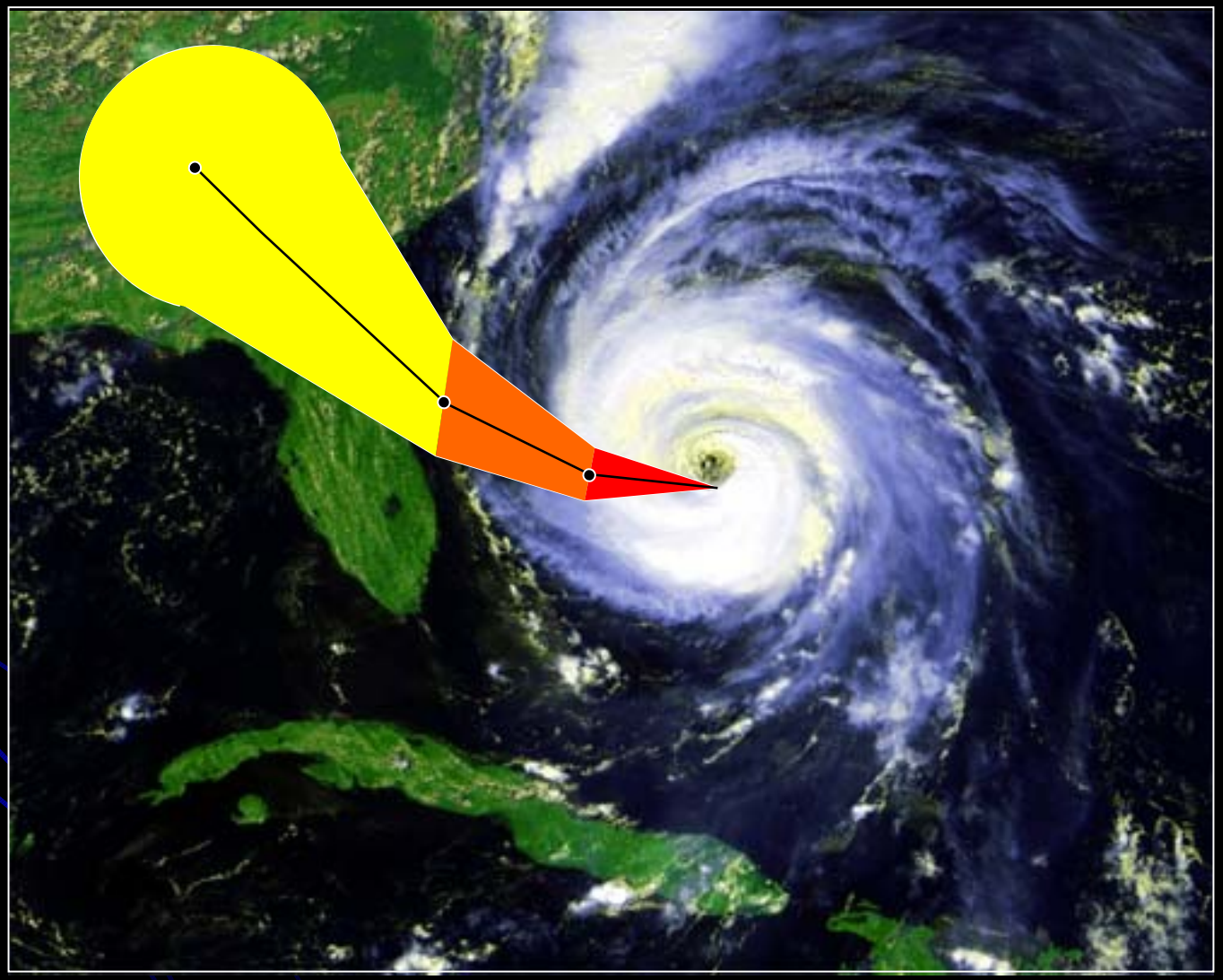
Bayesian Forecasting

by David Will
Mentor: Josh Rigler

Overview

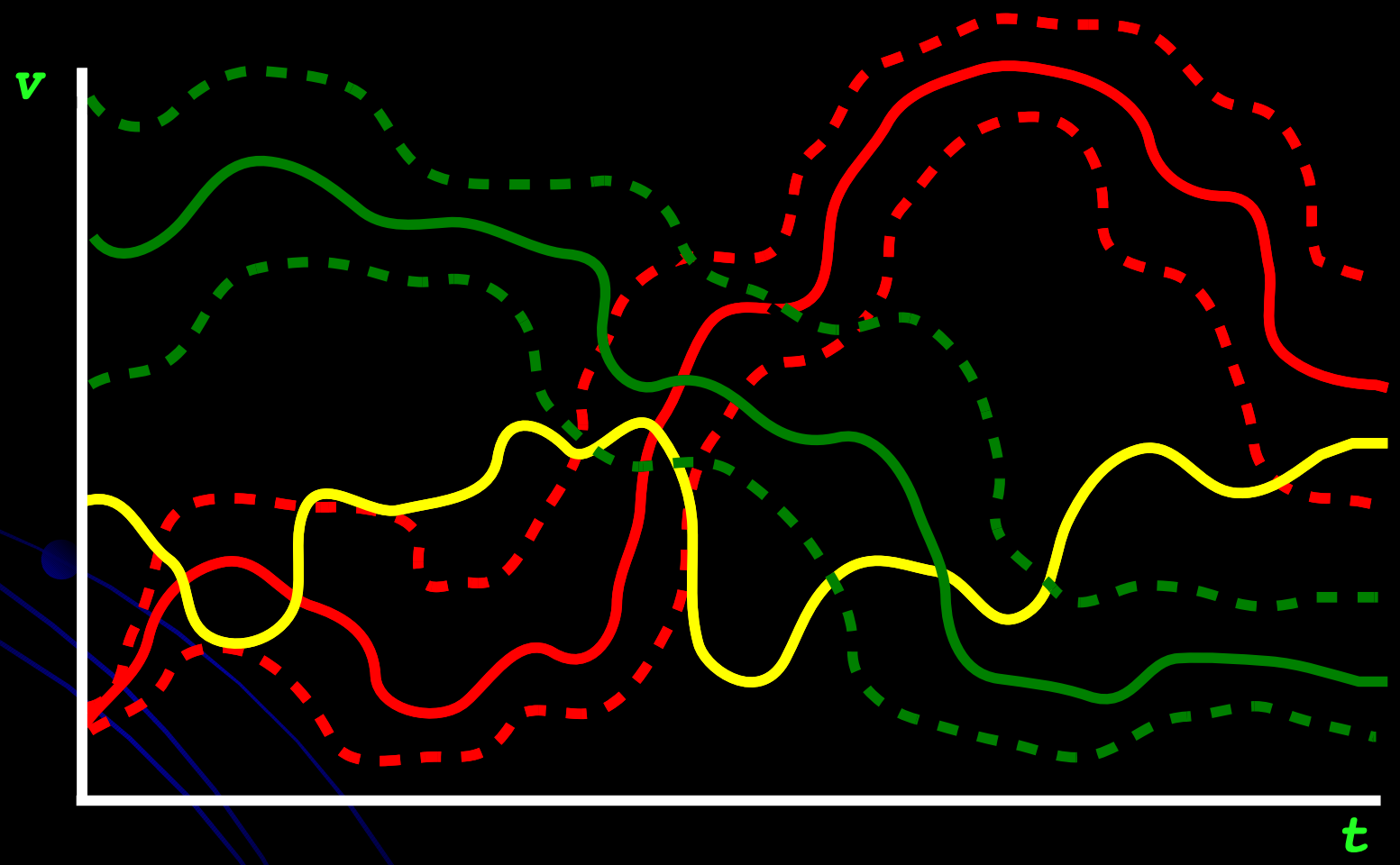
- Discussion of the problem and the proposed solution
- Our work toward the solution
- Results
- Plans for future work

