

# Die Bell-Ungleichungen in der T0-Theorie

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# Kapitel 1

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## **Zusammenfassung**

Die Bell-Ungleichungen sind ein fundamentaler Test der Quantenmechanik. Dieses Dokument untersucht, wie die T0-Theorie die Verletzung der Bell-Ungleichungen interpretiert und welche neuen Einsichten sie bietet.

## 1.1 Die Bell-Ungleichung

### 1.1.1 Bells Theorem

John Bell zeigte 1964, dass lokale verborgene Variablen-Theorien der Ungleichung:

$$|E(a, b) - E(a, c)| \leq 1 + E(b, c) \quad (1.1)$$

genügen müssen, wobei  $E(a, b)$  die Korrelation zwischen Messungen in Richtungen  $a$  und  $b$  ist.

### 1.1.2 Experimentelle Verletzung

Experimente (Aspect et al., 1982) zeigen eindeutig:

$$|E(a, b) - E(a, c)|_{\text{exp}} > 1 + E(b, c) \quad (1.2)$$

Die Quantenmechanik ist nichtlokal!

## 1.2 T0-Interpretation

### 1.2.1 Zeitfeld-Korrelationen

Die T0-Theorie erklärt die Bell-Verletzung durch:

#### **T0-Erklärung der Nichtlokalität**

Verschränkte Teilchen teilen ein gemeinsames intrinsisches Zeitfeld:

$$T_{12}(x_1, x_2) \neq T_1(x_1) \cdot T_2(x_2) \quad (1.3)$$

Diese Nichtfaktorisierbarkeit ist die Quelle der Quantenkorrelationen.

### 1.2.2 Keine Signalübertragung

Obwohl das Zeitfeld nichtlokal ist, gibt es keine superluminale Signalübertragung:

$$\langle A_1 \rangle = \text{Tr}(\rho_1 A_1) \quad \text{unabhängig von } B_2 \quad (1.4)$$

Die Kausalität bleibt erhalten.

## 1.3 Philosophische Implikationen

### 1.3.1 Realismus vs. Lokalität

Bells Theorem zwingt zur Wahl:

- Aufgabe des lokalen Realismus (Standard-QM)
- Oder: Nichtlokale verborgene Variablen

#### **T0-Resolution**

Die T0-Theorie wählt einen dritten Weg: Das intrinsische Zeitfeld ist real und nicht-lokal, aber keine „verborgene Variable“ im klassischen Sinne. Es ist ein fundamentales Feld, das die Struktur der Raumzeit selbst beschreibt.

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