Anisotropic inflation and its imprints on the CMB

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- **Primordial fluctuation** in conventional inflationary universe:

  Statistically homogeneous & **isotropic** $\langle \delta(\mathbf{k})\delta^*(\mathbf{k}')\rangle = P(|\mathbf{k}|)\delta^{(3)}(\mathbf{k}-\mathbf{k}')$

  ↑**Is this true of our Universe?**

- We propose a counter examle: **anisotropic inflation**
  - Introduction of a **vector field (coupled to inflaton)**

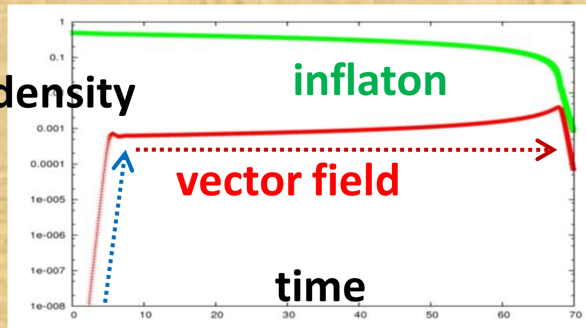
    $$\mathcal{L} \supset -\frac{1}{4} f(\phi)^2 F_{\mu\nu}F^{\mu\nu}$$

  - Assumption of homogeneous but **anisotropic** background

    $$ds^2 = -dt^2 + a^2(t)[b^{-4}(t)dz^2 + b^2(t)(dx^2 + dy^2)].$$

--> **How can it be imprinted on the CMB?**

1. *Evolution of homogeneous background*



Tracking & **scaling** solution of **anisotropic inflation** exists.

2. *Primordial fluctuations*

- Power **direction dependence**

$$P_\zeta(\mathbf{k}) = P_\zeta^{\rm iso}(k)(1 + g\ \sin^2\theta),$$

$$P_h(\mathbf{k}) = P_h^{\rm iso}(k)(1 + g_h\ \sin^2\theta),$$

$$g \sim \frac{\rho_{\rm vec}/\rho_{\rm inf}}{\epsilon^3}, \quad g_h \sim \epsilon \cdot g.$$

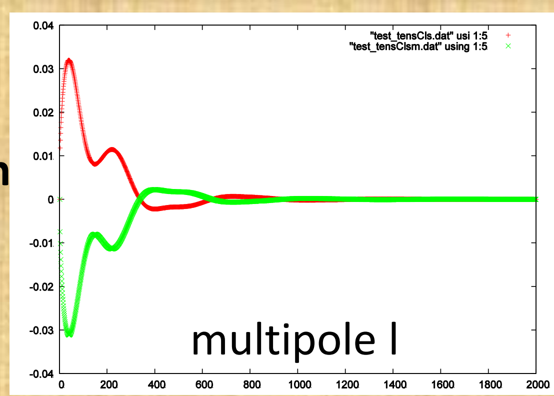
- **cross correlation w/ GW**

$$P_{h_+\zeta}(\mathbf{k}) = \sqrt{P_\zeta^{\rm iso}(k) P_h^{\rm iso}(k)}\ g_c\ \sin^2\theta,$$

$$g_c \sim \sqrt{\epsilon}\cdot g.$$

3. *CMB correlations*

Off diagonal TB correlation spectrum



Signal of anisotropic inflation appears :

- in **On- and Off-diagonal** (l≠l') components
- even in **TB, EB** correlations