Weather on Earth

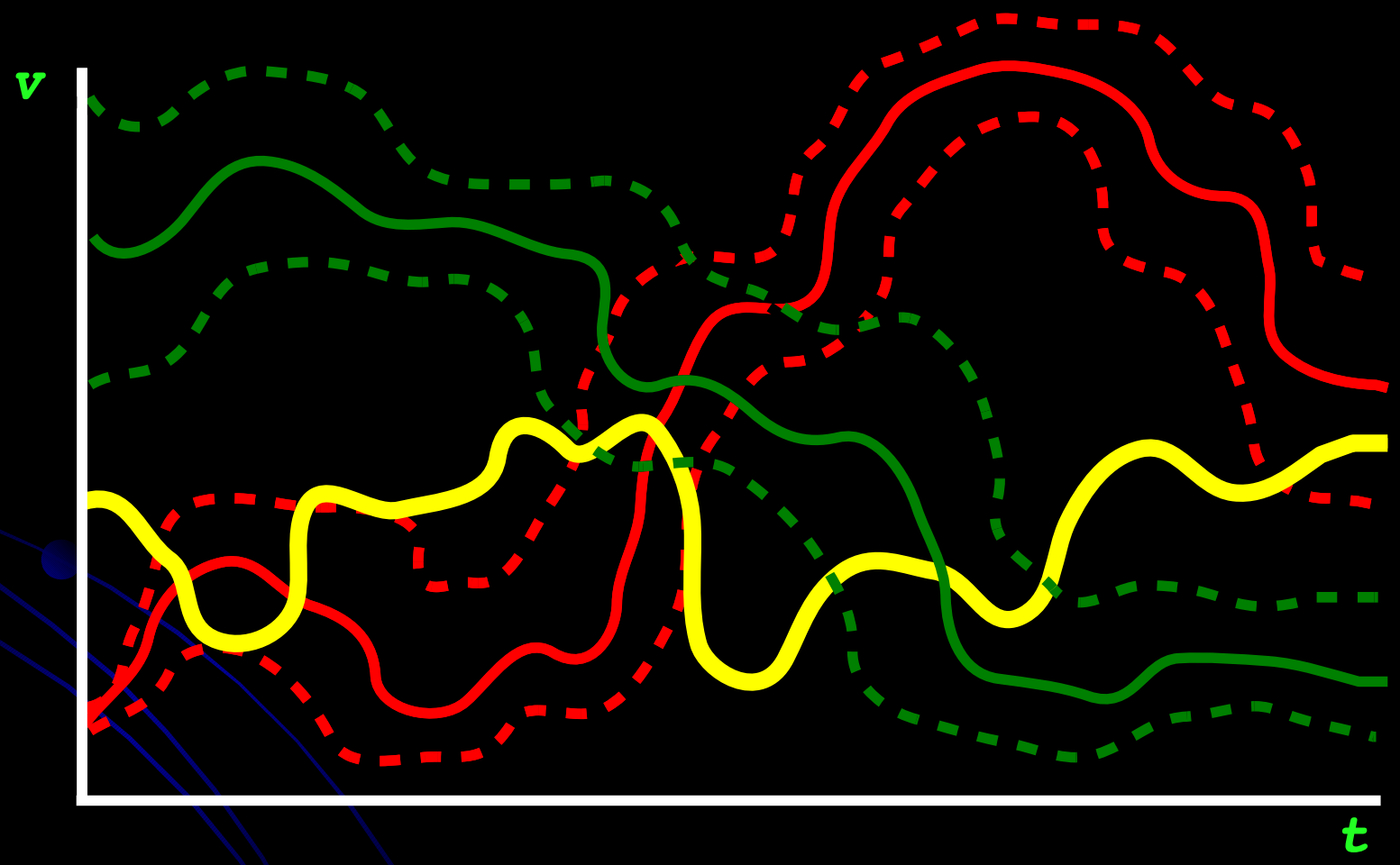


http://weblogs.marylandweather.com/hurricane_fran_nasa.jpg

Models of Weather



Models of Weather



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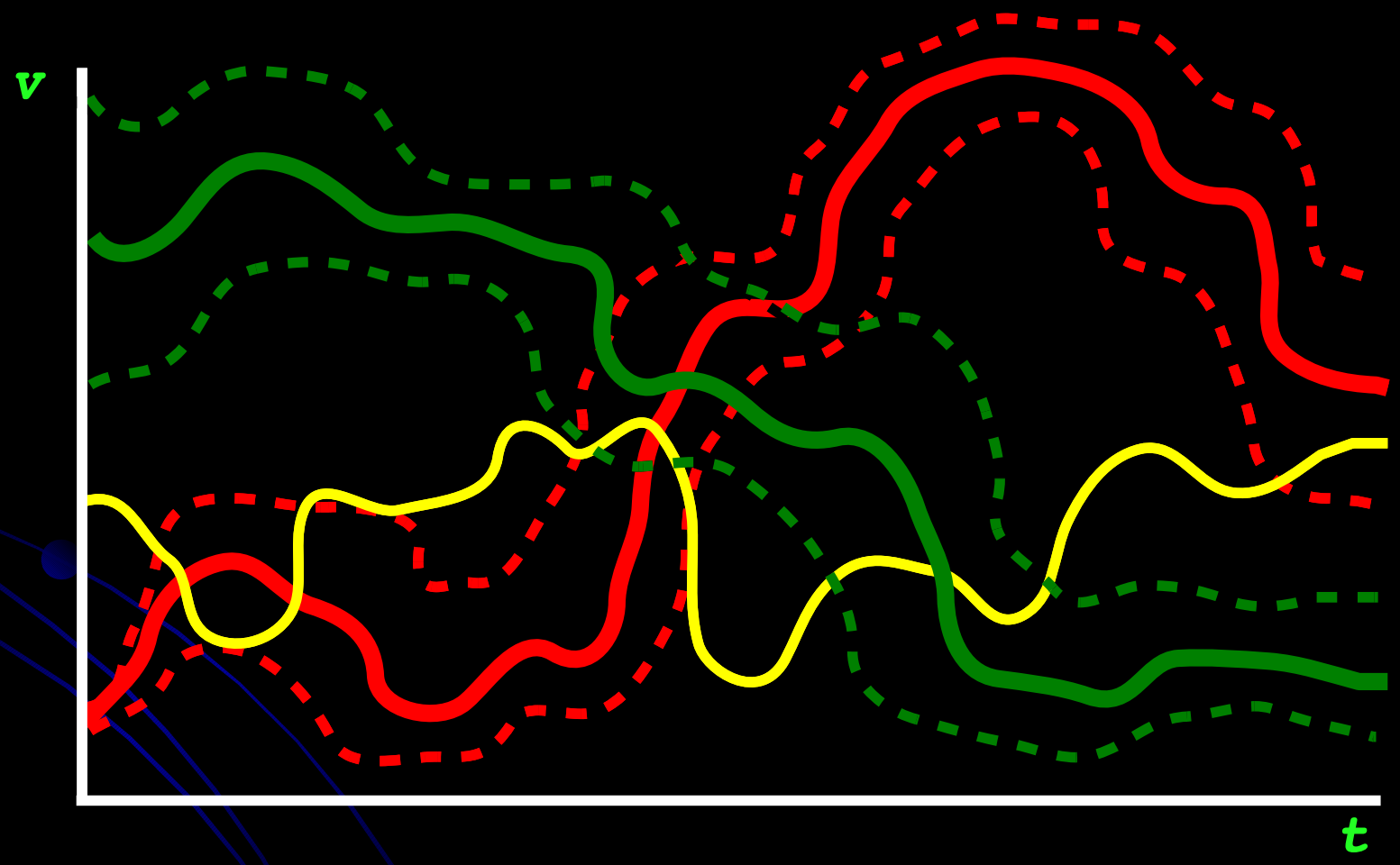
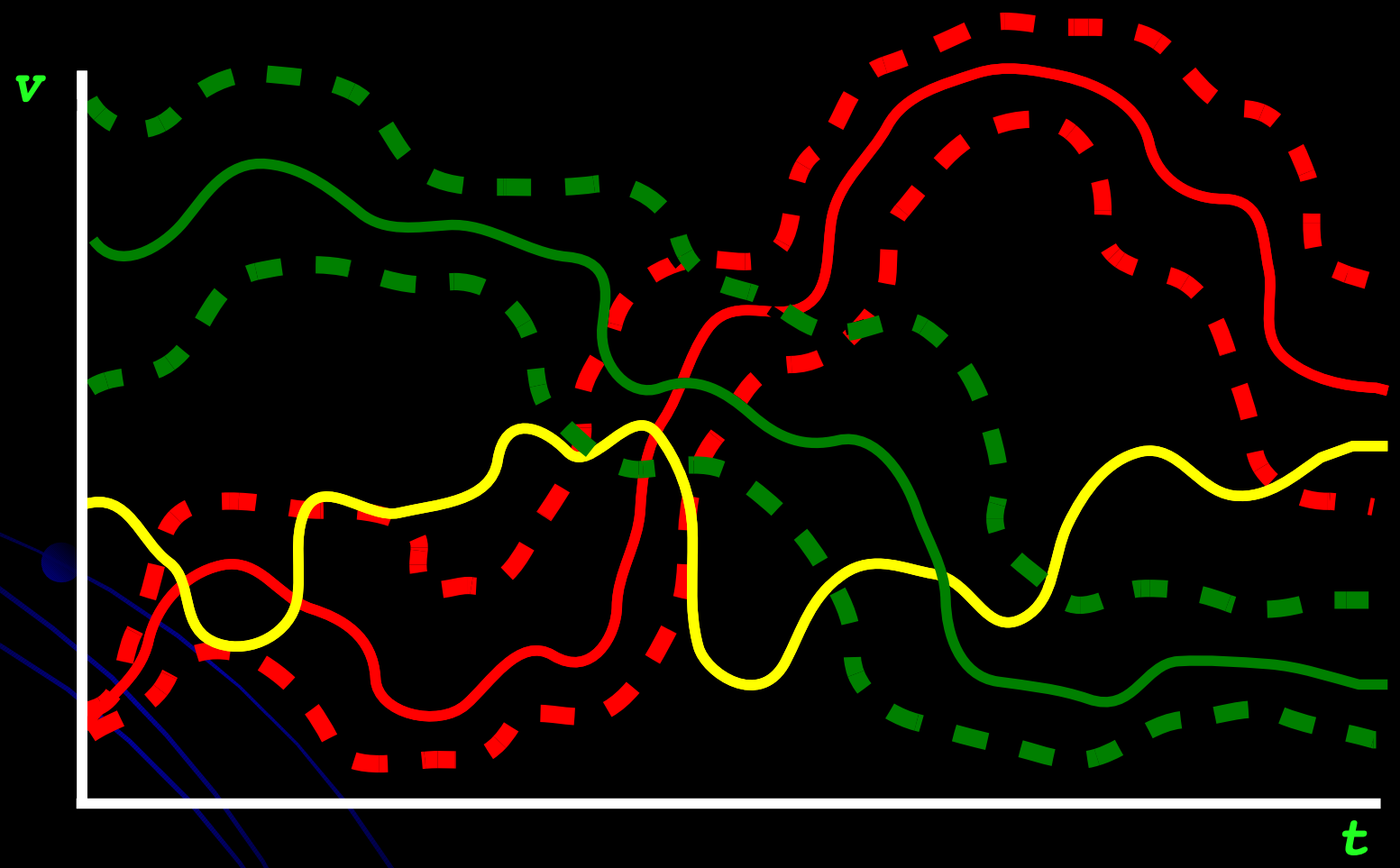
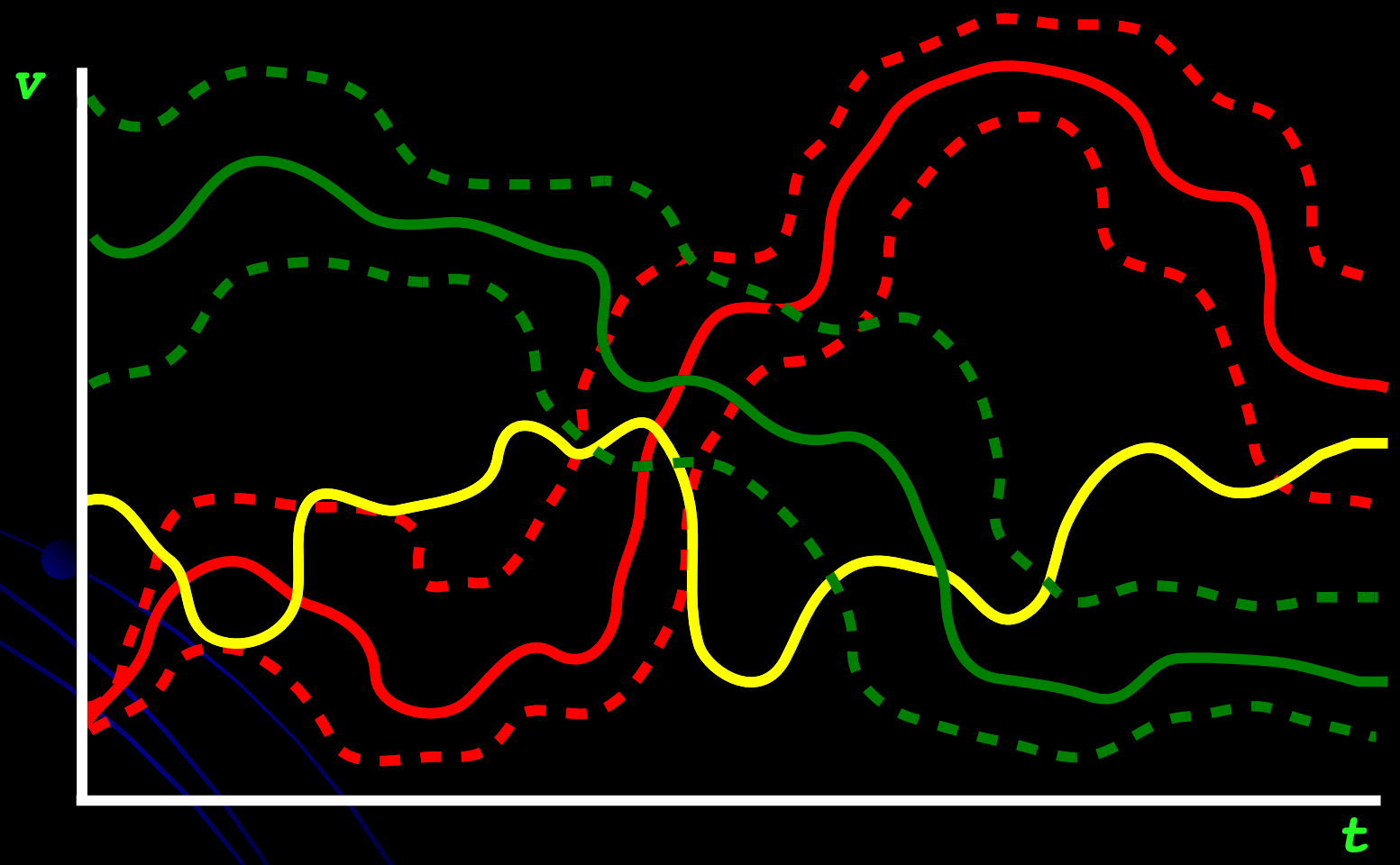


