

Signals of primordial magnetic fields in the CMB

Kerstin E. Kunze
(University of Salamanca, Spain)

Gaussian, helical magnetic field

$$M = S, A$$

$$\langle B_i^*(\vec{k}) B_j(\vec{q}) \rangle = \delta_{\vec{k}, \vec{q}} \mathcal{P}_S(k) \left(\delta_{ij} - \frac{k_i k_j}{k^2} \right) + \delta_{\vec{k}, \vec{q}} P_A(k) i \epsilon_{ijm} \hat{k}_m \quad \text{where}$$

$$\mathcal{P}_M(k, k_m, k_L) = A_M \left(\frac{k}{k_L} \right)^{n_M} W(k, k_m)$$

WINDOW FUNCTION: GAUSSIAN

Scalar, vector and tensor modes

Magnetic field contributions: Δ_B, π_B

Correlation functions:

Scalar

Vector

Tensor

$$\langle \Delta_B^*(\vec{k}) \Delta_B(\vec{k}') \rangle = \frac{2\pi^2}{k^3} \mathcal{P}_{\Delta_B \Delta_B}(k) \delta_{\vec{k}, \vec{k}'} \quad \text{etc.}$$

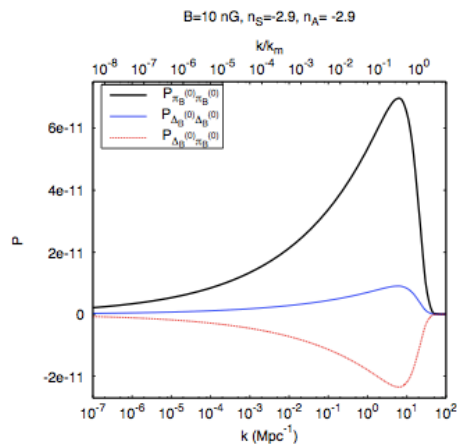
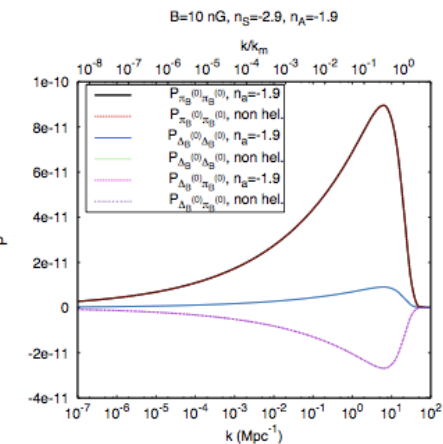
$$\langle \pi_B^{(+1)*}(\vec{k}) \pi_B^{(+1)}(\vec{k}') + \pi_B^{(-1)*}(\vec{k}) \pi_B^{(-1)}(\vec{k}') \rangle$$

$$\langle \pi_B^{(+2)*}(\vec{k}) \pi_B^{(+2)}(\vec{k}') + \pi_B^{(-2)*}(\vec{k}) \pi_B^{(-2)}(\vec{k}') \rangle$$

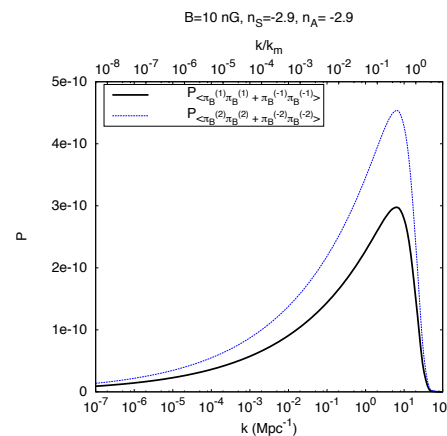
NON ZERO ONLY FOR HELICAL MAGNETIC FIELDS:

$$\langle \pi_B^{(+1)*}(\vec{k}) \pi_B^{(+1)}(\vec{k}') - \pi_B^{(-1)*}(\vec{k}) \pi_B^{(-1)}(\vec{k}') \rangle$$

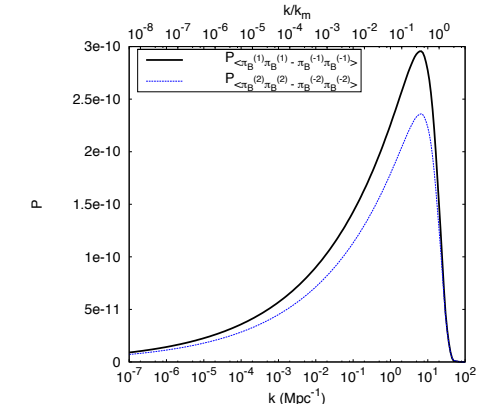
$$\langle \pi_B^{(+2)*}(\vec{k}) \pi_B^{(+2)}(\vec{k}') - \pi_B^{(-2)*}(\vec{k}) \pi_B^{(-2)}(\vec{k}') \rangle$$



