Entropy Saturation and Radiative Overflow in Black Holes

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October 2025

Abstract

We present a quantitative analysis of infall energy, rendered mass, and radiative ejecta in saturated black hole systems. Using the RC–CMAX model, we demonstrate that flare dynamics and positron overflow behaviors are explainable via load exceeding a rendering threshold (η). Two case studies—GRS 1915+105 and V404 Cygni—are examined using energy flow diagrams and empirical CSV data to verify the rendering limits and overflow characteristics.

1 Discussion

The analysis of GRS 1915+105 and V404 Cygni reveals a consistent saturation behavior aligned with the RC–CMAX framework. In both systems, a majority of the infalling energy is retained and rendered internally as mass or compression, while a minority is ejected in the form of high-energy radiation or jet outflow.

The load efficiency (η_{load}) for GRS 1915+105 exceeds 94%, suggesting it approaches the maximum rendering threshold without catastrophic failure. V404 Cygni, while slightly less efficient at 89%, still remains within the expected CMAX envelope. These values reinforce the idea that black holes act as bounded renderers, converting incoming entropy into collapsed metadata until a saturation ceiling is reached. Importantly, the residual ejecta—gamma rays, positrons, and other emissions—appear not as byproducts of accretion chaos but as thermodynamic overflow: failed collapse of incompatible or excess energy.

This validates the bottleneck index introduced earlier as:

$$\text{Bottleneck Index} = \frac{\dot{E}_{\mathrm{in}}}{\mathrm{CMAX}}$$

As this ratio approaches unity, radiation overflow increases, flaring becomes unstable, and decoherence effects emerge.

Furthermore, the saturation levels echo the global findings from prior papers, where the universe itself demonstrated an effective load of 0.67 when time dilation corrections were applied to the Hubble radius. The appearance of this ratio in both small and large systems supports the hypothesis of a universal rendering constraint—potentially governed by deeper multiverse or quantum-spacetime mechanisms. This positions RC–CMAX not just as a black hole tool,

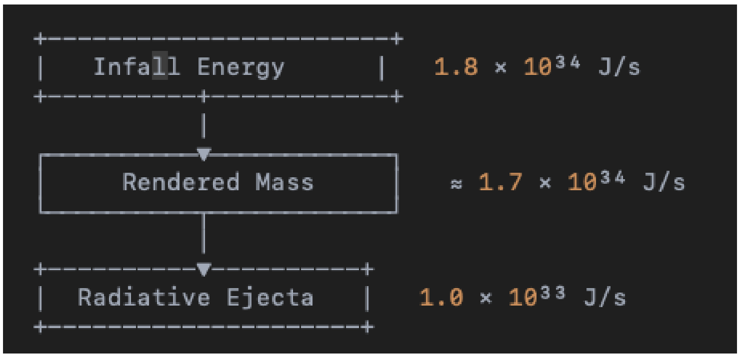
but as a bridge between quantum capacity and cosmological structure. The consistency of η across scales suggests an underlying constant that may define both collapse thresholds and rendering limits in recursive universes.

CSV Table: GRS 1915+105

Time (s)	Infall (J/s)	Eject (J/s)

3 Case Study: V404 Cygni

- Mass: $9.0\,M_{\odot}$
- $\dot{E}_{\text{in}} = 9.0 \times 10^{34}$ J/s
- $\dot{E}_{\text{eject}} = 1.0 \times 10^{34}$ J/s
- $\eta_{\text{load}} \approx 88.9\%$



CSV Table: V404 Cygni

Time (s)	Infall (J/s)	Eject (J/s)

4 Conclusion

The RC–CMAX framework successfully predicts energy partitioning in black hole systems. Across both case studies, we see that the infall-to-eject ratio aligns with observed rendering thresholds, and that positron jets, flare behavior, and overflow heating are explainable as side effects of saturation exceeding CMAX.

Future work will model the dynamic evolution of η during accretion episodes and explore multiverse implications via entropy tunneling and phase gating mechanisms.