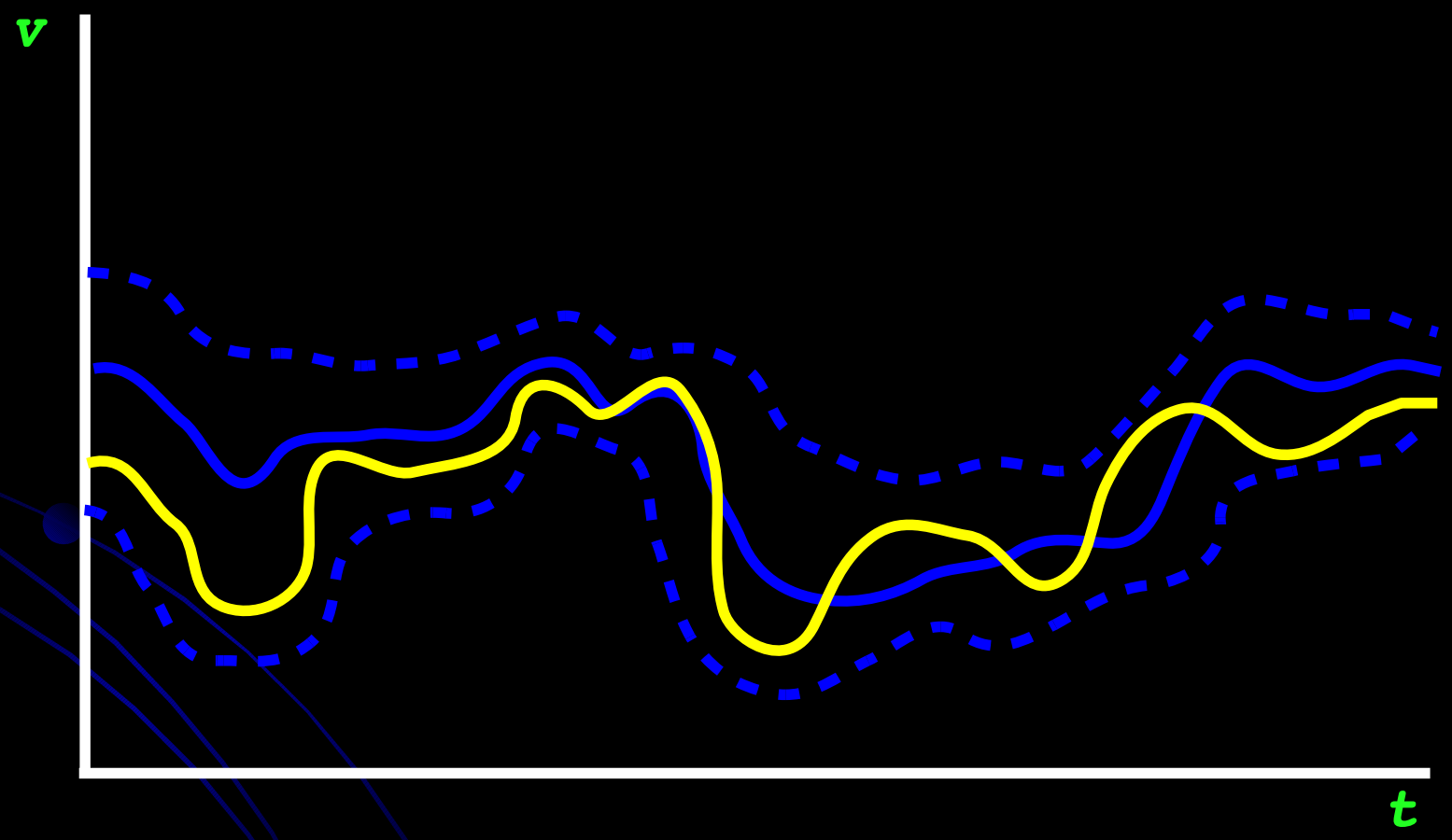
Models of Weather



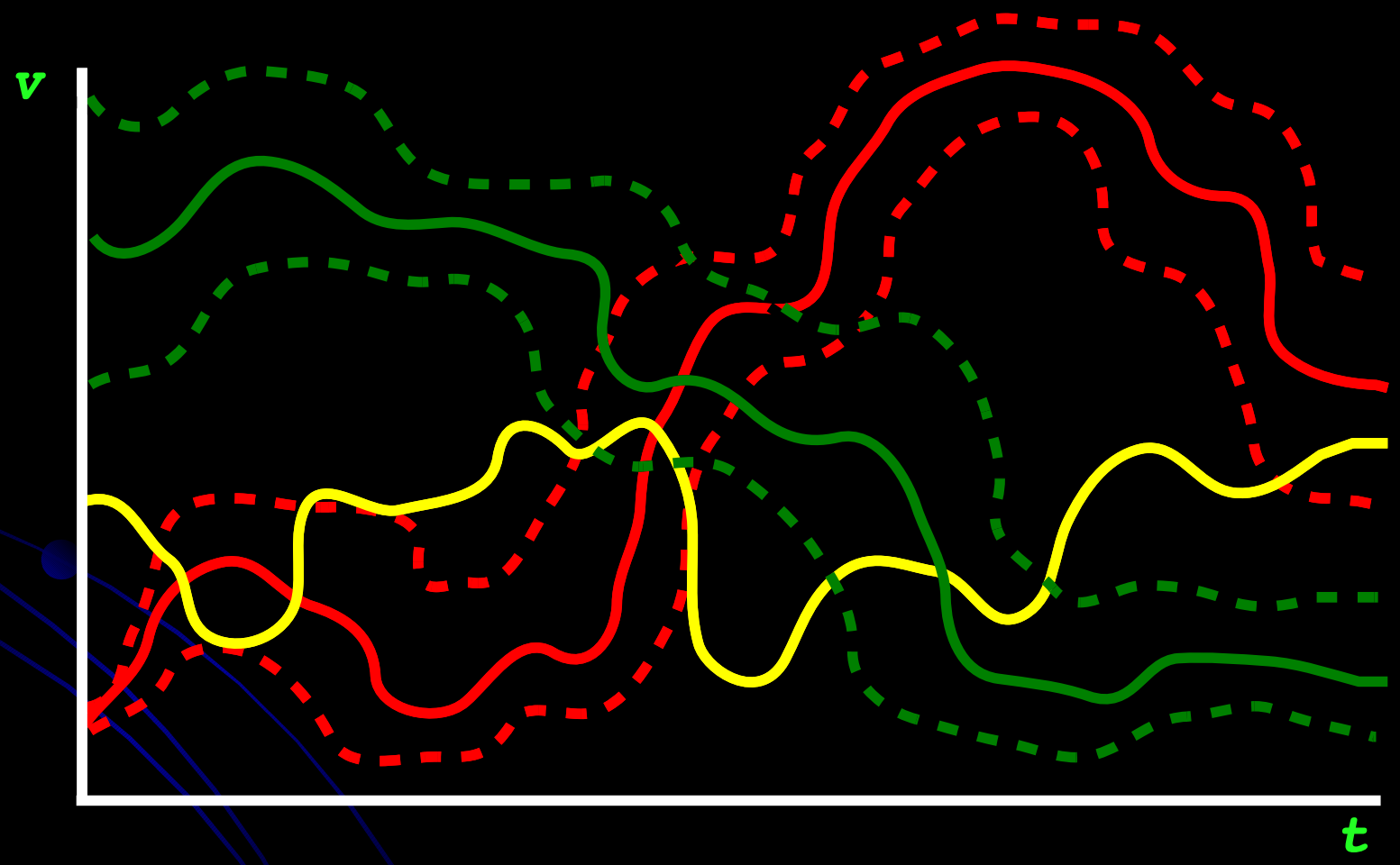
Models of Weather



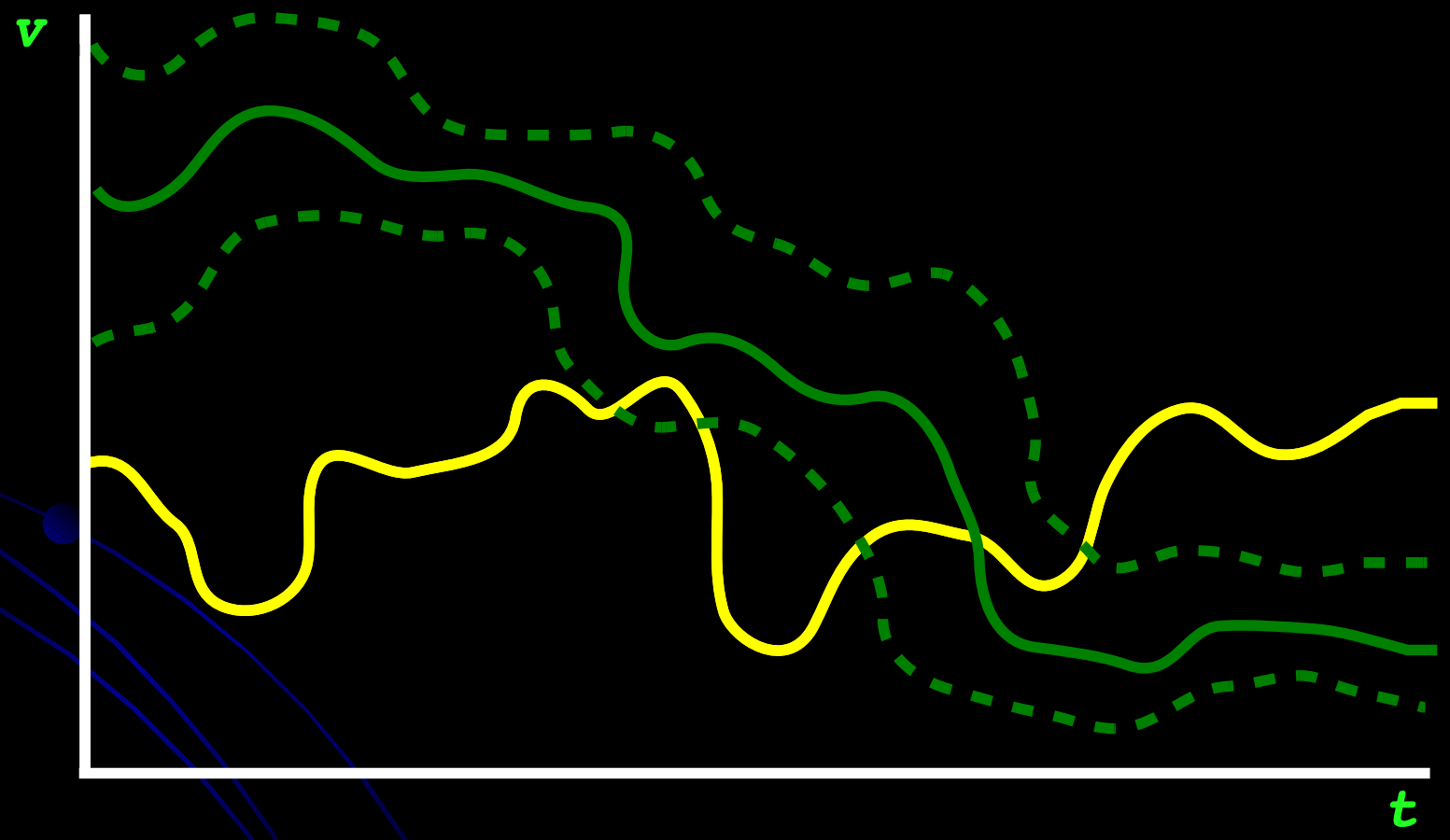
Good Models of Weather



Models of Weather



Models of Weather Simplified



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