Wave Function Information Encoding in Heim Theory: A Detailed Analysis

by Joel Michalowitz for APEC based on a question by Daniel Davis

Contents

1 Introduction

Heim theory postulates a unified description of matter and gravity via an extended space of six or more dimensions. Central to this approach is the idea that the conventional wave function of quantum theory is not confined to the four-dimensional space-time manifold $\mathbb{R}^4$, but rather resides within a complex, structured space $\mathbb{R}^6$ (or higher), where additional dimensions encode probabilistic and organizational information.

This document presents an in-depth explanation of how the wave function is treated in Heim theory, including notational details and theoretical constructs required to understand the geometric encoding of physical states.

2 Dimensional Framework in Heim Theory

Heim theory introduces a six-dimensional space:

$$x^A = (x^1, x^2, x^3, x^4, x^5, x^6), \quad A = 1, \ldots, 6 \tag{1}$$

where:

- $x^1, x^2, x^3 \in \mathbb{R}$: ordinary spatial coordinates,
- $x^4 = ict$: imaginary time coordinate (multiplied by i),
- $x^5 = i\epsilon$: imaginary entelechy coordinate,
- $x^6 = i\eta$: imaginary aonic (directional) coordinate.

Thus, the manifold is:

$$\mathcal{M}_6 = \{(x^1, x^2, x^3, ict, i\epsilon, i\eta)\} \subset \mathbb{C}^6 \tag{2}$$

The traditional 4D space-time $\mathbb{R}^4$ is embedded as a real submanifold of $\mathcal{M}_6$.

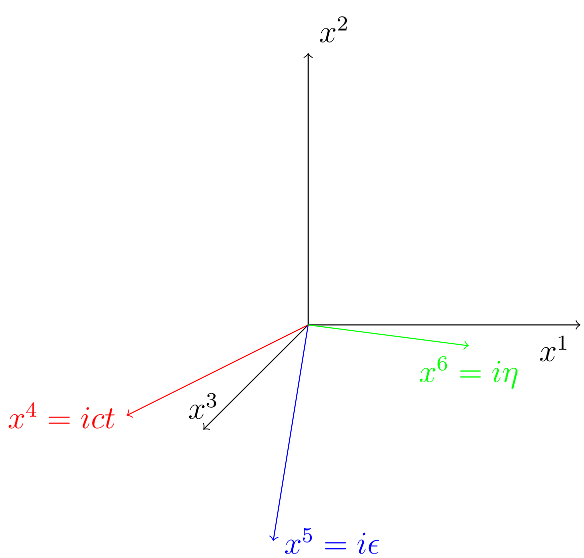

Figure 1: Coordinate system of $\mathcal{M}_6$ with three real spatial axes and three imaginary axes.

3 State Function and Hilbert Space Structure

Let $\Psi(x^A)$ be a state function defined over $\mathcal{M}_6$. Heim constructs a Hermitian operator $\hat{H}$ such that:

$$\hat{H}\Psi = \lambda\Psi \tag{3}$$

Here:

- $\hat{H}$ is an eigenoperator arising from geometrized physical structures (e.g., curvature tensors or operators on structured lattices),
- $\lambda \in \mathbb{R}$ is an eigenvalue representing mass, energy, or charge.

The space of all such square-integrable functions forms a Hilbert space:

$$\mathcal{H}_6 = \{\Psi : \mathcal{M}_6 \to \mathbb{C} \mid \langle\Psi|\Psi\rangle < \infty\} \tag{4}$$

with inner product:

$$\langle\Psi|\Phi\rangle = \int_{\mathcal{M}_6} \Psi^*(x^A)\Phi(x^A)\, d^6x \tag{5}$$

3.1 Reduction to $\mathbb{R}^4$

The physical Hilbert space is projected:

$$\Psi|_{\mathbb{R}^4} = \psi(x^\mu), \quad \mu = 1, \ldots, 4 \tag{6}$$

where the imaginary coordinates x^5, x^6 encode additional information not directly measurable.

