Lab 9

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1 Riess et al. 1998

High-redshift SNe Ia are observed to be dimmer than expected in an empty universe (i.e., $\Omega_M = 0$) *with no cosmological constant.* A cosmological explanation for this observation is that a positive vacuum energy density accelerates the expansion. Mass density in the universe exacerbates this problem, requiring even more vacuum energy. For a universe with $\Omega_M = 0.2$, the MLCS and template-fitting distances to the well-observed SNe are 0.25 and 0.28 mag farther on average than the prediction from $\Omega_\Lambda = 0$. The average MLCS and template-fitting distances are still 0.18 and 0.23 mag farther than required for a 68.3%(1 σ) consistency for a universe with $\Omega_M = 0.24$ and without a cosmological constant.

2 Higgs 1964

The simplest theory which exhibits this behavior is a gauge-invariant version of a model used by Goldstone himself: Two real [1] scalar fields φ_1, φ_2 and a real vector field $A\mu$ interact through the Lagrangian density

$$L = -\frac{1}{2}(\nabla\varphi_1)^2 - \frac{1}{2}(\nabla\varphi_2)^2 - V(\varphi_1^2 + \varphi_2^2) - \frac{1}{4}F_{\mu\nu}F^{\mu\nu}, \tag{12.1}$$

where

$$\begin{aligned}
\nabla_\mu\varphi_1 &= \partial_\mu\varphi_1 - eA_\mu\varphi_2, \\
\nabla_\mu\varphi_2 &= \partial_\mu\varphi_2 + eA_\mu\varphi_1, \\
F_{\mu\nu} &= \partial_\mu A_\nu - \partial_\nu A_\mu,
\end{aligned}$$

e is a dimensionless coupling constant, and the metric is taken as $- + ++$.

[1]In the present note the model is discussed mainly in classical terms; nothing is proved about the quantized theory...

3 Einstein 1905

Letztere ist $\frac{3}{2}(R/N)T$, während man für die mittlere Größe des Energiequantums unter Zugrundelegung der Wienschen Formel erhält:

$$\frac{\int_0^\infty \alpha\nu^3 e^{-\frac{\beta\nu}{T}}\,d\nu}{\int_0^\infty \frac{N}{R\beta\nu}\alpha\nu^3 e^{-\frac{\beta\nu}{T}}\,d\nu} = 3\frac{R}{N}T.$$