A Model of Axion-Gauge Field Inflation

arxiv:1706.03765

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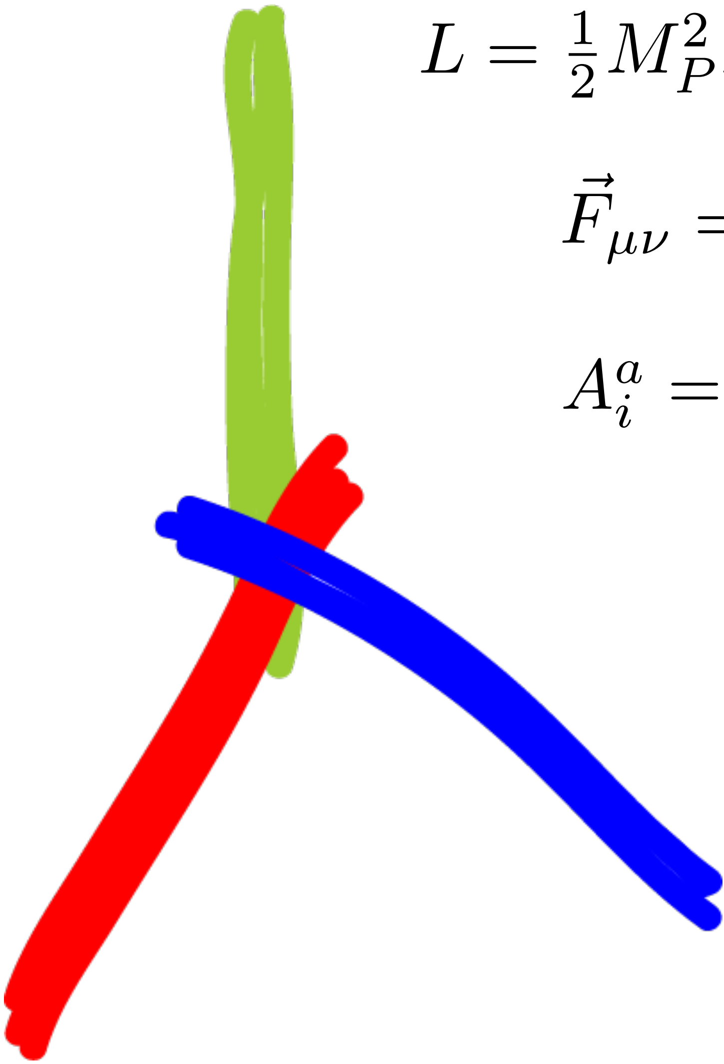
Novel Gravitational Behavior



$$L = \frac{1}{2} M_P^2 R - \frac{1}{4} \vec{F}_{\mu\nu} \cdot \vec{F}^{\mu\nu}$$

$$\vec{F}_{\mu\nu} = \partial_\mu \vec{A}_\nu - \partial_\nu \vec{A}_\mu - g \vec{A}_\mu \times \vec{A}_\nu \quad \mathrm{SU(2)}$$

