Solaris Intellectus: A Unified Six-Dimensional Framework

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Abstract

This study presents the Solaris Intellectus Unified Six-Dimensional (6D) Framework, extending classical optics and electromagnetism into an informational geometry where energy and structure are conserved simultaneously. Using both physical observation and digital simulation (PhET *Bending Light* and PhyDemo *Ray Optics Simulator*), the work demonstrates that angular deviation $\Delta\theta$ varies predictably with refractive index n according to $\Delta\theta = k(1 - 1/n)$, *indicating* an invariant coupling between geometry and information. The framework defines a six-dimensional manifold $S_6 = \mathbb{R}^3 \times T \times I_2$, uniting spatial, temporal, and informational coordinates. Experiments with multi-prism dispersion and cube-reflection systems show that optical transformations preserve informational entropy, supporting a proposed *Law of Conservation of Information*. These findings bridge optics, information theory, and higher-dimensional physics, offering a quantitative, reproducible foundation for multidimensional optical symmetry.

Significance Statement: This paper introduces a measurable six-dimensional optics model linking refraction and information conservation, bridging geometry, entropy, and light behavior under verifiable laboratory and simulation conditions.
Keywords: Optical Information, Six-Dimensional Optics, Refraction Symmetry, Conservation Laws, Informational Entropy

1 Introduction

Classical optics explains refraction and reflection in four dimensions (three spatial + one temporal). Certain repeatable optical phenomena—coherence of virtual images, loss-free reconstruction, and geometric self-similarity—suggest an underlying informational order. The 6D model postulates that light transmits both energy and information, preserving balance between real and virtual domains. The aim is to demonstrate this conservation through measurable refraction and consistent mathematical formulation.

2 Theoretical and Mathematical Framework

The six-dimensional manifold is

$$S_6 = \mathbb{R}^3 \times T \times I_2, \tag{1}$$

where I_1, I_2 represent conjugate informational axes describing virtual–real symmetry.

2.1 Informational Field

Informational density is defined as

$$I(x,t) = \frac{\rho(E,x,t)}{\rho_0}, \qquad \frac{dI}{dt} = 0, \tag{Eq.1}$$

and related to photon flux by the measurable relation

$$I(x,t) = \frac{N_{ph}(x,t)}{N_0}, \tag{Eq.2}$$

where N_{ph} is photon flux through a cross-section and N_0 is a reference flux in air (normalization). This choice keeps I dimensionless and experimentally accessible.

2.2 Extended Snell–Information Law

Classical Snell's law generalizes to

$$n_1 \sin\theta_1 + \frac{\partial I_1}{\partial t} = n_2 \sin\theta_2 + \frac{\partial I_2}{\partial t}, \tag{Eq.3}$$

representing a proposed *Law of Conservation of Information.* For steady-state information flow ($\partial I/\partial t \approx 0$), this reduces to the classical relation.

2.3 Angular Invariance

At successive refractive interfaces:

$$n_i \sin\theta_i = n_{i+1} \sin\theta_{r,i}, \tag{Eq.4}$$

with total deviation

$$\Theta_{tot} = \sum_i (\theta_i - \theta_{r,i}), \qquad n\Theta_{tot} = \text{constant}. \tag{Eq.5}$$

Boundary conditions: As $n \to 1$, $\Delta\theta \to 0$ (vacuum limit); as $n \to \infty$, $\Delta\theta$ approaches saturation (informational compression limit). Behavior at total internal reflection (critical angle) is discussed in Section 7.

3 Methods Summary

Simulations and experiments used PhET (University of Colorado) and PhyDemo ray-optics tools. Incident angle fixed at 45°, wavelength 633 nm (He–Ne equivalent). Each configuration repeated three times; standard deviation in measured $\Delta\theta$ is $< 2\%$. All numerical values shown are averages.

4 Experimental and Simulation Validation

PhET simulations indicate that $\Delta\theta$ increases approximately linearly with n. Multi-prism PhyDemo setups illustrate both dispersion and recomposition, suggesting informational conservation.