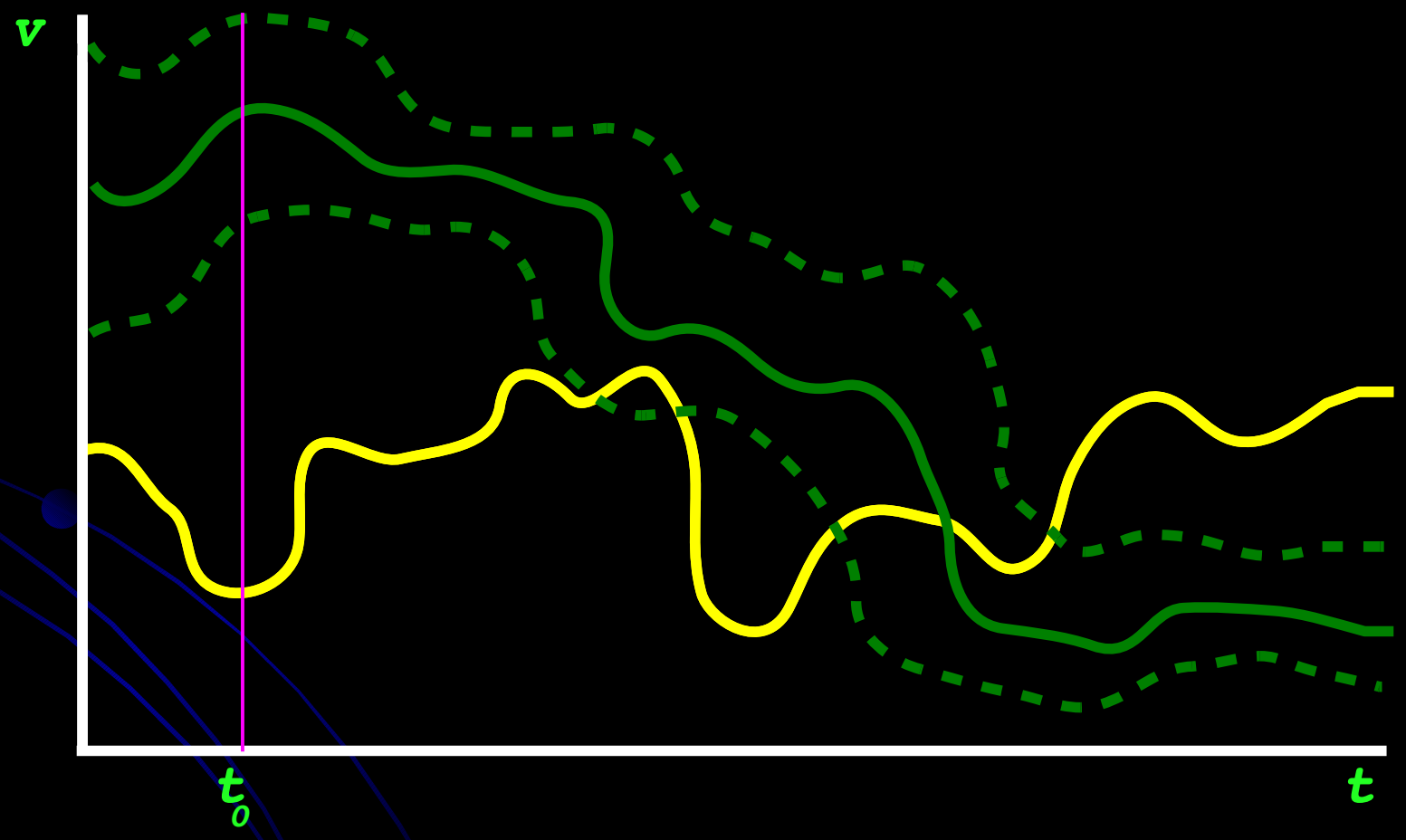
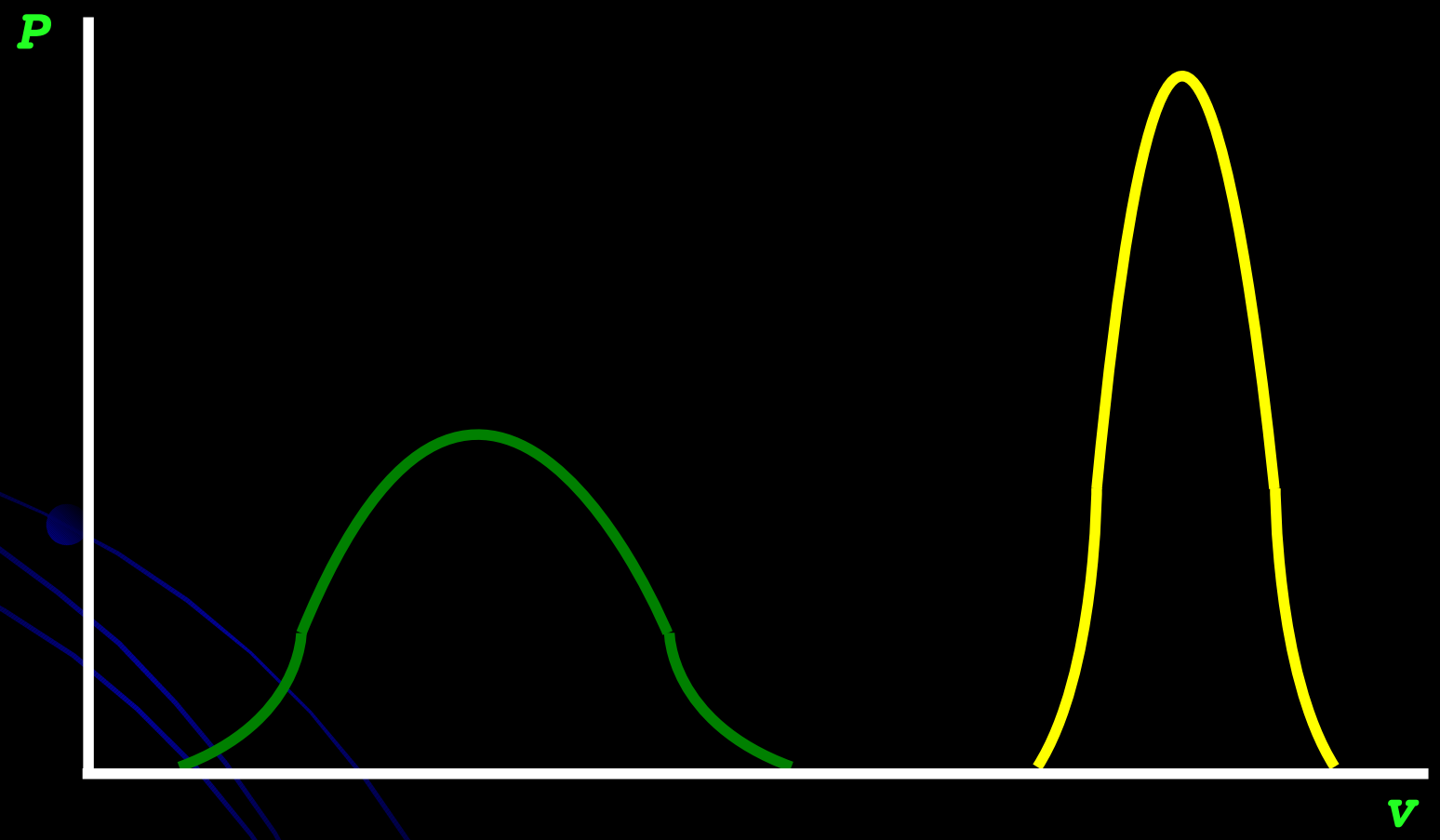


Bayesian Statistics



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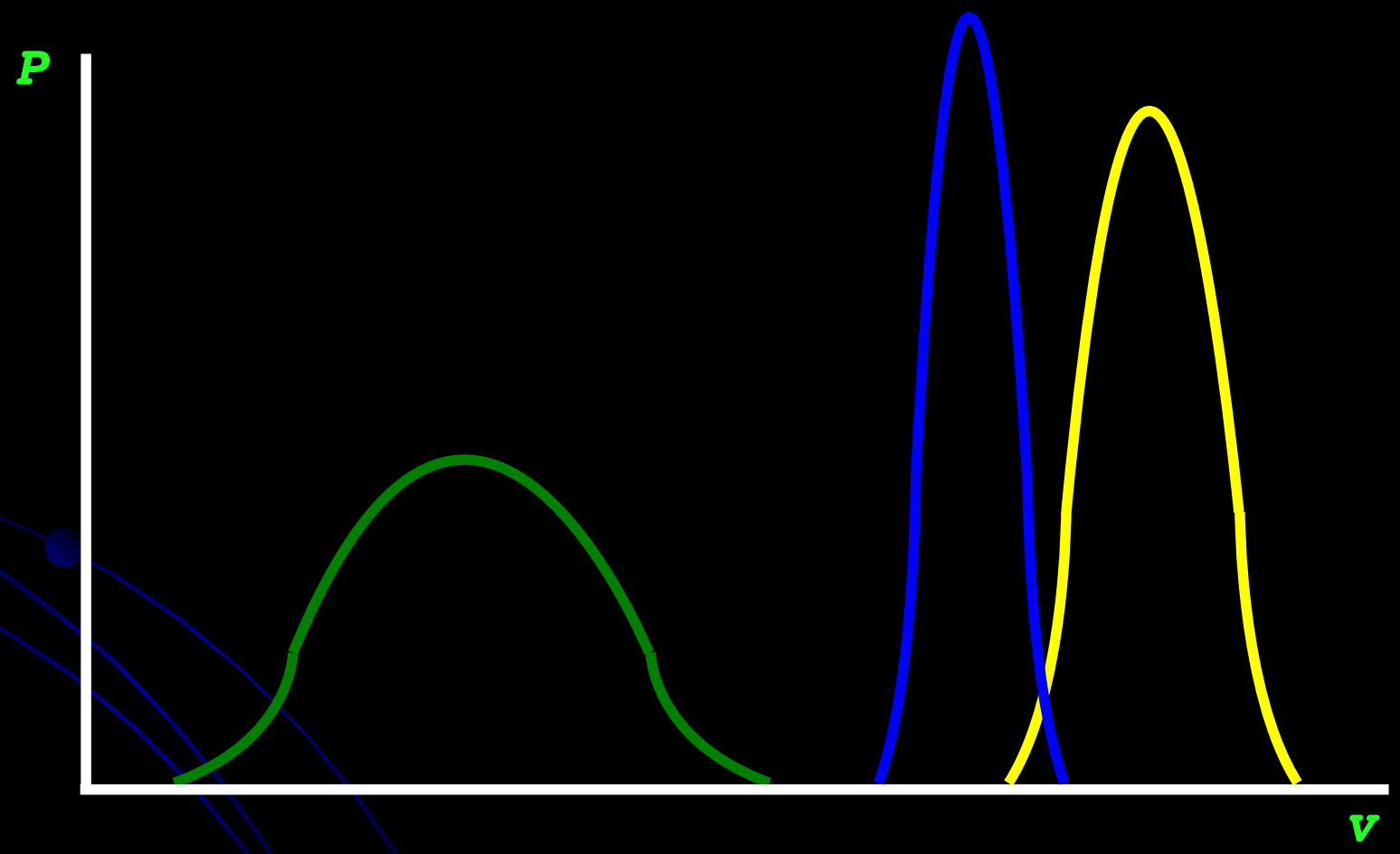
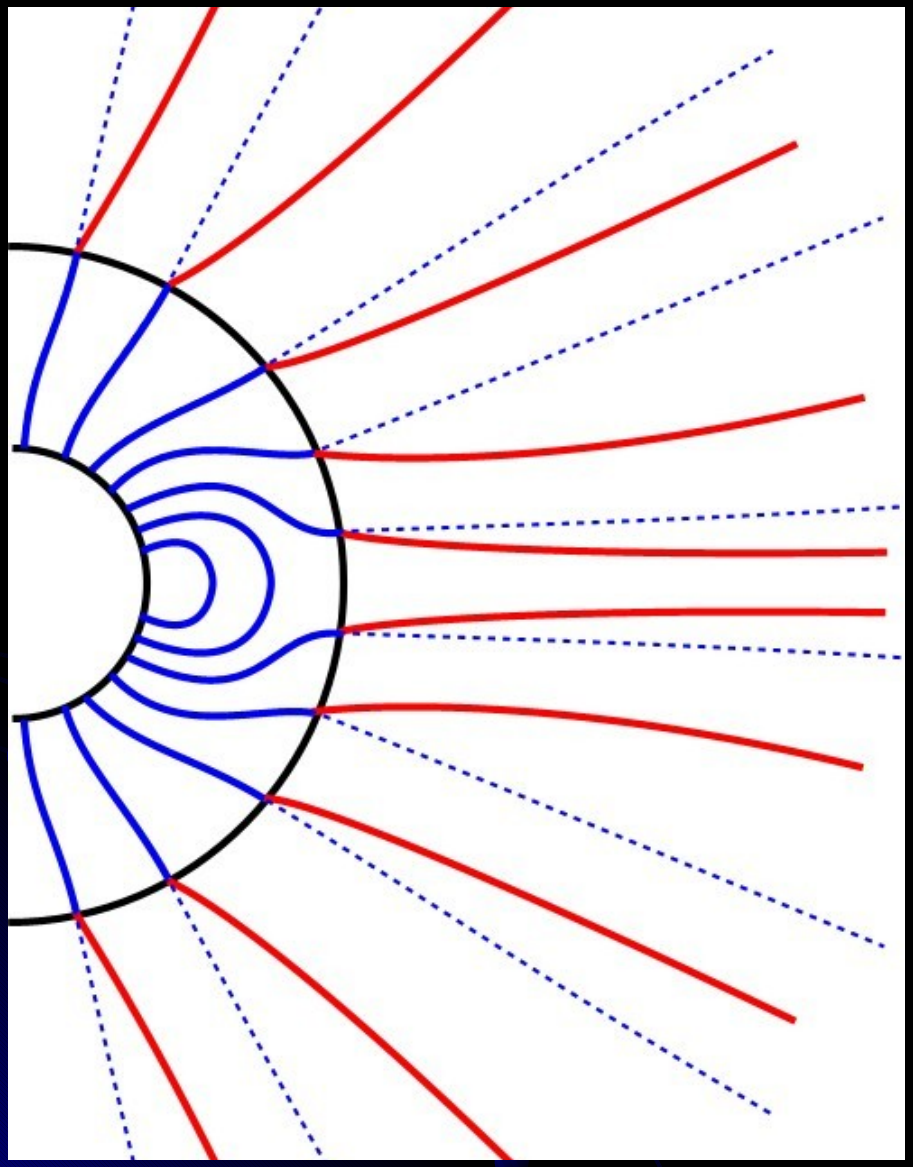
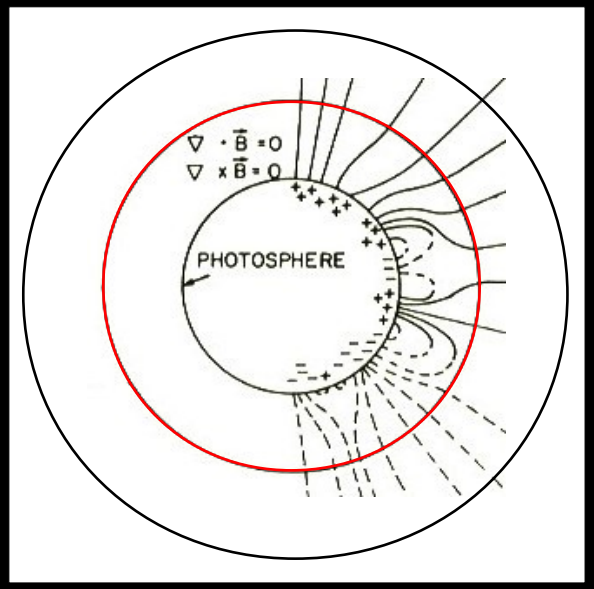