$$A_i^a = \phi(\tau) \delta_i^a \quad \mathrm{flavor-space\,locked}$$

Devulder, Maksimova, RC 2016, 2017
Bielefeld, RC 2015, 2016

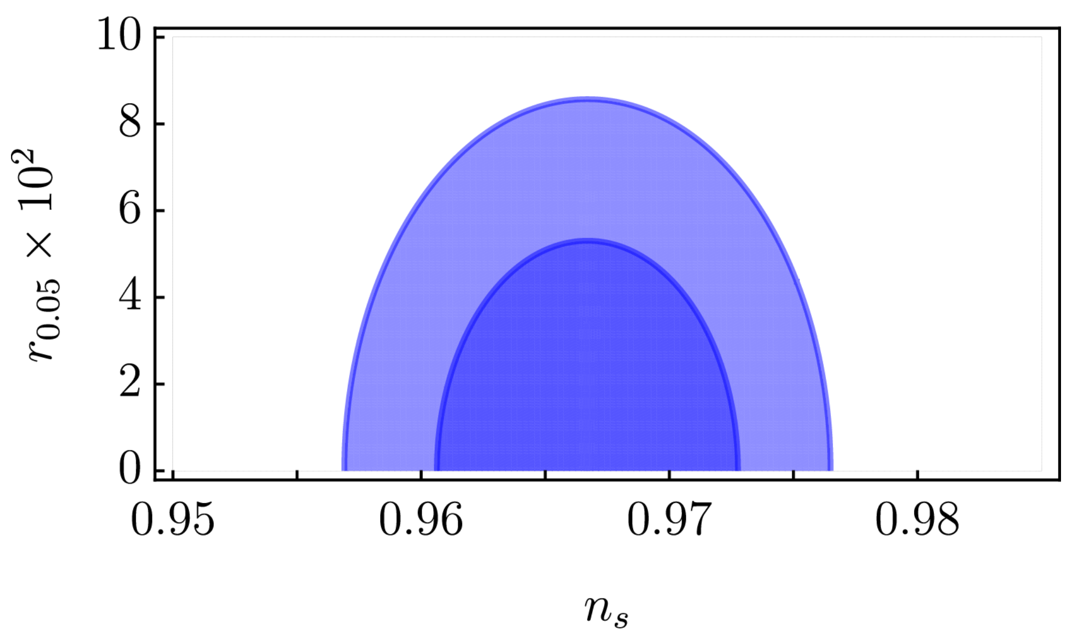
Models of Inflation

Anber & Sorbo 2009;
Maleknejad & Sheikh-Jabbari 2011;
Adshead & Wyman 2012;
Namba, Dimastrogiovanni, Peloso 2013;
Dimastrogiovanni, Fasiello, Fujita 2016;
Adshead, Martinec, Sfakianakis, Wyman 2016…

Models of Inflation

$$\mathcal{L} = \frac{1}{2}M_P^2 R - \frac{1}{2}(\partial\chi)^2 - V(\chi) - \frac{1}{4}F^a_{\mu\nu}F_a^{\mu\nu} + \frac{\chi}{M}F^a_{\mu\nu}\widetilde{F}_a^{\mu\nu}$$

Models of Inflation



$$n_s = 0.9667 \pm 0.0040\,(1\sigma)$$ Planck 2016

$$r < 0.07\,(95\%\,C.L.)$$ BKP 2016

New: Toy Model of Inflation

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$$V = \frac{1}{n}m^4(\chi/m)^n$$

Parameters: n, m, M, g

Constraints: Δ_ζ^2, $r(n_s)$

Devulder & RC 2017
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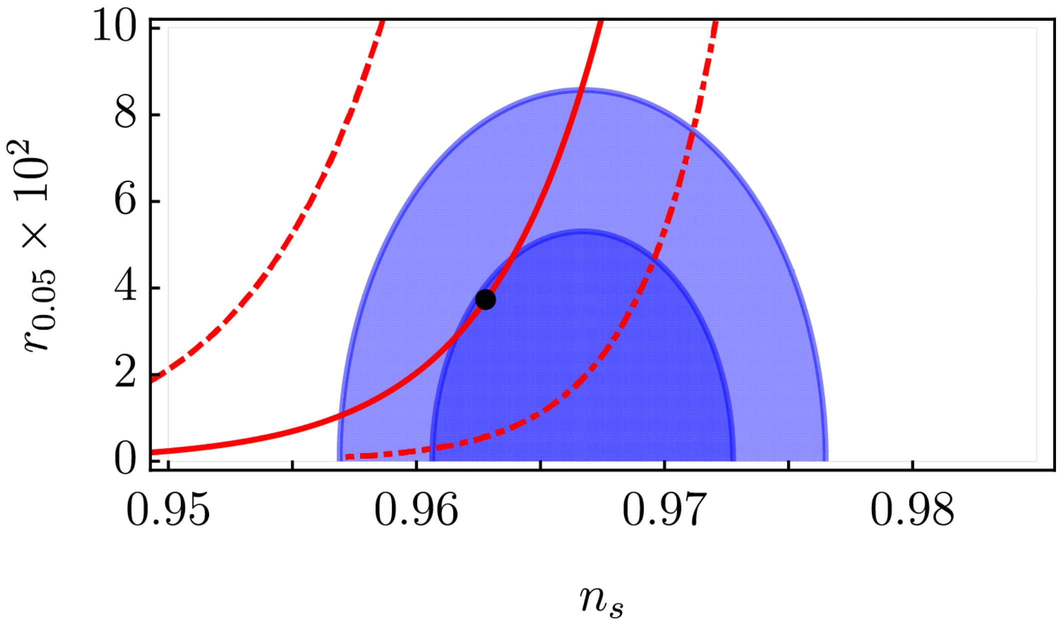
New: Toy Model of Inflation

