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From Quarks to Cosmos

Gravitational memory effects and Bondi-Metzner-Sachs symmetries in scalar-tensor theories



Shaoqi Hou

hou.shaoqi@whu.edu.cn

Wuhan University



2005.01310

2008.05154

Questions and Treatments

- What are the memory effects in Brans-Dicke theory?
- Are the asymptotic symmetries the same as in general relativity?
- How are the memory effects related to the asymptotic symmetries?
- Look for series solutions in Bondi-Sachs-like coordinates.
- Identify infinitesimal asymptotic symmetries
- The action of symmetries on radiative modes reveals the desired relation.

Results

- Memory effects exist in both the tensor and the scalar sectors

$$\Delta S_A = \frac{1}{2r} \left(\Delta \hat{c}_{AB} - \delta_{AB} \frac{\Delta \varphi_1}{\varphi_0} \right) S_0^B + \dots$$

- The asymptotic symmetries are Bondi-Metzner-Sachs symmetries
- Memory in tensor sector: caused by supertranslations

$$\Delta \hat{c}_{AB} = -2\mathcal{D}_A \mathcal{D}_B \alpha + \gamma_{AB} \mathcal{D}^2 \alpha$$

- Memory in scalar sector: caused by Lorentz transformations

$$\Delta \varphi_1 = \mathcal{L}_Y \varphi_1 + \frac{\mathcal{D}_A Y^A}{2} \varphi_1$$