Wang-Sheeley-Arge Model



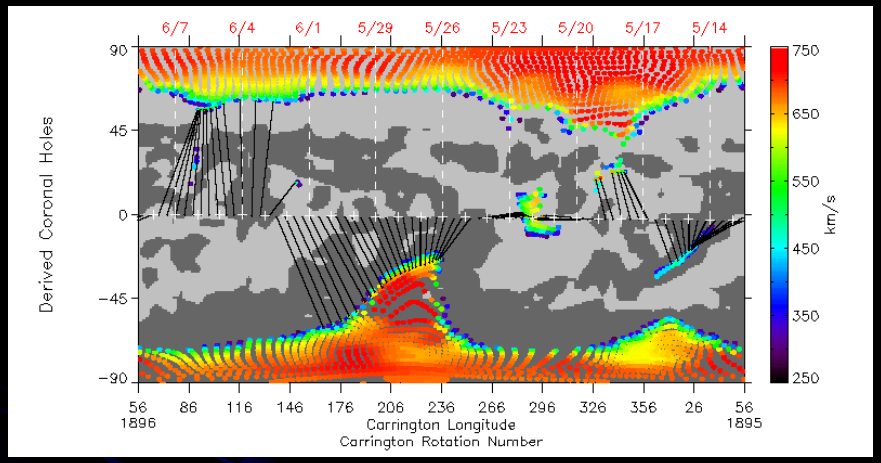


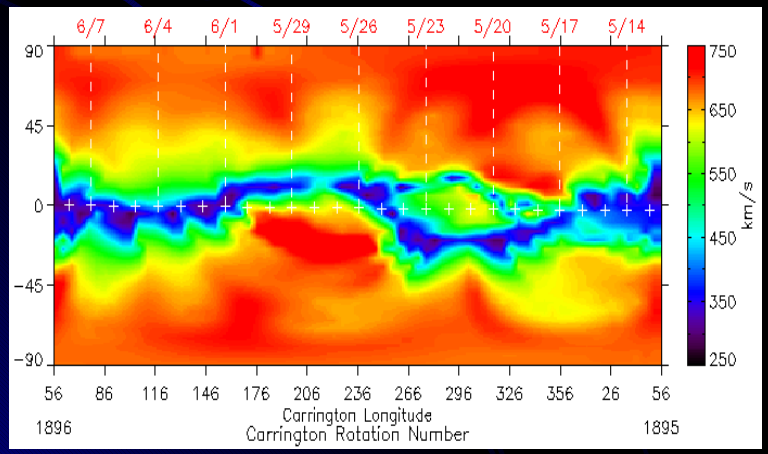
Images courtesy of Sarah McGregor

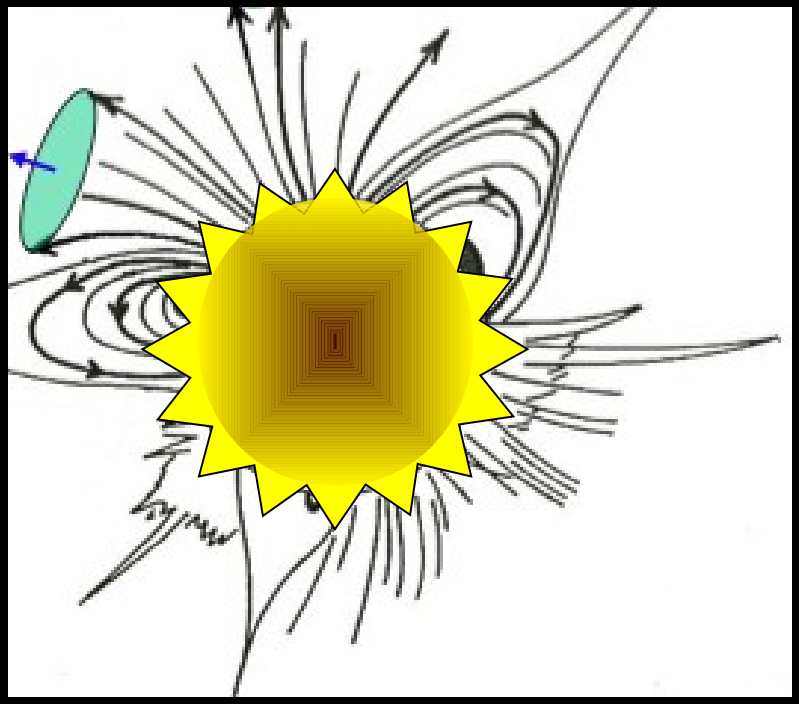
Wang-Sheeley-Arge Model

$$V(f_s,\theta_b) = 265 + \frac{1.5}{(1+f_s)^{1/3}}\left(5.8 - 1.6\exp\left[1-\left(\frac{\theta_b}{7.5}\right)^3\right]^{3.5}\right)$$