n=1/4,   1/8,   1/16



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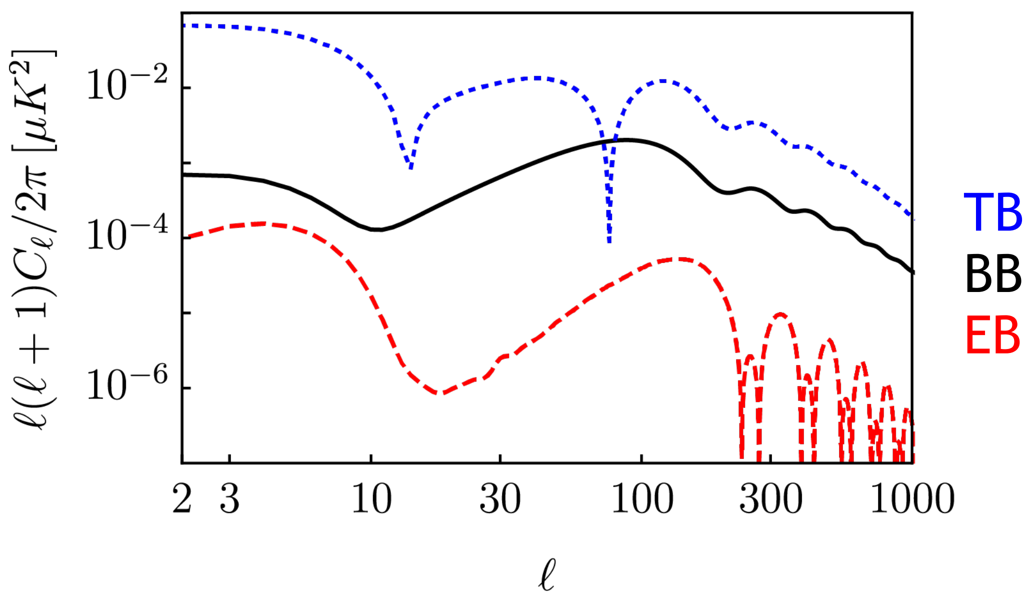
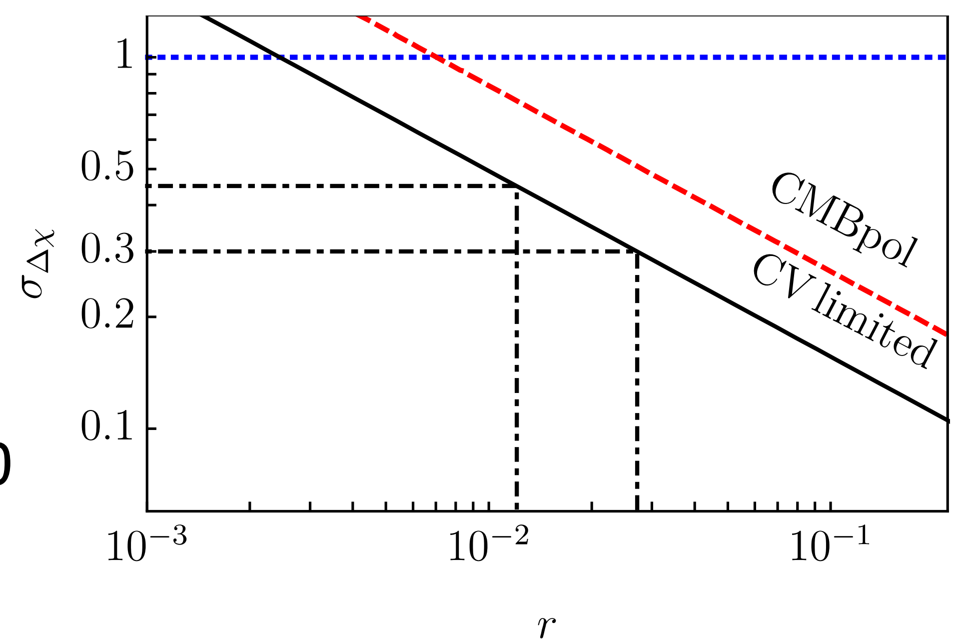
Chiral Gravitational Waves