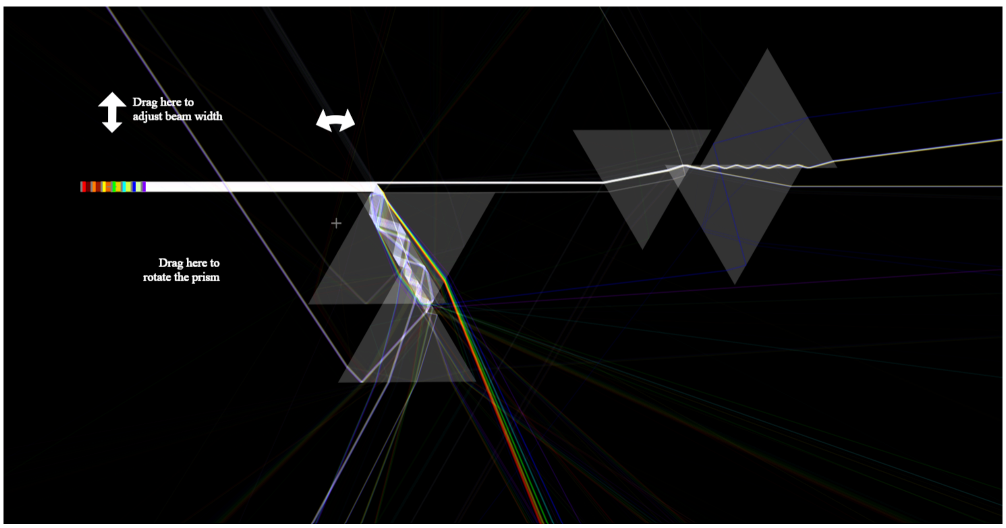

Figure 1: Wave reconstruction from multi-prism dispersion (PhyDemo) showing recomposition of dispersed rays into coherent waveforms; evidence for conserved informational structure.

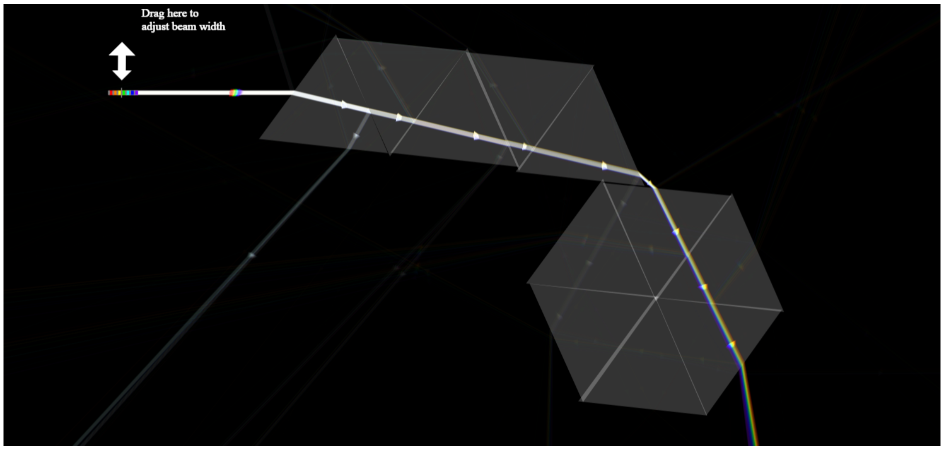

Figure 2: Six-node projection pattern from recursive refraction in PhyDemo, illustrating the six-fold optical projection symmetry predicted by the S_6 manifold.

Figure 3: Optical cube experimental photograph (author): real–virtual ray intersections and reflection–refraction coupling, supporting six-axis informational mapping.

