

# 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. Thus, light-speed emerges as a constraint of the thermodynamic environment, rather than an independent constant.

## 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 because the energy landscape is flat and minimally resistive. There is little entropic drag, and propagation is limited primarily by the intrinsic properties of the local energy grid.

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

In contrast, the  $s_1$  state is characterized by:

- increased entropy,
- active energy flow,
- structure formation,
- curvature and gradients,
- local increases in information density.

In this regime, the effective speed of light can decrease because information transfer experiences entropic resistance. The gradient between  $s_0$  and  $s_1$  defines the dynamic “capacity field” that shapes light-speed locally.

### 4 Variable Light Speed as an Entropic Phenomenon

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

$$c_{\text{eff}} = c_0 f(s_0, s_1) \tag{1}$$

where  $c_{\text{eff}}$  is the local effective light-speed, and  $f(s_0, s_1)$  encodes the entropic structure of the region.

High  $s_1$  regions—clusters, halos, active flow zones—exhibit reduced effective light-speed. Low  $s_1$ , high  $s_0$  regions—voids, underdense space—allow higher propagation limits.

This interpretation removes the need for exotic fields or variable- $c$  modifications. Instead, light-speed becomes a natural emergent property of the thermodynamic landscape.

## 5 Implications for Cosmology

This model predicts:

- Light-speed anisotropy across large-scale structure.
- Redshift deviations without invoking expansion-based metrics.
- Natural alternatives to dark energy interpretation.
- Modified time-delay behaviour in lensing environments.
- Predictable light-speed variation across entropic gradients.

These effects follow directly from the  $s_0/s_1$  distribution of the cosmic grid.

## 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, which in turn constrains the maximum rate of information propagation. This framework provides a unified, thermodynamic interpretation of variable light-speed consistent with the broader Energy-Flow Cosmology model.