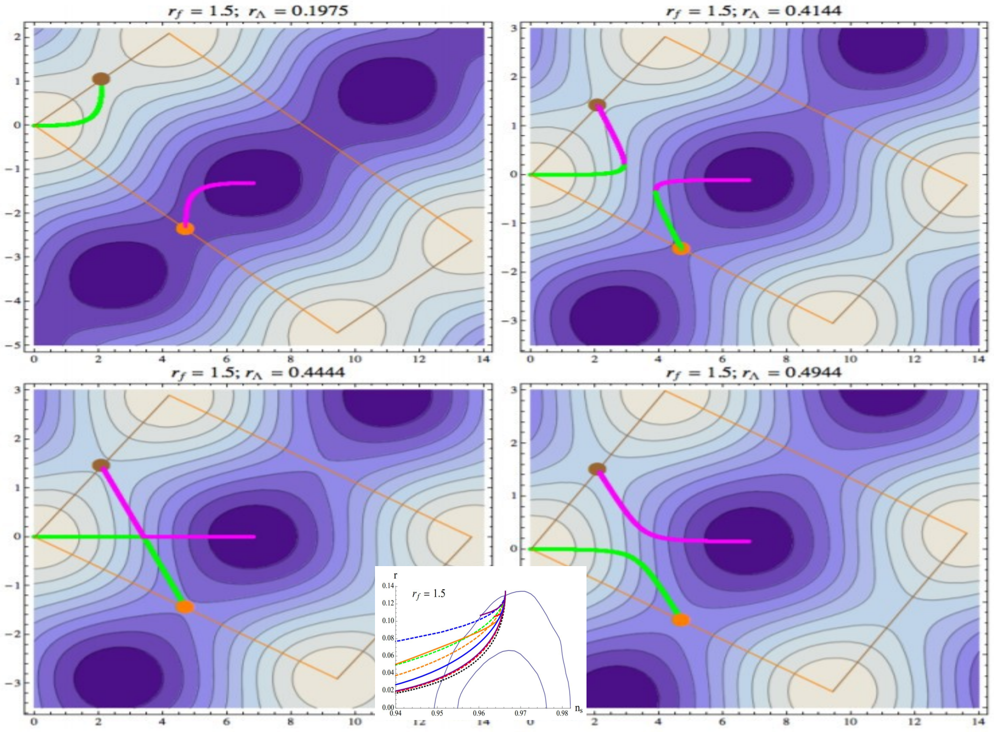
- Aligned Natural inflation : 2 axions with generic cosine potential + alignment/misalignment **Kim, Nilles, Peloso 2004**
- Task: Analyze this generic manifold and find all the trajectories
- We did, we found maxima, minima and saddles, then categorised whole solutions in terms of a couple parameters describing the manifold and studied inflationary phenomenology of each trajcetory
- Finally we showed again that two axion alignment is an "INHERENT" way to create hierarchy in axion scales, which also allows the axion to couple gauge fields with large enough couplings to observe rich class of signals such as parity violation in tensor sector, GW at CMB-LSS and interferometers LISA, PTA, DECIGO, BBO, etc.



$$V = \Lambda_1^4 \left[1 - \cos\left(\frac{\theta}{f_1} + \frac{\rho}{g_1}\right)\right] + \Lambda_2^4 \left[1 - \cos\left(\frac{\theta}{f_2} + \frac{\rho}{g_2}\right)\right]$$

Perfect alignment = flat direction

$$f_1/g_1 = f_2/g_2$$

Small misalignment factor alpha

$$\frac{g_1}{f_1} \equiv \frac{r_g}{1+\alpha} \ , \quad \frac{g_2}{f_2} \equiv \frac{r_g}{1-\alpha}$$

Ratio of axion scales

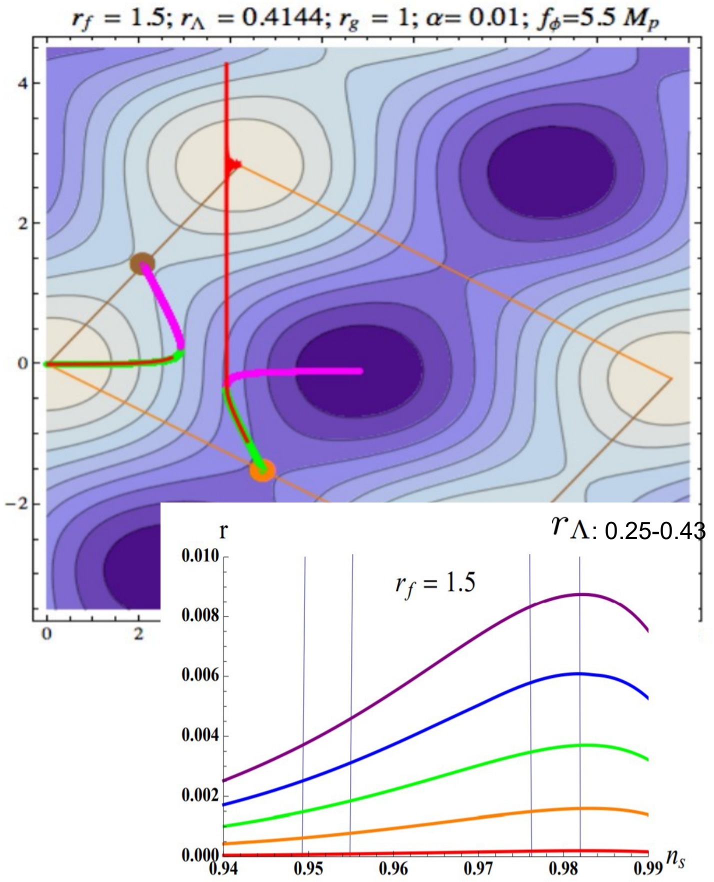
$$f_1 \equiv r_f \, f \ , \quad f_2 \equiv \frac{f}{r_f}$$

Light and Heavy Eigenstates

$$\begin{pmatrix} \theta \\ \rho \end{pmatrix} = R \begin{pmatrix} \phi \\ \psi \end{pmatrix} ,$$

$$R_{11} = R_{22} = \frac{1}{\sqrt{1+r_g^2}} + \alpha \frac{r_g^2}{(1+r_g^2)^{3/2}} \frac{1 - r_f^4 r_\Lambda}{1 + r_f^4 r_\Lambda} ,$$

$$R_{12} = -R_{21} = \frac{r_g}{\sqrt{1+r_g^2}} - \alpha \frac{r_g}{(1+r_g^2)^{3/2}} \frac{1 - r_f^4 r_\Lambda}{1 + r_f^4 r_\Lambda}$$



Conclusions:

-Saddles give r ~ 0.001

-Maxima, minima natural inflation-like pheno

-Inherent hierarchy

-Gauge couplings