Attosecond Prediction of Quantum Entanglement Formation as Supporting Evidence for the T_0-Time-Mass-Duality Theory

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Abstract

This document summarizes the theoretical prediction of the time-resolved formation of quantum entanglement (Jiang et al., 2024) and presents it as supporting evidence for the fundamental time dynamics postulated in the T_0-Time-Mass-Duality Theory. All theoretical interpretations are drawn exclusively from the content of the Master Narrative (FFGFT_Narrative_Master_En.pdf) and related documents in the repository: https://github.com/jpascher/T0-Time-Mass-Duality/tree/main/2/.

1 The Theoretical Work

The study by Jiang et al. (2024) demonstrates theoretically that quantum entanglement does **not** form instantaneously, but emerges over a measurable local time window.

1.1 Key Details from the Simulation

- **System**: Helium atom driven by an intense high-frequency EUV laser pulse (photoionization).
- **Process**: One electron absorbs energy and escapes (ionizes), while the second electron is excited to a higher energy state.
- **Superposition**: The escaping electron is in a superposition of different departure times (no single sharp instant).

- **Correlation**: The final energy of the bound electron is directly correlated with the departure time of the escaping electron:
  - Higher energy in the bound electron → escaping electron departed earlier
  - Lower energy → escaping electron departed later
- **Predicted Time Window**: Full time-dependent Schrödinger equation simulations yield an entanglement formation window of ~**232 attoseconds** ($\approx 2.32 \times 10^{-16}$ s).
- **Proposed Experimental Verification**: A double-pulse scheme (generation pulse + probe pulse) combined with coincidence detection of both electrons to reconstruct the shared quantum history and time the formation process.

Important note: This is a theoretical/numerical prediction. No laboratory measurement has been performed yet. The authors propose a feasible future experiment using current attosecond laser technology.

1.2 Popular-Science Video

Video summary of the work: https://www.youtube.com/watch?v=t3wjY95zvNM („Scientists Measure Quantum Entanglement Speed — And It Breaks Physics“, Channel: NASA Space News, Uploaded: January 14, 2026)

2 Connection to the T_0-Time-Mass-Duality Theory

This theoretical result provides strong conceptual support for the core postulate of the theory:

> „In the T_0-Time-Mass-Duality Theory, time is ontologically equivalent to mass and therefore not merely a coordinate, but an active physical quantity with real dynamics on all scales. Quantum correlations (entanglement) therefore do not arise instantaneously, but develop as a temporal, emergent process within a local interaction window. The predicted attosecond formation time of ~ 232 as confirms exactly this finite, dynamical build-up without non-local 'spooky action at a distance' and without violating causality.“

This highlights that all quantum phenomena carry intrinsic time dynamics — a direct consequence of the fundamental duality between time and mass.

3 References

1. Jiang, W.-C., Zhong, M.-C., Fang, Y.-K., Donsa, S., Březinová, I., Peng, L.-Y., Burgdörfer, J. (2024).
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2. Video: „Scientists Measure Quantum Entanglement Speed — And It Breaks Physics“.
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