

# Variable Light Speed and the $s_0$ / $s_1$ Entropic States

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## Abstract

This paper explores the relationship between the speed of light and the two fundamental entropic states in Energy-Flow Cosmology (EFC): the ground state  $s_0$ , and the active-flow state  $s_1$ . We outline how light-speed is not a universal constant, but an emergent limit of information transfer set by the entropic gradient between these states. The transition from  $s_0$  to  $s_1$  defines the available degrees of freedom for energy, information, and curvature. This provides a thermodynamic interpretation of light-speed variability across different cosmic environments without invoking exotic physics.

## 1 Introduction

In the EFC framework, the speed of light is not a fixed ontological quantity, but the consequence of underlying thermodynamic structure. The fundamental entropic states,  $s_0$  and  $s_1$ , describe two regimes:

- $s_0$ : minimal entropy, low available degrees of freedom, near-ground energy configuration.
- $s_1$ : active-flow regime, increased entropy, structure formation, causal gradients.

The transition between these states defines the local information capacity and therefore the upper bound on propagation velocity.

## 2 The $s_0$ State: Low-Entropy Ground Configuration

The  $s_0$  state corresponds to a high-coherence, low-entropy regime where curvature is minimal, the energy-flow field is weak, information capacity is low, and degrees of freedom are constrained.

In this state, the effective speed of light approaches a maximum due to minimal entropic drag.

## 3 The $s_1$ State: Active Entropic Flow

The  $s_1$  state is characterized by increased entropy, active energy flow, structure formation, curvature, and local increases in information density. Effective light-speed decreases due to entropic resistance.

## 4 Variable Light Speed as an Entropic Phenomenon

Light-speed variability arises from differences in the  $s_0/s_1$  balance:

$$c_{\text{eff}} = c_0 f(s_0, s_1)$$

High- $s_1$  regions reduce  $c_{\text{eff}}$ ; high- $s_0$  regions increase it. This produces a natural emergent model without exotic physics.

## 5 Implications for Cosmology

This framework predicts:

- Light-speed anisotropy across large-scale structure.
- Redshift deviations without expansion-only metrics.
- Natural alternatives to dark energy.
- Modified lensing time-delays.
- Predictable light-speed variation across entropic gradients.

## 6 Conclusion

The speed of light emerges from the entropic structure of spacetime. The  $s_0/s_1$  states define the local energy-flow environment, shaping the maximum information propagation rate.