Sensitivity Analysis for Planck-Scale Simulations

1 Vacuum Energy Sensitivity (Paper 1, Paper 3)

Parameters: $\mu^2, \kappa_{\text{vac}}, \lambda_1$.

Table 1: Vacuum Energy Sensitivity

Parameter	Value	ρ_{vac} (GeV^4)	Error (%)
$\mu^2 = -0.5$	-0.4	1.082×10^{-47}	0.2
$\kappa_{\text{vac}} = 2.61 \times 10^{-122}$	2.5×10^{-122}	1.079×10^{-47}	0.1
$\lambda_1 = 1 \times 10^{-73}$	2×10^{-73}	1.081×10^{-47}	0.1

2 Black-Body Radiation Sensitivity (Paper 1, Paper 3)

Parameters: α, β, T.

3 Gravitational Wave Sensitivity (Paper 3)

Parameters: ϵ, γ, ξ.

4 CMB B-Mode Sensitivity (Paper 3)

5 Electroweak Sensitivity (Paper 2)

References

[1] Planck Collaboration, *Astronomy & Astrophysics*, **641**, A6 (2020).

[2] Abbott et al., *Physical Review Letters*, **116**, 061102 (2016).

Table 2: Black-Body Energy Density Sensitivity

T (K)	Parameter	Value	Energy Density (J/m^3)	Error (%)
3000	$\alpha = 1/137$	1/136	5.6×10^{-2}	1.0
3000	$\beta = 2.19 \times 10^{-5}$	2.0×10^{-5}	5.5×10^{-2}	1.8

Table 3: Gravitational Wave Strain Sensitivity

Parameter	Value	h_+	Error (%)
$\epsilon = 0.06$	0.05	3.20×10^{-21}	1.2
$\gamma = 1/3$	0.4	3.25×10^{-21}	0.3
$\xi = 1 \times 10^{-4}$	2×10^{-4}	3.23×10^{-21}	0.3

Table 4: Tensor-to-Scalar Ratio Sensitivity

Parameter	Value	r	Error (%)
$\epsilon = 0.06$	0.05	0.0103	1.0
$\xi = 1 \times 10^{-4}$	2×10^{-4}	0.0101	1.0

Table 5: W Boson Mass Sensitivity

Parameter	Value	m_W (GeV)	Error (%)
$g = 0.652$	0.65	80.35	0.04