This model predicts

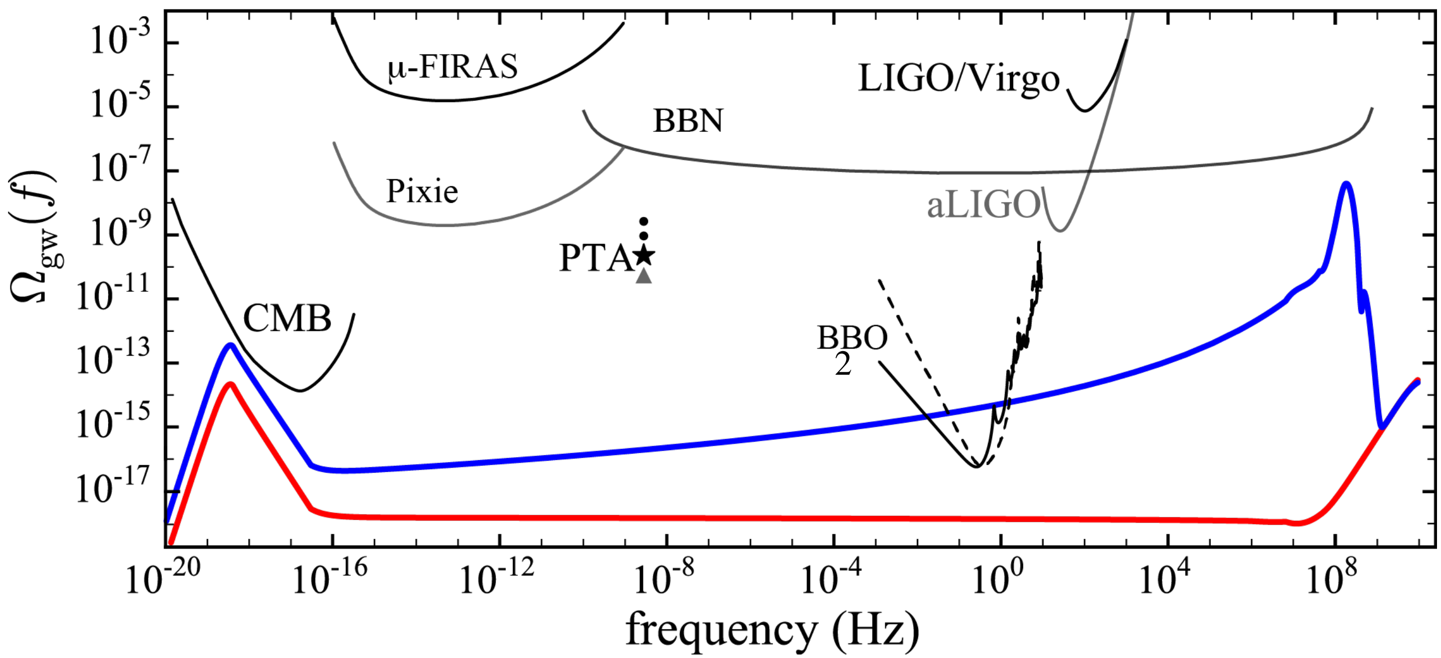
(L−R)/(L+R) $\Delta\chi \simeq 0.9$



Detect Chirality:

Gluscevic & Kamionkowski 2010

Chiral Gravitational Waves



$\Omega_{\delta A} \ll 1$

$|\delta A| \ll |A|$

Lasky et al 2016;
Smith & RC 2017

see also Seto 2006,
Crowder et al 2013,
Thorne et al 2017.

