Axion-Photon Interactions in an RS1 Braneworld and CMB Anisotropy

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- Large $\not{P}$ correlations not seen, will perhaps never be seen! Problem for RS1 ?

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Bianchi

$$\begin{aligned} d\mathbf{H} \; &= \; 0 \\ \Rightarrow \quad d^*d\mathbf{V} \; &= \; 0 \end{aligned}$$

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Composite gauge invariance

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Plane waves of circ pol $\Rightarrow$ LC & RC pol travel at different freq $\rightarrow$ **Optical activity** $\rightarrow$ rotation of pol plane SenGupta & PM 1999; Kar, SenGupta, Sinha, PM 2002

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$$d^*dV \;=\; M_5^{-3/2}\,F\wedge F$$

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Exponentially large axion-photon coupling $\Rightarrow$ unobserved exponentially large optical activity! $\rightarrow$ **Contradiction ! Who is to blame ?**

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Correlates of multipole moment coeff a^X_{lm} , $X = T, E, B$

$$C_l^{XX'} \equiv \langle a^X_{lm} \, a^{X'}_{lm} \rangle$$

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- Existence of ζ_- $\Rightarrow$ time-varying (increasing) $\alpha_{eff}^{-1} = \alpha_0^{-1} + (\zeta_-/M_P)\phi^{(-)}(t)$, but $(\Delta\alpha/\alpha) \sim 10^{-5}$
- Embedding the augmentation in a braneworld scenario may have interesting consequences

Is the antiwarping seen in an RS1 braneworld still there ? Maity, Sengupta, PM

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$$\begin{aligned}S_{int} &= \frac{1}{M_P^{1/2}}\int d^5x\sqrt{-g}\delta^M_\mu\delta^N_\nu\delta^L_\lambda\delta(\phi-\pi)H_{MNL}A^{[\mu} \\ &\cdot \; [\zeta_+ F^{\nu\lambda]} \; + \; \zeta_-{}^* F^{\nu\lambda]}]\end{aligned}$$

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Integrating over the bulk

$$S_{int} = \sqrt{\frac{k}{M_P}r_c e^{kr_c}}\int d^4x H_{\mu\nu\lambda}A_{[\mu}[\zeta_+ F^{\nu\lambda]} + \zeta_-{}^* F^{\nu\lambda]}$$

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Need unnatural fine tuning of $d\phi/dt$ to reconcile results obtained with experiment