# CMB Polarization in Einstein-Aether Theory

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✓ Acceleration of the universe

= Modification of gravity at cosmological scale?

= Adding the extra degree of freedom in gravity sector.

✓ scalar : F(R)-gravity, Galileon theory...
✓ tensor : massive gravity, bi-gravity theory...
✓ vector : Einstein-Aether theory

✓ <u>Action</u> = Einstein-Hilbert + Fixed Norm Vector Field
with a Lorentz Violating VEV. [Jacobson and Mattingly (1999)]

$$S = \frac{1}{16\pi G} \int d^4x \sqrt{-g} \left[ R + \mathcal{L}_A \right] + \int d^4x \sqrt{-g} \mathcal{L}_m$$

$$\left( \begin{array}{l} \mathcal{L}_A = -[c_1 \nabla_a A^b \nabla^a A_b + c_2 \nabla_a A^a \nabla_b A^b + c_3 \nabla_a A^b \nabla_b A^a \\ \qquad + c_4 A^a A^b \nabla_a A^c \nabla_b A_c] + \lambda (A^a A_a - 1) \end{array} \right)$$

What is the observational consequence of this new transverse
vector degree?

➡ CMB B-mode Polarization!

# Our Works

✓ Formulate the linear perturbation of the vector mode in Einstein Aether theory using the covariant formalism.

✓ Derive the initial condition in the early Radiation Dominated stage considering the ordinary matter and Aether.

✓ Calculate the CMB B-mode Power spectrum due to the vector mode numerically using modified CAMB code

✓ Understand the shape of the spectrum in an analytic way.

# Numerical Result from Modified CAMB