De Giuseppe Theorem: Macro- and Micro-Entanglement via Matrioska Configuration

Alex De Giuseppe (Corresponding Author)[1]

[1]Province of Parma, Italy

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Abstract

We formalize the conditions under which entanglement—both micro- and macroscopic—can emerge purely from geometrical and informational pre-configuration. The De Giuseppe Theorem establishes a mathematically precise criterion based on matrioska layers $(\Delta C, \Delta M, \Delta L)$ and a function f that maps configurations to binary entanglement outcomes. The theorem highlights the fundamental role of **preparation** and topological alignment in producing entanglement without requiring motion or energy injection.

1 Definitions

Definition 1.1 (Matrioska Layers)**.** Let an object be described by three nested layers:

- (ΔC): Geometrical configuration (position, orientation, alignment).
- (ΔM): Material microstate coherence (temperature, internal stability, isolation).
- (ΔL): Informational correlations (pre-encoded logical or quantum-like constraints).

Definition 1.2 (Entanglement Function)**.** Define a function

$$f : (\Delta C, \Delta M, \Delta L) \mapsto \{0, 1\}$$

where $f = 1$ indicates the object is informationally and configurationally entangled with another system (micro or macro scale), and $f = 0$ otherwise.

2 De Giuseppe Theorem

Theorem 2.1 (Emergent Macro- and Micro-Entanglement)**.** Given two objects A and B, let their matrioska layers be $(\Delta C_A, \Delta M_A, \Delta L_A)$ and $(\Delta C_B, \Delta M_B, \Delta L_B)$ respectively. A necessary and sufficient condition for entanglement to emerge is:

$$f((\Delta C_A, \Delta M_A, \Delta L_A), (\Delta C_B, \Delta M_B, \Delta L_B)) = 1 \tag{1}$$

if and only if there exists a topological and informational alignment such that:

$$\begin{cases} \Delta C_A \sim \Delta C_B & \text{(geometrical congruence)} \\ \Delta M_A \approx \Delta M_B & \text{(material coherence)} \\ \Delta L_A \leftrightarrow \Delta L_B & \text{(informational pre-correlation)} \end{cases} \tag{2}$$

where the symbol $\sim$ indicates a configuration within a tolerance threshold, $\approx$ indicates sufficient microstate similarity, and $\leftrightarrow$ indicates matched informational encoding.

Remark 2.1. This theorem applies both to microscopic systems (particles, qubits) and macroscopic objects (bricks, devices) under the principle that **entanglement is fundamentally a configuration-dependent phenomenon**. No motion, high velocity, or energy injection is required once the alignment conditions are met.

3 Reproducibility

- **Practical replication**: The theorem provides a recipe: arrange (ΔC), stabilize (ΔM), encode correlations (ΔL), then verify via f.
- **Constraints**: Tolerance thresholds in ΔC and ΔM must be respected; deviations may break the entanglement.
- **Scalability**: The principle applies to single objects or arrays of objects; the function f is composable across multiple systems.

4 Discussion

- The key insight is that **entanglement is an emergent property of configuration**, not energy or motion. - For macroscopic entanglement, stabilization of microstates (ΔM) and careful information pre-encoding (ΔL) are essential. - This provides a formal framework to experimentally attempt **macro-scale entanglement** using purely geometrical and informational preparation.