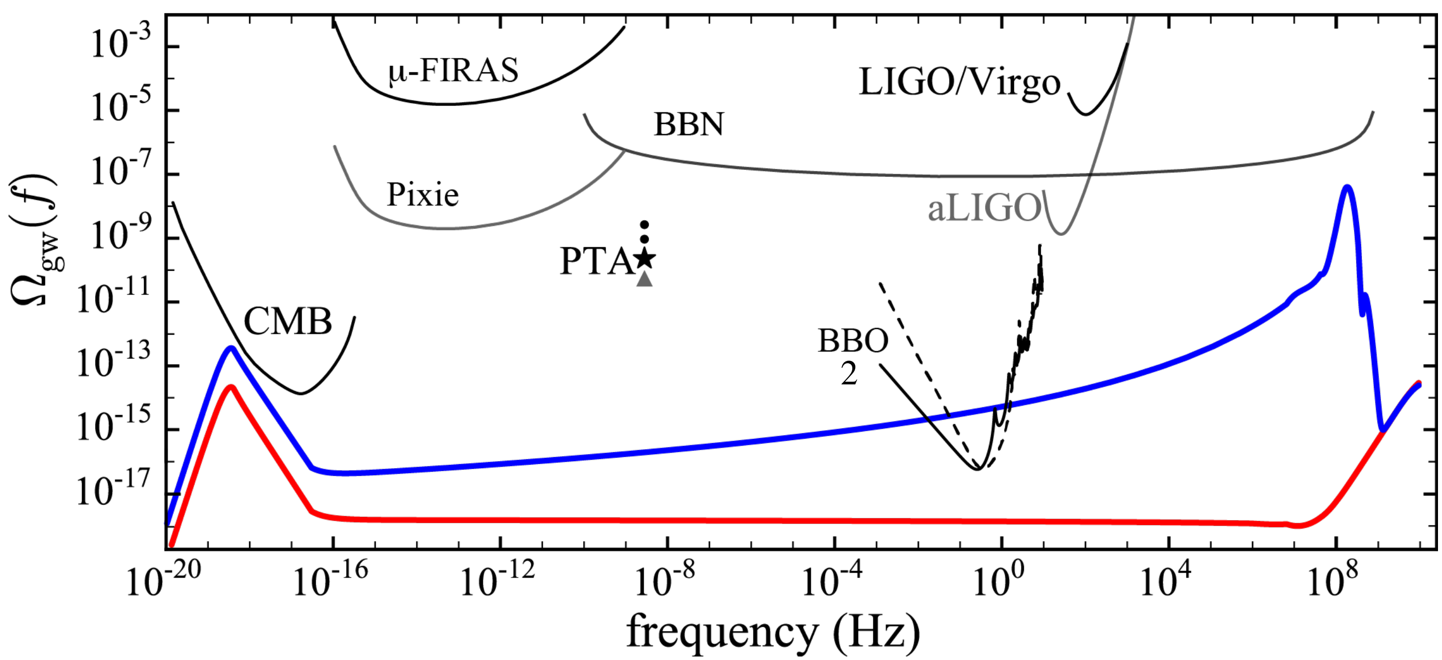
Leptogenesis

cosmological fermion number non-conservation

$$N_R - N_L = \frac{1}{24(16\pi^2)} \int d^4x \sqrt{-g} R\widetilde{R}$$

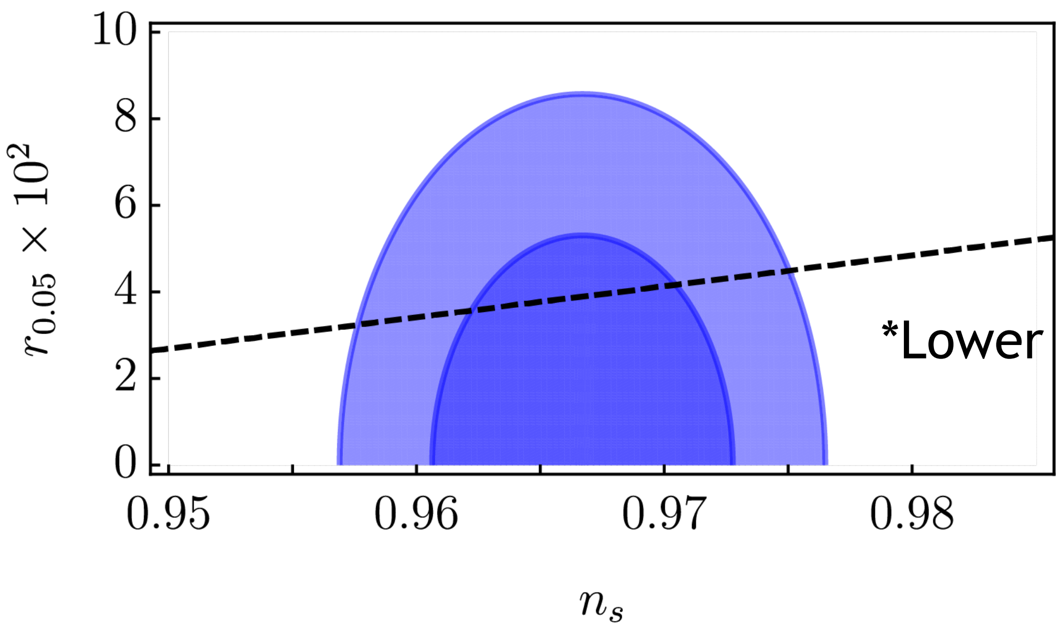
Eguchi, Gilkey, Hanson (1980)

create lepton asymmetry from chiral gravitational waves



Leptogenesis

$$\eta = \frac{n_B}{n_\gamma} = \frac{n_B}{n_\ell}\frac{n_\ell}{s}\frac{s}{n_\gamma}$$



$$\eta \simeq 6.1(\pm 0.04) \times 10^{-10}$$

*Lower Bound Planck 2016

*Model variations reduce the lepton asymmetry, thereby requiring higher r=t/s to explain baryon excess.

Summary

<u>Axion-Gauge Field Inflation</u>

Viable scalar, tensor spectra

Unique imprint: chiral asymmetric GWB

Leptogenesis: lower bound for B modes

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