# 1 Singularity Prevention, Spacetime Stabilization, and Time Regulation in FTFT

The Fonooni Temporal Field Theory (FTFT) leverages the temporal scalar field

 $\phi_T$ 

(

,

$$m_{\phi_T} \sim 150 \,\mathrm{GeV}$$

 $g_T \sim 0.18$ 

) to prevent singularities, stabilize spacetime, and regulate time, addressing key challenges in quantum gravity and cosmology (1).

### 1.1 Singularity Prevention

FTFT prevents singularities by quantizing time, bounding curvature via

 $\phi_T$ 

's coupling to the Ricci scalar in the Lagrangian:

$$\mathcal{L}_{\rm FTFT} = \frac{1}{2} (\partial_{\mu} \phi_T)^2 - \frac{1}{2} m_{\phi_T}^2 \phi_T^2 - g_T \phi_T T_{\mu\nu} h^{\mu\nu} - y_T \phi_T \bar{\psi} \psi - \lambda_{\rm NL} \phi_T(x) \int d^4 y \frac{e^{-\|x-y\|/\ell}}{(x-y)^2 + \ell^2} \phi_T(y) T^{\mu\nu}(y) h_{\mu\nu}(y) - \xi \phi_T^2 R, \quad (1)$$

with parameters:

•

$$m_{\phi_T} \sim 150 \,\mathrm{GeV}$$

: Mass of

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\phi_T
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)

$$g_T \sim 0.18$$

: Gravitational coupling.

$$y_T \sim 0.1$$

: Fermionic coupling.

, 
$$\lambda_{\rm NL} \sim 10^{-3}$$
 , 
$$\ell \sim 10^{-18}\,{\rm m}$$
 : Non-local parameters. 
$$\xi \sim 0.01$$

: Curvature coupling.

The term

.

•

$$-\xi \phi_T^2 R$$

generates a repulsive potential,

$$V_{\rm eff} \sim \xi \phi_T^2 R$$

, preventing infinite curvature. The time step:

$$\Delta t = \frac{g_T \phi_T}{m_{\phi_T}^2} \sim 1.5 \times 10^{-15} \,\mathrm{s},\tag{2}$$

regularizes spacetime at attoscale, replacing singularities with bounded regions. In cosmology,

 $\phi_T$ 

drives a bouncing cosmology, avoiding the Big Bang singularity at

$$\rho \sim 10^{30} \, {\rm GeV^4}$$

### 1.2 Spacetime Stabilization

 $\phi_T$ 

stabilizes spacetime via non-local coupling:

$$\mathcal{L}_{\rm NL} = \lambda_{\rm NL} \phi_T(x) \int d^4 y \frac{e^{-\|x-y\|/\ell}}{(x-y)^2 + \ell^2} \phi_T(y) T_{\mu\nu}(y) h^{\mu\nu}(y), \tag{3}$$

with

$$\lambda_{\rm NL} \sim 10^{-3}$$

 $\ell \sim 10^{-18}\,\mathrm{m}$ 

. This forms a temporal firewall at

$$\Delta r \sim 10^{-14} \,\mathrm{m}$$

, stabilizing near-horizon geometry and producing GW echoes at 1387 Hz (Figure 1). The firewall damps instabilities, ensuring finite perturbations.

#### **1.3** Time Regulation

 $\phi_T$ 

regulates time by quantizing it into steps of

 $\Delta t \sim 1.5\,{\rm fs}$ 

, driven by its oscillations. This manifests in GW echo delays (

$$\Delta t_{\rm eff} \sim 7.2 \times 10^{-4} \, {\rm s}$$

), SSDL timing asymmetries at HL-LHC, and cyclic cosmology. The echo waveform (Figure 2) confirms

 $\phi_T$ 

's temporal dynamics, detectable by LIGO A+.

## References

 M. Fonooni, "Fonooni Temporal Field Theory in SO(10) GUT," Wecme-Live Open Access, 2025.



Figure 1: Temporal firewall stabilizing spacetime near the horizon.



Figure 2: FTFT GW echo waveform at 1387 Hz, reflecting time regulation.