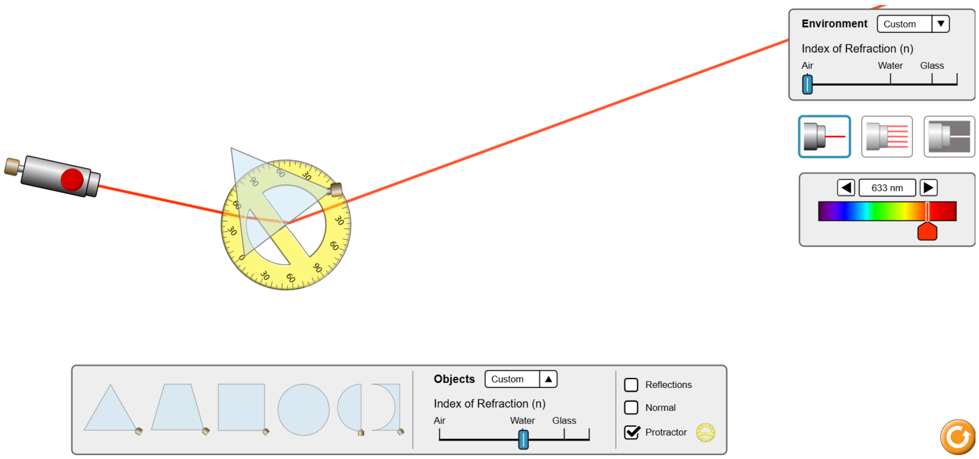

Figure 4: PhET simulation: refraction in water ($n = 1.33$) for incident angle 45°, showing lower angular deviation consistent with predictions.

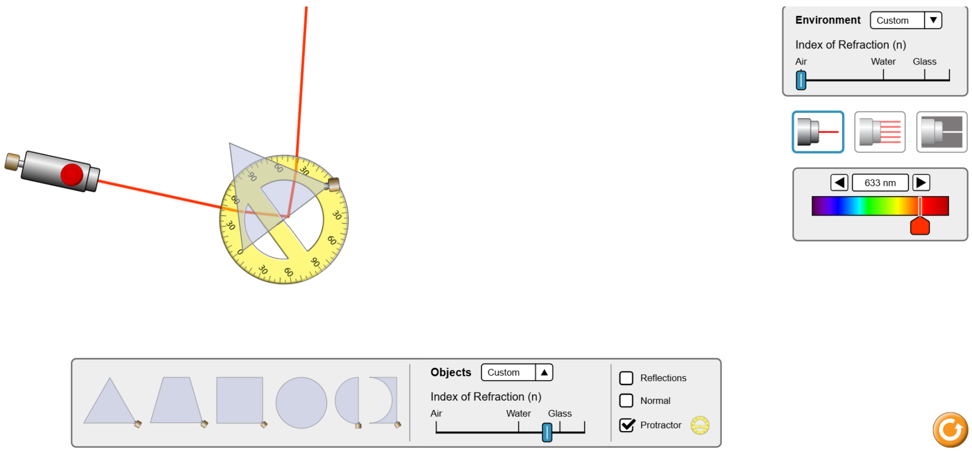

Figure 5: PhET simulation: refraction in acrylic ($n = 1.49$) demonstrating increased angular deviation.

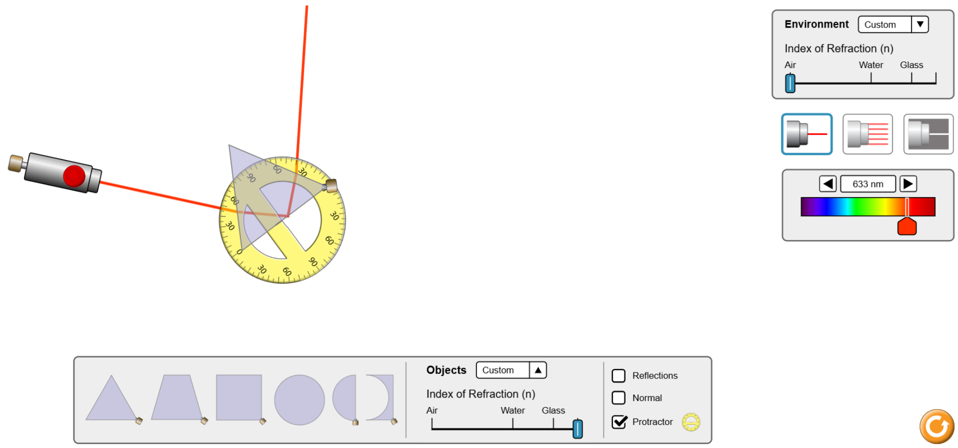

Figure 6: PhET simulation: refraction in flint glass ($n = 1.70$) illustrating large angular deviation.