$$f_s = \left(\frac{R_s}{R_{ss}}\right)^2\left(\frac{B(R_s)}{B(R_{ss})}\right)$$

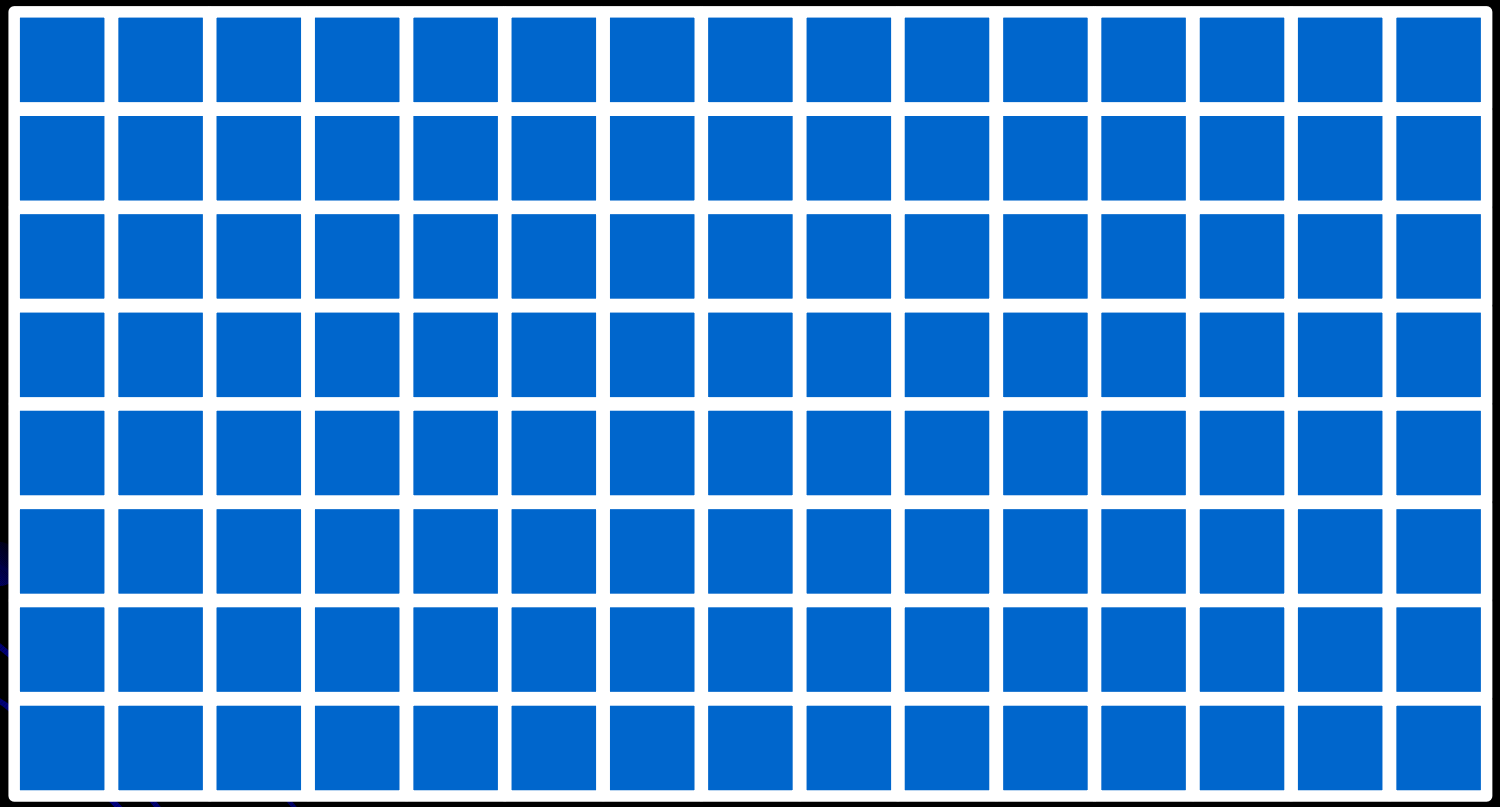






Images courtesy of Sarah McGregor

Magnetograms – Model Input



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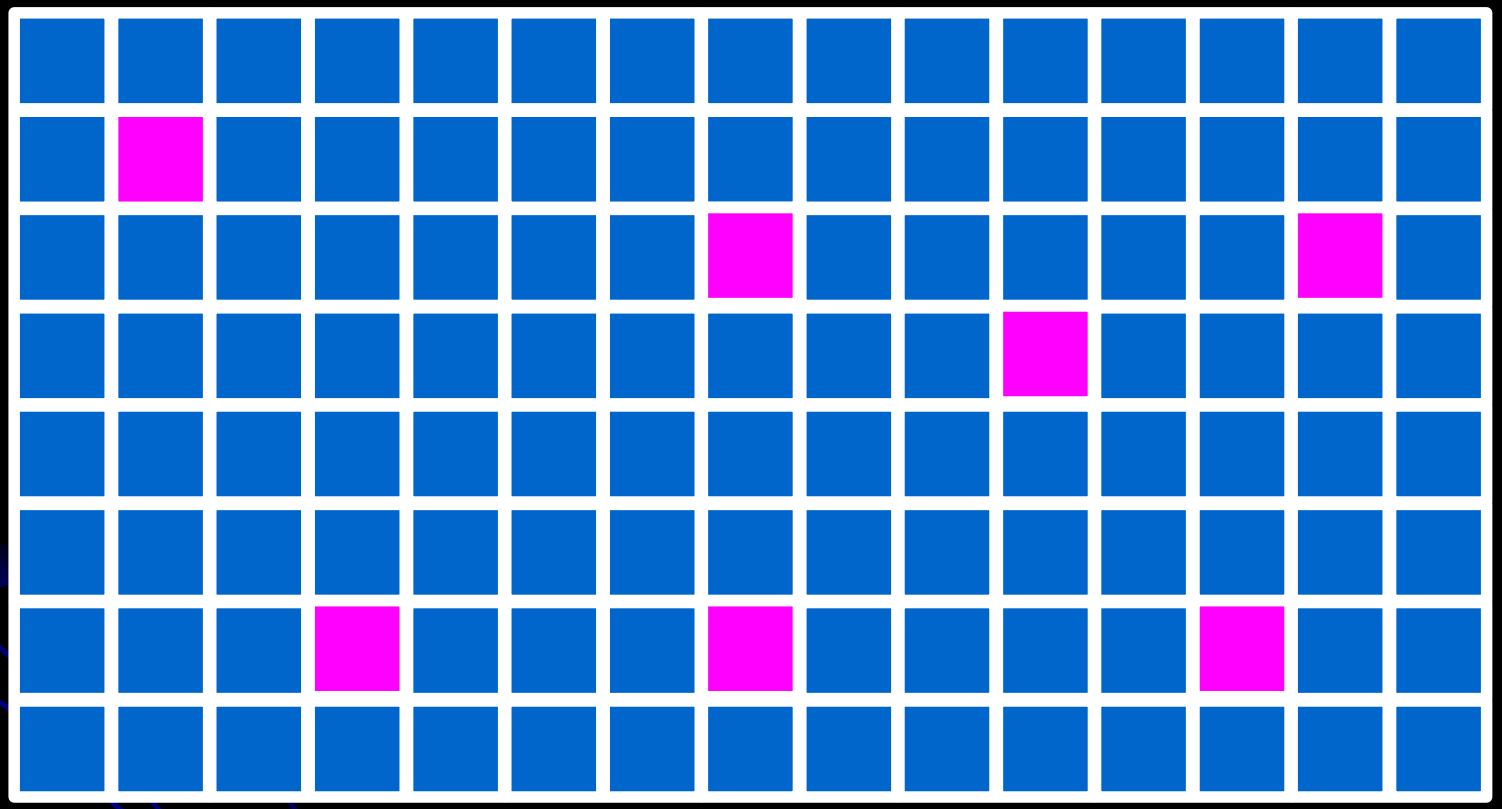

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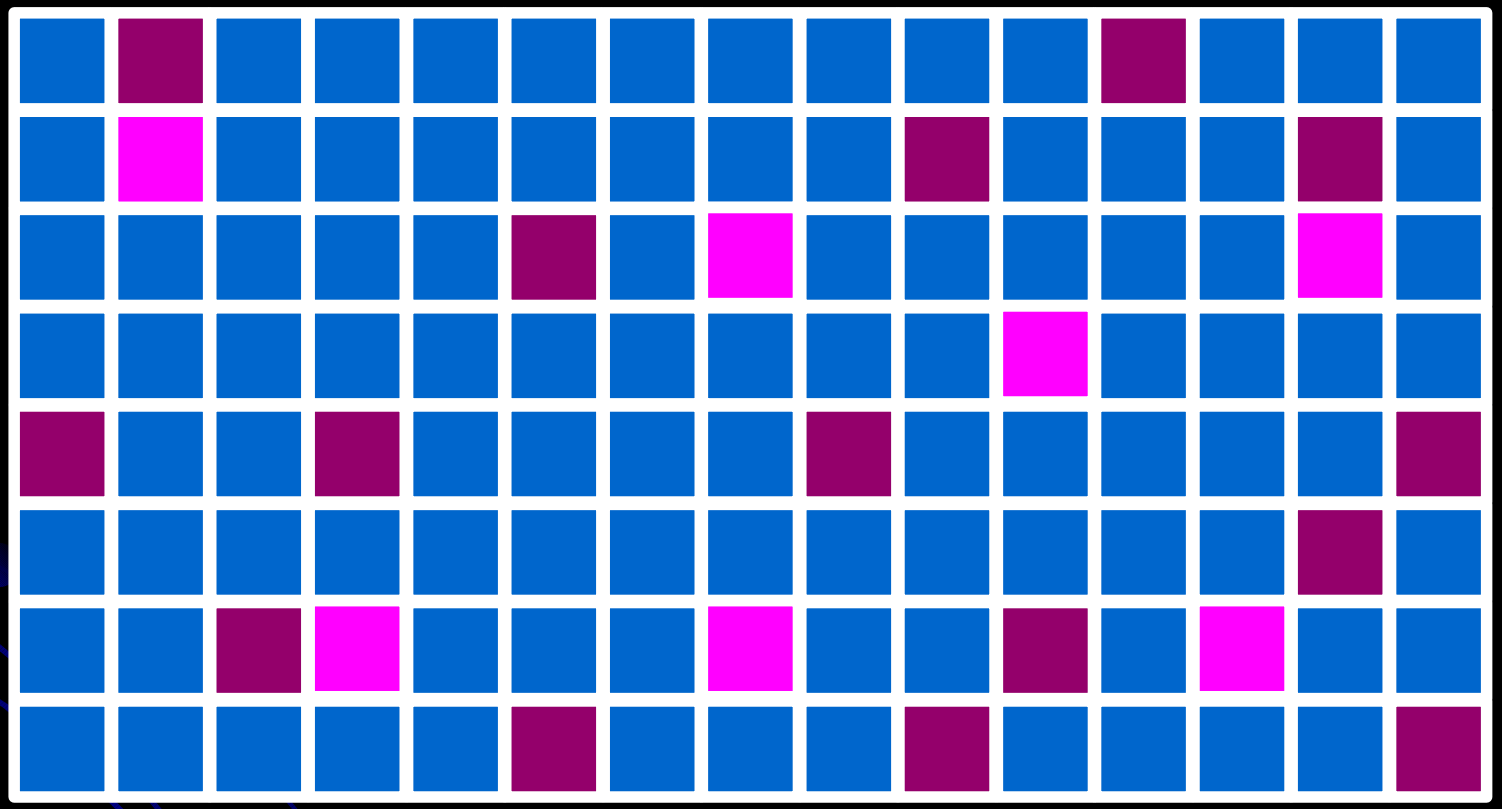
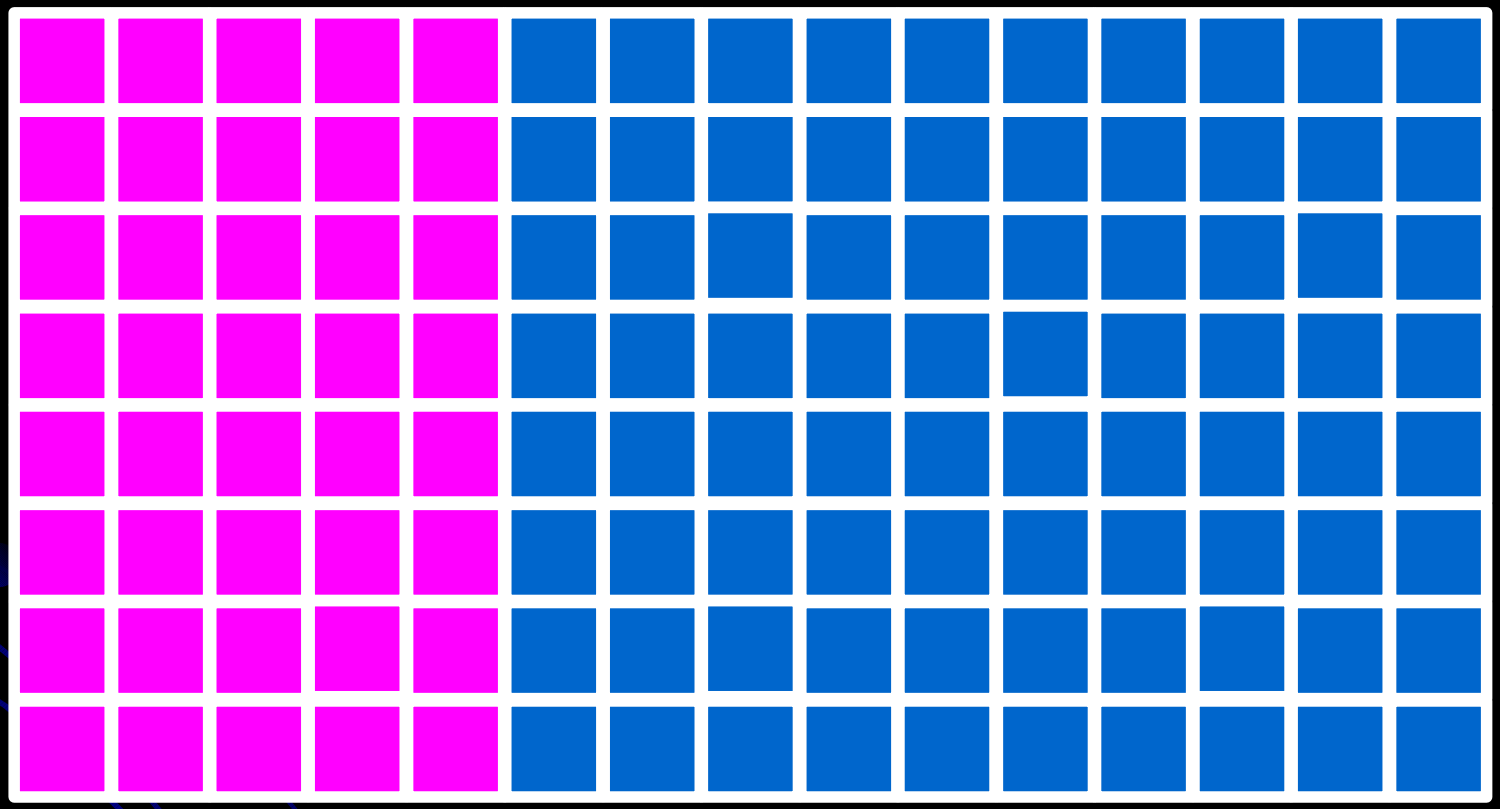
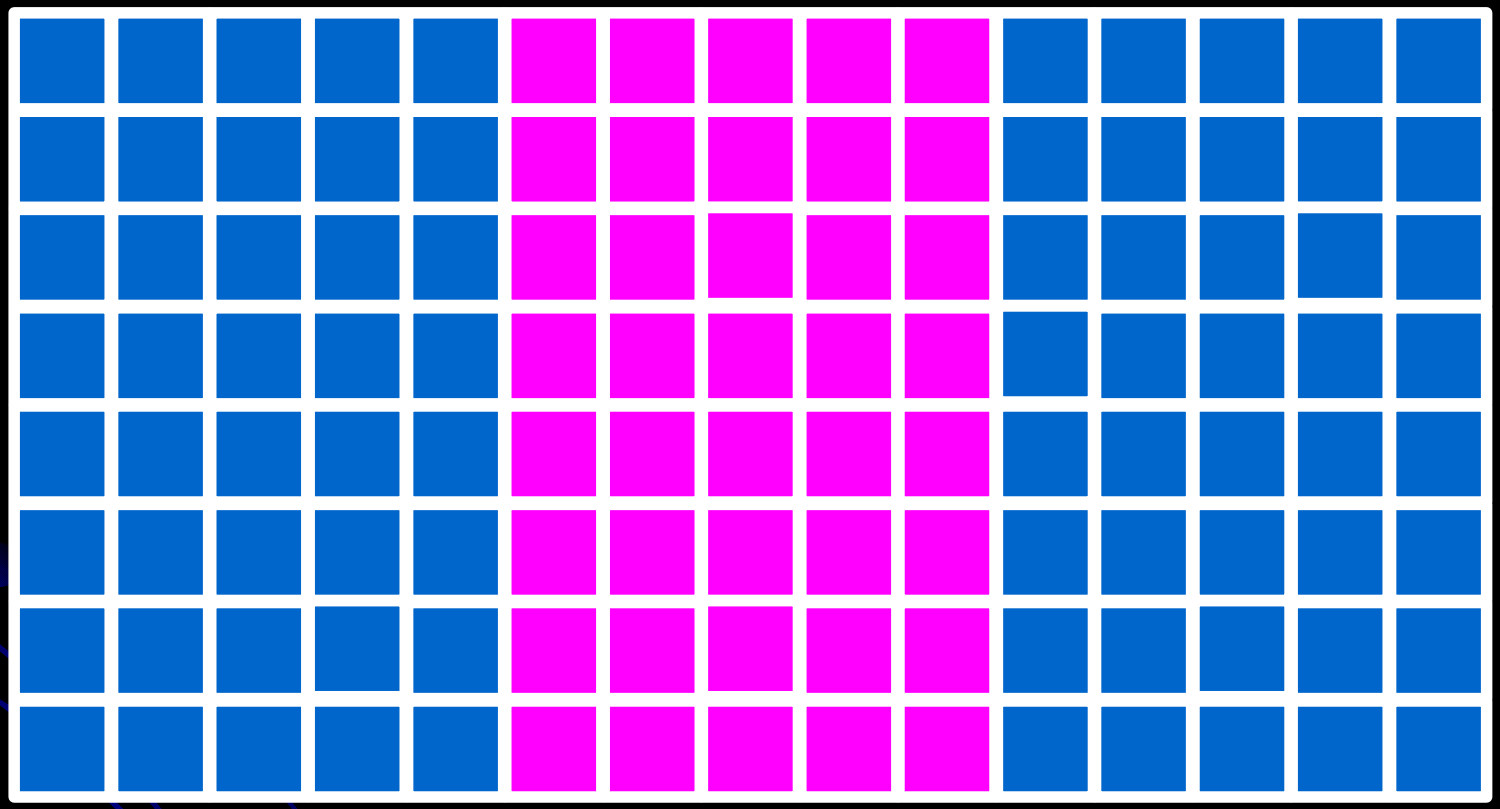


