Dissertation Notes

Cosmological Geometries

- $k \in \{-1, 0, 1\}$ topological?

Einstein Gravity

- Total action I is stationary with respect to arbitrary variation in $g_{\mu\nu}$ if and only if $R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = T_{\mu\nu}$ (Weinberg pg. 364)
- Can show conservation of $\nabla^\mu T_{\mu\nu}$ by imposing field equation (only holds for stationary paths), or by imposing (scalar) field equations of motion to $T_{\mu\nu}$ directly (holds for stationary paths beyond those satisfying field equations)

Perturbations and Gauge Transformations

- Small compared to what?
- Fluctuations capture departure from homogeneity and isotropy
- "As an essential feature of the analysis presented here, we assume that during most of the history of the universe all departures from homogeneity and isotropy have been small, so that they can be treated as first-order perturbations."
- First given by Lifshitz 1946, created notation $\delta g_{\mu\nu} = h_{\mu\nu}$
- Weinberg G&C 10.9, 15.10 580, Cosmology 235
- Maggiore, $x^\mu \to x'^\mu$. x'^μ must be invertible, differentiable, and with a differential inverse (i.e. an arbitrary diffeomorphism)
- Brane Localized Mannheim pg. 82

SVT3 $\delta G_{\mu\nu}$ in a de Sitter Background

- How to address gauge invariants?

SVT3 Integral Formulation

- Show identical vanishing of surface term upon application of $\partial_i \partial^i$
- Wording: harmonic, Laplacian?
- Think about conditions requires to vanish