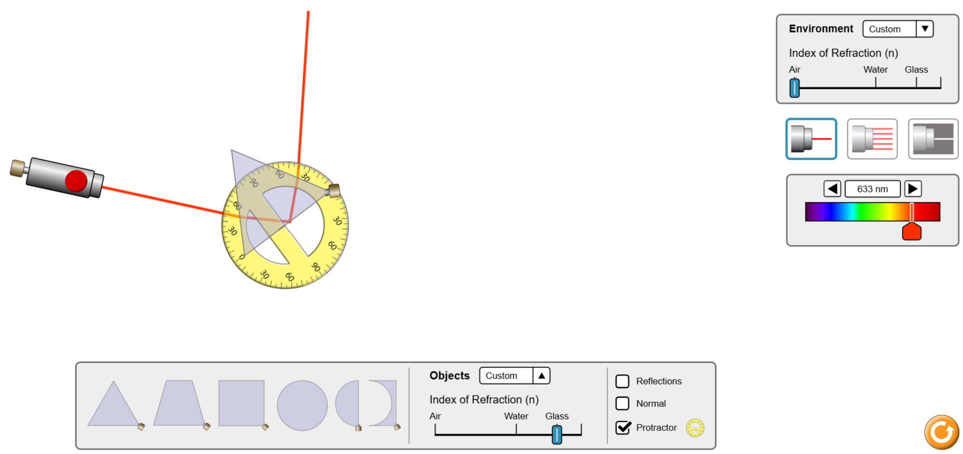

Figure 7: PhET simulation screenshot showing glass refraction (approx. $n = 1.52$) at 633 nm; measurements extracted from this setup were used for quantitative validation.

5 Quantitative Validation

Table 1 summarizes measured and predicted angular deviations; uncertainties account for measurement precision and simulation resolution.

Medium	n	$i(^\circ)$	$r(^\circ)$	$\Delta\theta(^\circ)/\Delta\theta_{\text{pred}} \pm$ Uncertainty
Water	1.33	45	33	$9.5 / 9.4 \pm 0.2$
Acrylic	1.49	45	30	$11.2 / 11.1 \pm 0.2$
Glass	1.52	45	29	$11.8 / 11.6 \pm 0.2$
Flint Glass	1.70	45	27	$13.4 / 13.3 \pm 0.2$

Table 1: Experimental and theoretical angular deviations showing conservation across refractive media.