4 Physical Meaning of Imaginary Dimensions

The two additional imaginary coordinates encode aspects that influence the system's dynamics:

- $x^5 = i\epsilon$: "Entelechy" dimension. It encodes the internal potential for organizational change in physical systems.
- $x^6 = i\eta$: "Aon" dimension. It defines the preferred or probabilistic directionality in time (nonlocality, delayed-choice).

These components are used to construct wave operators that are fully Hermitian, which allows stable discrete spectra in quantum theory. Heim notes that a complete theory must go beyond $\mathbb{R}^4$ to incorporate these hidden variables.

5 Geometric Quantization and the Metron Lattice

Heim introduces the concept of a fundamental area unit:

$$\ell_m^2 \sim L_P^2 = \left(\frac{\hbar G}{c^3}\right) \tag{7}$$

called the "metron," which leads to a discretization of $\mathcal{M}_6$ into a geometric lattice. Localized deformations in this lattice correspond to particle structures. The deformation operator corresponds to the eigenoperator $\hat{H}$.

6 Path Integral Analogy

Although Heim does not explicitly formulate a Feynman-style path integral, his framework implies a sum over metric states in x^5 and x^6. One can express the projection of a wave function into $\mathbb{R}^4$ as:

$$\psi(x^\mu) = \int\int \Psi(x^\mu, x^5, x^6)\, dx^5 dx^6 \tag{8}$$

This resembles a path integral over internal, probabilistic coordinates.

7 Extension to 12D Geometry and S-Matrix Formulation

Heim and Dröscher extended the formalism to a 12-dimensional space $\mathcal{M}_{12}$ to account for all known and hypothesized interactions, including psychophysical phenomena.

Let:

$$x^I, \quad I = 1, \ldots, 12 \tag{9}$$

where the extra six coordinates include higher-order informational and control structures:

- x^7, x^8: morphogenetic fields
- x^9, x^{10}: teleological (goal-directed) processes
- x^{11}, x^{12}: transcendental or integrative causal fields

The full wave function $\Psi_{12}(x^I)$ resides in a Hilbert space $\mathcal{H}_{12}$:

$$\mathcal{H}_{12} = \left\{\Psi_{12} \in L^2(\mathcal{M}_{12})\right\} \tag{10}$$

7.1 S-Matrix Formulation

To describe transition amplitudes, Heim formulates an S-Matrix S_{fi} as:

$$S_{fi} = \langle \Psi_f |\, \hat{S}\, | \Psi_i \rangle = \int_{\mathcal{M}_{12}} \Psi_f^*(x^I) \hat{S}(x^I) \Psi_i(x^I)\, d^{12}x \tag{11}$$

where $\hat{S}$ is a scattering operator representing geometric transformations in $\mathcal{M}_{12}$.

This allows predictions of reaction rates and cross-sections within a fully geometrized, multi-dimensional field theory.

8 Sensorial Curvature and Geometric Eigenstate Quantization

Heim's field equations are geometric in nature, defined via an eigenvalue problem based on a curvature operator derived from the fundamental tensor field. The core equation reads:

$$\hat{\mathcal{R}}(x^I)\Psi(x^I) = \lambda\Psi(x^I) \tag{12}$$

where:

- $\hat{\mathcal{R}}$ is a curvature-derived operator, typically involving contractions of a general Riemann tensor $\mathcal{R}^A{}_{BCD}$ in $\mathcal{M}_{12}$,
- λ is an eigenvalue associated with physical quantities such as mass, charge, or interaction coupling.

8.1 Metric Tensor and Curvature Construction

Let g_{AB} be the metric on $\mathcal{M}_{12}$, then the Christoffel symbols are:

$$\Gamma^A_{BC} = \frac{1}{2} g^{AD} \left(\partial_B g_{DC} + \partial_C g_{DB} - \partial_D g_{BC}\right) \tag{13}$$

The Riemann tensor follows:

$$\mathcal{R}^A{}_{BCD} = \partial_C \Gamma^A_{DB} - \partial_D \Gamma^A_{CB} + \Gamma^A_{CE}\Gamma^E_{DB} - \Gamma^A_{DE}\Gamma^E_{CB} \tag{14}$$

