Title: High-Frame-Rate Imaging of Light Propagation over Macroscopic Distances

Author: Sunil Singh Rawat Date: 24 October 2025

Abstract

This thought experiment explores the hypothetical observation of light propagation along a 300,000 km planar surface. A futuristic camera with 300,000 fps and 100,000-pixel resolution records the event. Each frame captures the light pulse advancing approximately 1 km, allowing visualization of light in motion over macroscopic distances. This conceptual experiment demonstrates the finite propagation of light in a slow-motion frame-by-frame manner.

1. Introduction & Motivation

Light is traditionally considered instantaneous at human scales, but high-speed imaging can reveal its finite propagation. MIT femtophotography has shown light-in-motion over millimeter scales. This experiment extends that idea to macroscopic distances using a hypothetical camera.

2. Assumptions

Plane length: 300,000 km

Light speed: 3 × 10⁵ km/s

Camera: 3 × 10⁵ fps, 100,000 pixels resolution

Observation: light emitted at one end at t = 0

3. Framewise Calculation

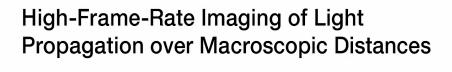
| lem:lem:lem:lem:lem:lem:lem:lem:lem:lem: |
|---|
| Each frame shows light moving 1 km forward. |
| |
| 4. Expected Observation |
| Light appears advancing 1 km per frame in the recorded video. |
| Human eyes cannot perceive this without ultra-high-speed recording. |
| Conceptually, this shows frame-by-frame visualization of light's finite propagation. |
| |
| |
| 5. Limitations |
| Practical cameras with these specifications do not exist. |
| 2. Pixel resolution limits detail (~3 km/pixel). |
| 3. Relativity and causality constraints are idealized. |
| 4. Atmospheric or medium effects ignored. |
| |
| 6. Relation to Prior Work |
| MIT femtophotography (2009–2010) captured light in motion using streak cameras at millimeter distances. |
| This is a macroscopic thought experiment extension. |

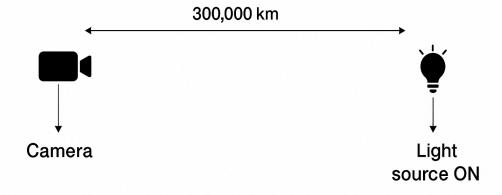
7. Conclusion & Priority Claim

Light can be visualized moving 1 km per frame over a macroscopic plane.

Conceptual idea formulated and recorded by Sunil Singh Rawat, 24 October 2025.

Figure: Schematic Diagram





Frames capture light moving 1 km per frame