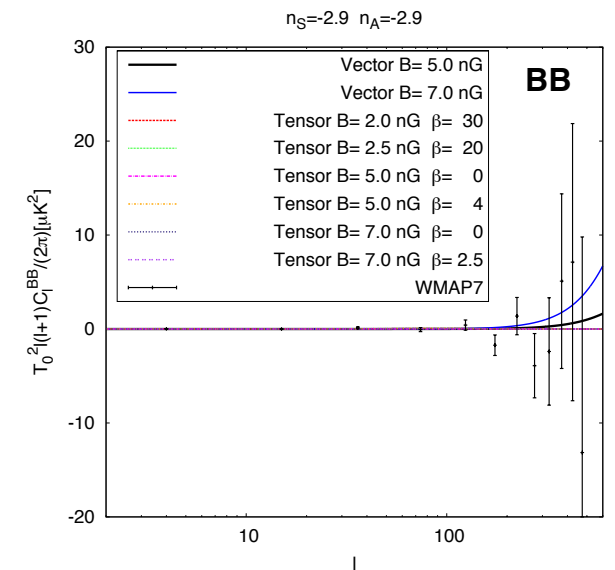
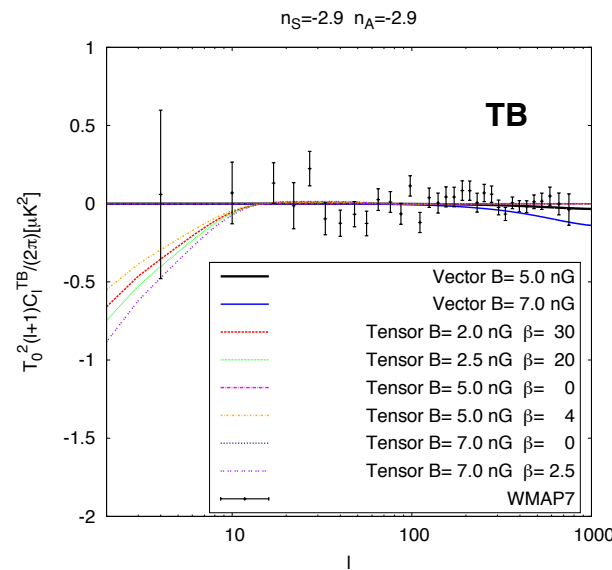
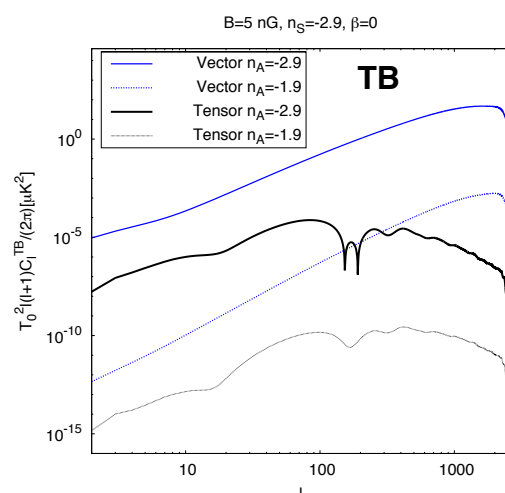
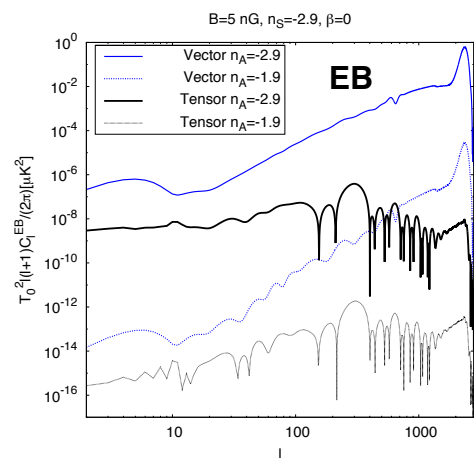
EVEN PARITY CORRELATION FUNCTIONS FOR VECTOR AND TENSOR MODES



ODD PARITY CORRELATION FUNCTIONS FOR VECTOR AND TENSOR MODES



Angular power spectra: B=5 nG, ns=-2.9, nA=-2.9 and nA=-1.9



Reference:
K.E. Kunze, Phys. Rev. D 85 (2012) 083004