Then the Ricci tensor:

$$\mathcal{R}_{BD} = \mathcal{R}^A{}_{BAD}, \quad \text{and scalar curvature } \mathcal{R} = g^{BD}\mathcal{R}_{BD} \tag{15}$$

8.2 Quantization Conditions and Eigenstate Calculation

To derive concrete eigenstates, one typically uses ansätze that separate variables in suitable coordinates:

$$\Psi(x^I) = \prod_{k=1}^{12} \psi_k(x^k) \tag{16}$$

Assuming weak curvature and a separable background metric, this reduces the eigenproblem to a sum of 1D Sturm–Liouville problems:

$$-\frac{d^2}{dx^{k2}}\psi_k(x^k) + V_k(x^k)\psi_k(x^k) = \lambda_k\psi_k(x^k), \quad \text{with } \sum_{k=1}^{12} \lambda_k = \lambda \tag{17}$$

Here $V_k(x^k)$ are effective geometric potentials derived from curvature contributions.

8.3 Worked Numerical Example: Quantized Scalar Field

To provide a concrete computation, let us consider a scalar field $\psi(x)$ constrained to a compactified dimension $x \in [0, L]$ with periodic boundary conditions. This mimics a quantized mode in an internal geometric dimension such as x^5.

Problem setup: Consider the equation

$$-\frac{d^2}{dx^2}\psi(x) = \lambda\psi(x), \quad \psi(0) = \psi(L), \quad \psi'(0) = \psi'(L) \tag{18}$$

The general solution is:

$$\psi_n(x) = A_n \cos\left(\frac{2\pi n x}{L}\right) + B_n \sin\left(\frac{2\pi n x}{L}\right) \tag{19}$$

The eigenvalues are:

$$\lambda_n = \left(\frac{2\pi n}{L}\right)^2, \quad n \in \mathbb{Z} \tag{20}$$

Numerical example: Let $L = 1$ and set $n = 1, 2, 3$:

$$\lambda_1 = (2\pi)^2 = 39.48$$

$$\lambda_2 = (4\pi)^2 = 157.91$$

$$\lambda_3 = (6\pi)^2 = 355.31$$

These can be interpreted as mass contributions from compactified geometric modes.

8.4 Symbolic Spectrum: Heim Mass Formula

The Heim mass formula is symbolic in nature but built from quantized geometric operators. A generalized symbolic form:

$$m = \mu_0 \left[\sum_{i=1}^{n} \alpha_i n_i (n_i + k_i) + Q(n),\right] \tag{21}$$

where:

- μ_0 is the fundamental mass unit (usually 1 MeV),
- n_i are geometric quantum numbers from curvature modes,
- α_i, k_i are coupling constants derived from metric and torsion components,
- $Q(n)$ is a correction term derived from internal symmetries (charge, spin, strangeness).

Interpretation: This formula computes the particle masses in terms of discrete curvature eigenvalues. The precise values of α_i and $Q(n)$ depend on the geometry of the internal lattice $\mathcal{M}_6$ or $\mathcal{M}_{12}$ and the specific eigenvalue problem solved.

8.5 Explanation and Significance

These calculations show how concrete physical quantities (e.g., masses) emerge from purely geometric quantization. Unlike standard QFT, where mass terms are inserted phenomenologically, Heim theory derives them from eigenvalues of a universal geometric operator acting on a quantized lattice of spacetime.

This geometric origin also suggests deeper symmetries: for instance, isospin and hypercharge could correspond to degeneracies in the curvature eigenvalues from certain internal dimensions.

In the full 12D context, higher-dimensional geometric potentials $V_k(x^k)$ could support solitonic or topological eigenmodes, further refining the particle spectrum beyond the Standard Model.

9 Conclusion

In Heim's geometric theory, the wave function encodes more than position and momentum in real space-time. It also carries organizational and probabilistic information in higher imaginary dimensions, resulting in a rich structure for deriving mass spectra and coupling constants. The additional dimensions x^5 and x^6 are essential for the completeness and hermiticity of the theory.