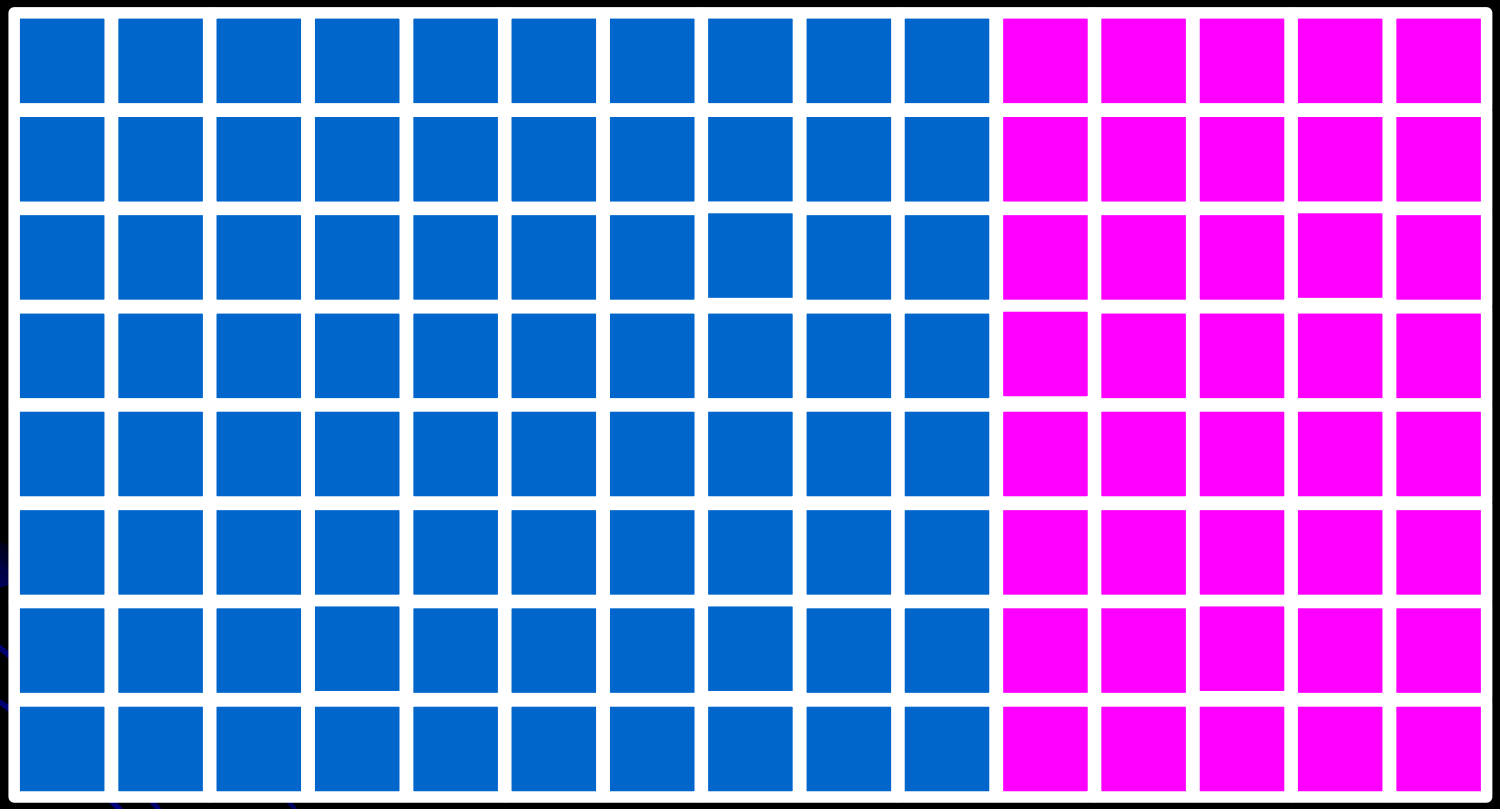
“Left Longitude” Perturbation



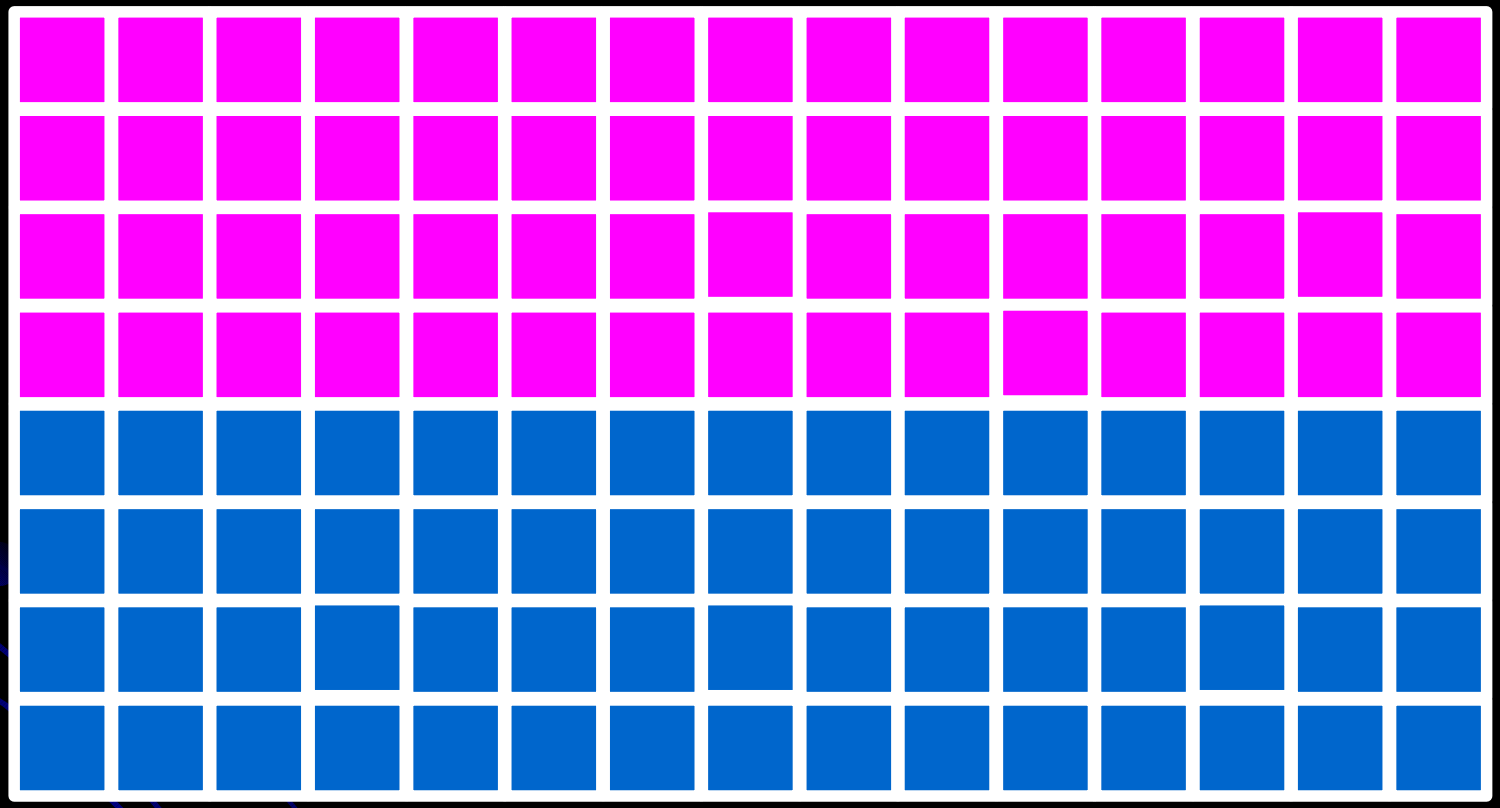
“Middle Longitude” Perturbation



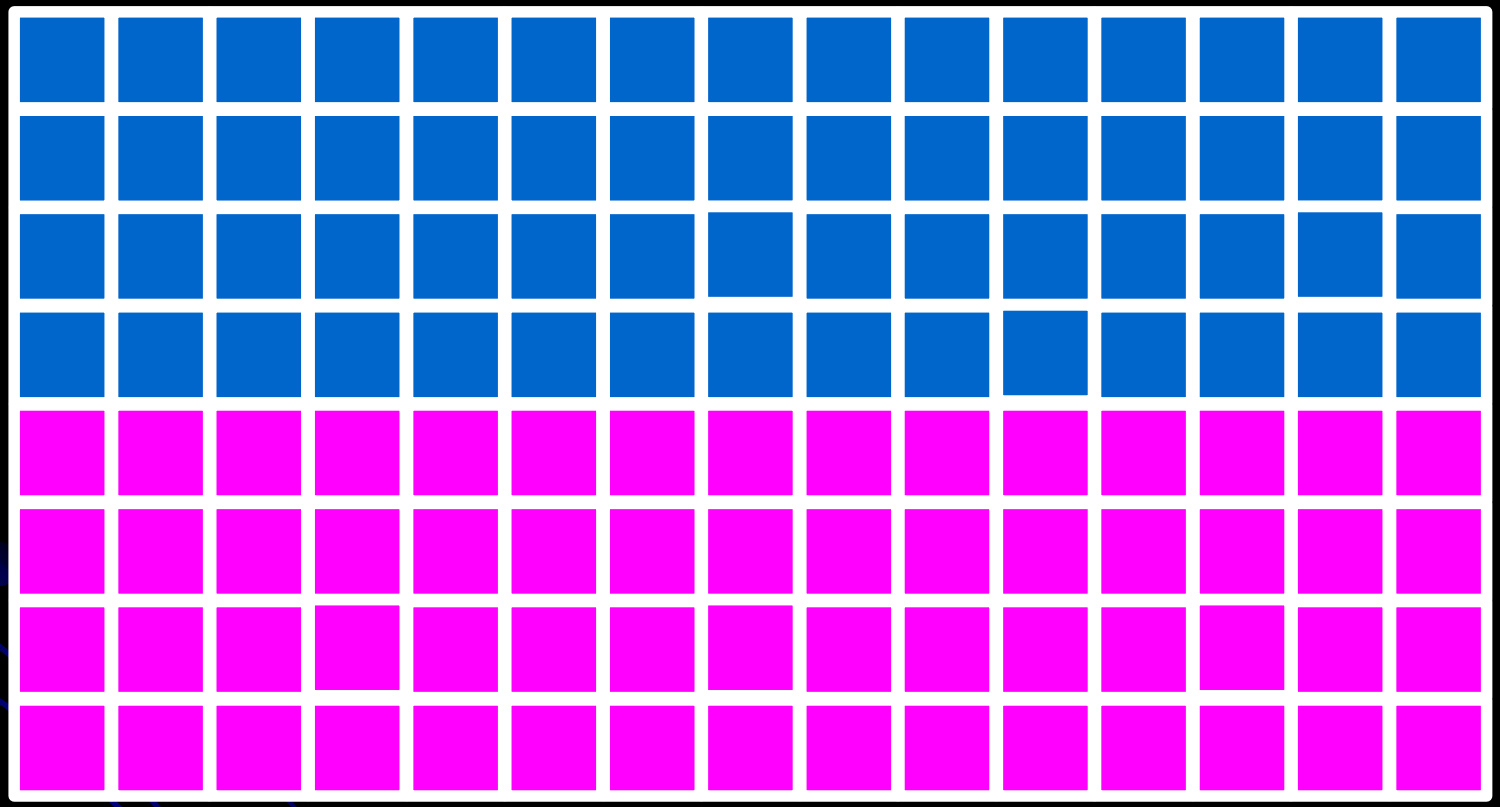
“Right Longitude” Perturbation



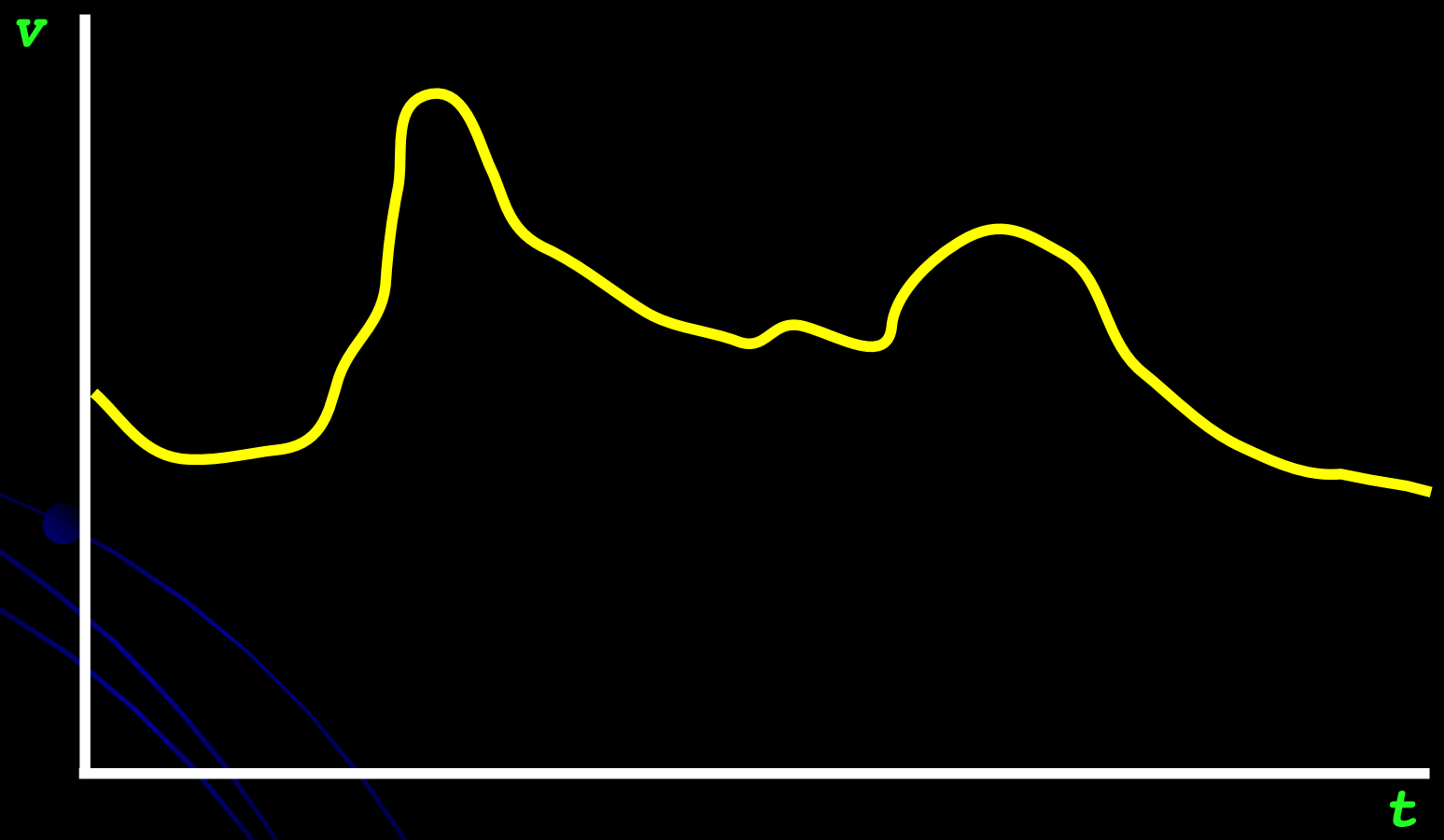
“Top Half” Perturbation