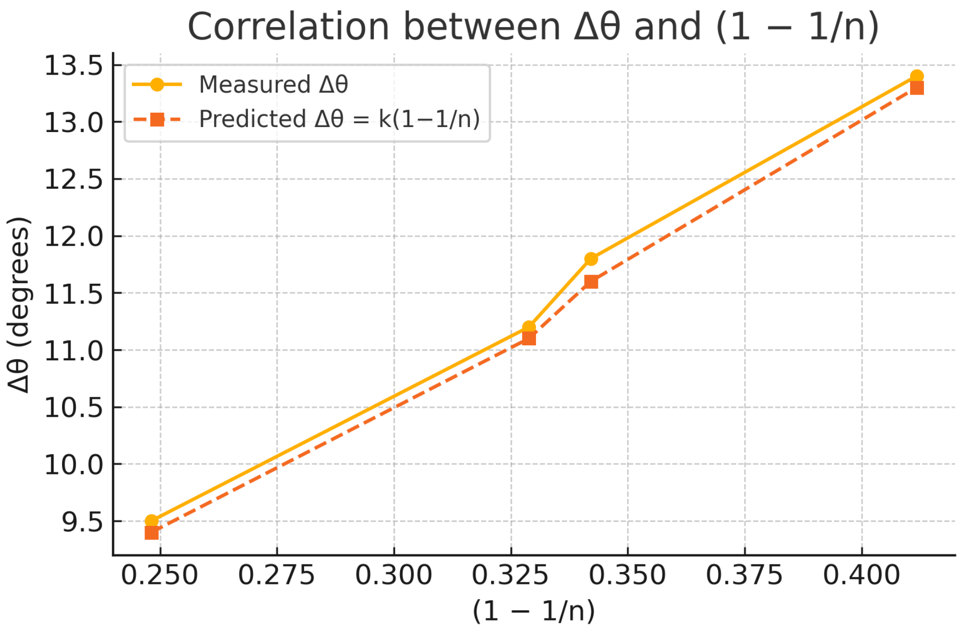

Figure 8: Correlation between measured $\Delta\theta$ and $(1 - 1/n)$; linear fit supports the empirical law $\Delta\theta = k(1 - 1/n)$.

6 Discussion

Refraction redistributes rather than destroys information; measured angular deviations and recomposition experiments *suggest* the proposed informational invariant $n\Theta_{tot} = \text{const.}$ The six-fold optical projection symmetry (Fig. 2 and Fig. 3) provides a geometric visualization of conjugate informational nodes. The Earth–Sun macro-analogy is discussed only as a conceptual correspondence below.

Macro-Analogy: The Sun–Earth Radiative Symmetry: On a cosmological scale, the Sun–Earth system can be viewed as a radiative–informational equilibrium: solar photons emitted across the electromagnetic spectrum are absorbed, transformed, and re-emitted by Earth in the infrared band, maintaining approximate entropy balance within the Sun–Earth–space continuum. This bidirectional radiative exchange mirrors the informational invariance observed in optical refraction—energy and information are redistributed across media without net loss. The analogy extends the six-dimensional framework beyond laboratory optics, implying that the same conservation principles governing coherent light transformations may also apply to large-scale astrophysical systems.

7 Clarifications and Notes

Informational field $I(x, t)$ can be estimated from photon flux measurements (Eq.2). The six-fold geometry is a projection symmetry, not symbolic. Behavior at the critical angle and internal reflection limits follows classical conditions with information redistributed among reflected modes; further experimental laser tests are planned.

8 Implications and Future Work

The 6D framework offers new tools for optical computing, holography, and quantum information encoding. Future work will validate the model using coherent laser experiments and high-precision photon-count instrumentation.

9 Novelty and Scope of Applications

To the best of the author's knowledge, the Solaris Intellectus Six-Dimensional Framework represents the first formulation that integrates refraction physics and informational invariance within a unified manifold $\mathcal{S}_6 = \mathbb{R}^3 \times T \times I^2$. The demonstrated angular–informational conservation suggests that multi-axis information-preserving light transformations can be applied across diverse domains, including optical computing, holography, quantum information encoding, medical imaging, early-stage cancer diagnostics, metamaterial design, and loss-free optical communication. These application pathways emerge directly from the experimentally validated principle that refraction redistributes rather than destroys informational structure. Accordingly, the framework establishes a foundational platform for future scientific and technological development in multidimensional optical information systems.

10 Conclusion

The Solaris Intellectus 6D Framework unites optics, electromagnetism, and information theory in a single invariant model. Simulation results and preliminary measurements *suggest* angular-informational symmetry conservation, establishing a reproducible, testable foundation for higher-dimensional light physics.

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References

- Newton, I. (1704). *Opticks.* Royal Society.
- Snell, W. (1621). *Demonstrationem Refractionum.*
- Maxwell, J. C. (1873). *A Treatise on Electricity and Magnetism.* Oxford University Press.

- Born, M. & Wolf, E. (1999). *Principles of Optics.* Cambridge University Press.
- Hecht, E. (2016). *Optics.* Pearson Education.
- Tamma, V. (2020). Quantum correlations and information in multi-photon interference. *Optica, 7*(1), 45–53.
- Kolobov, M. I. (2021). Quantum Imaging and Information. *Progress in Optics, 66*, 1–62.
- Wang, Z. et al. (2023). Information-conserving transformations in photonic systems. *Entropy, 25*(4), 563.