“Bottom Half” Perturbation



Model Peturbation



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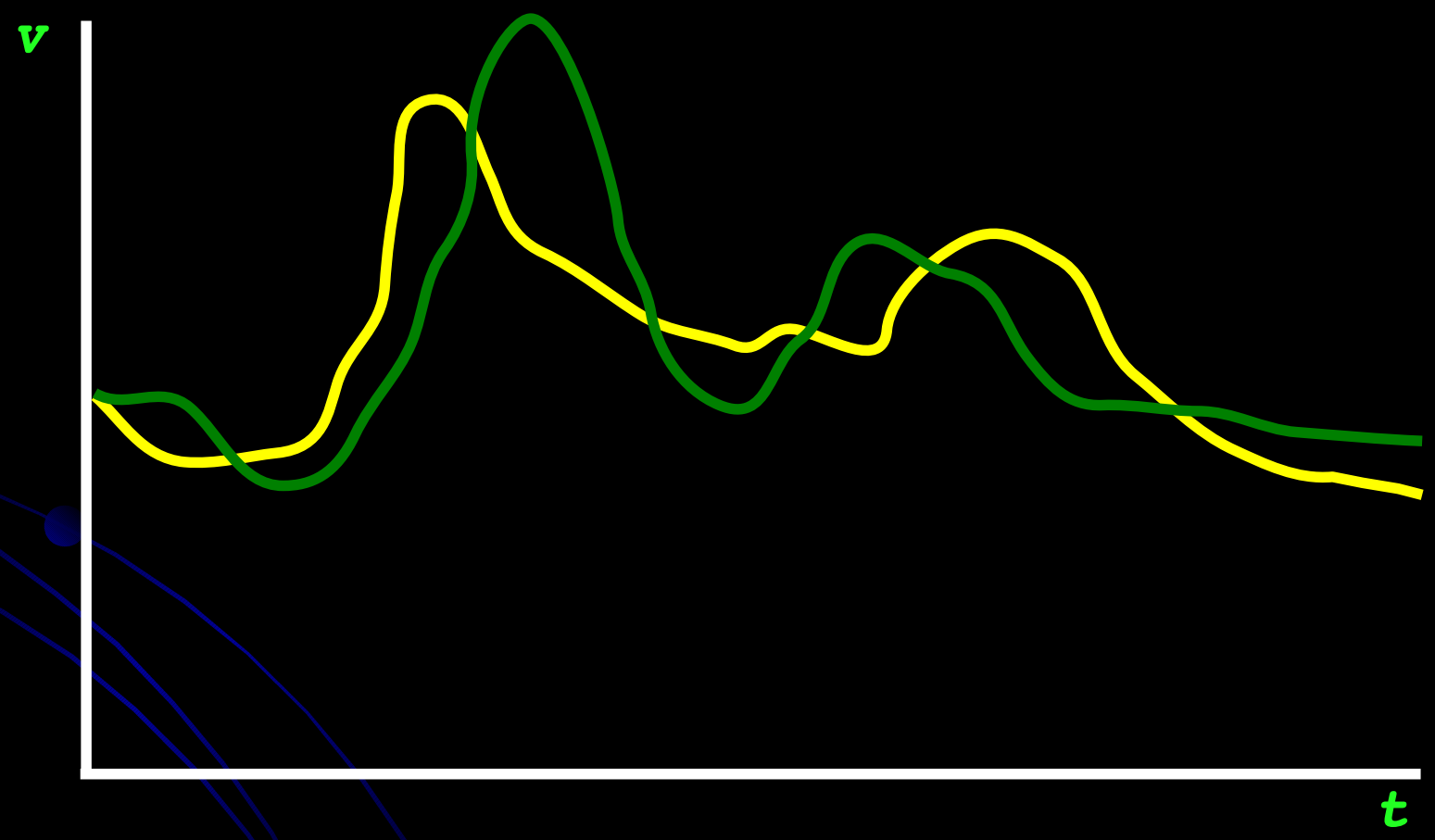

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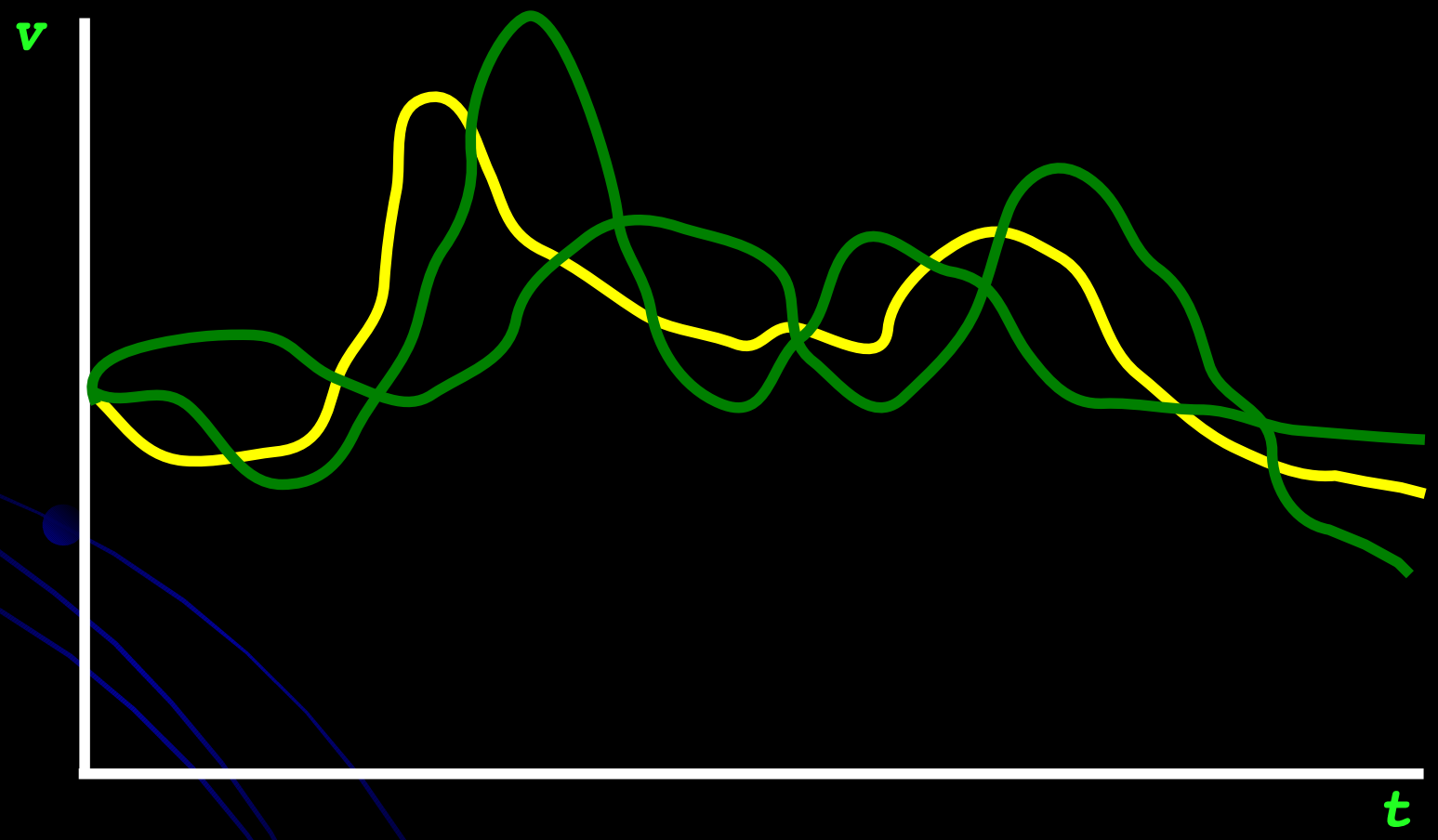

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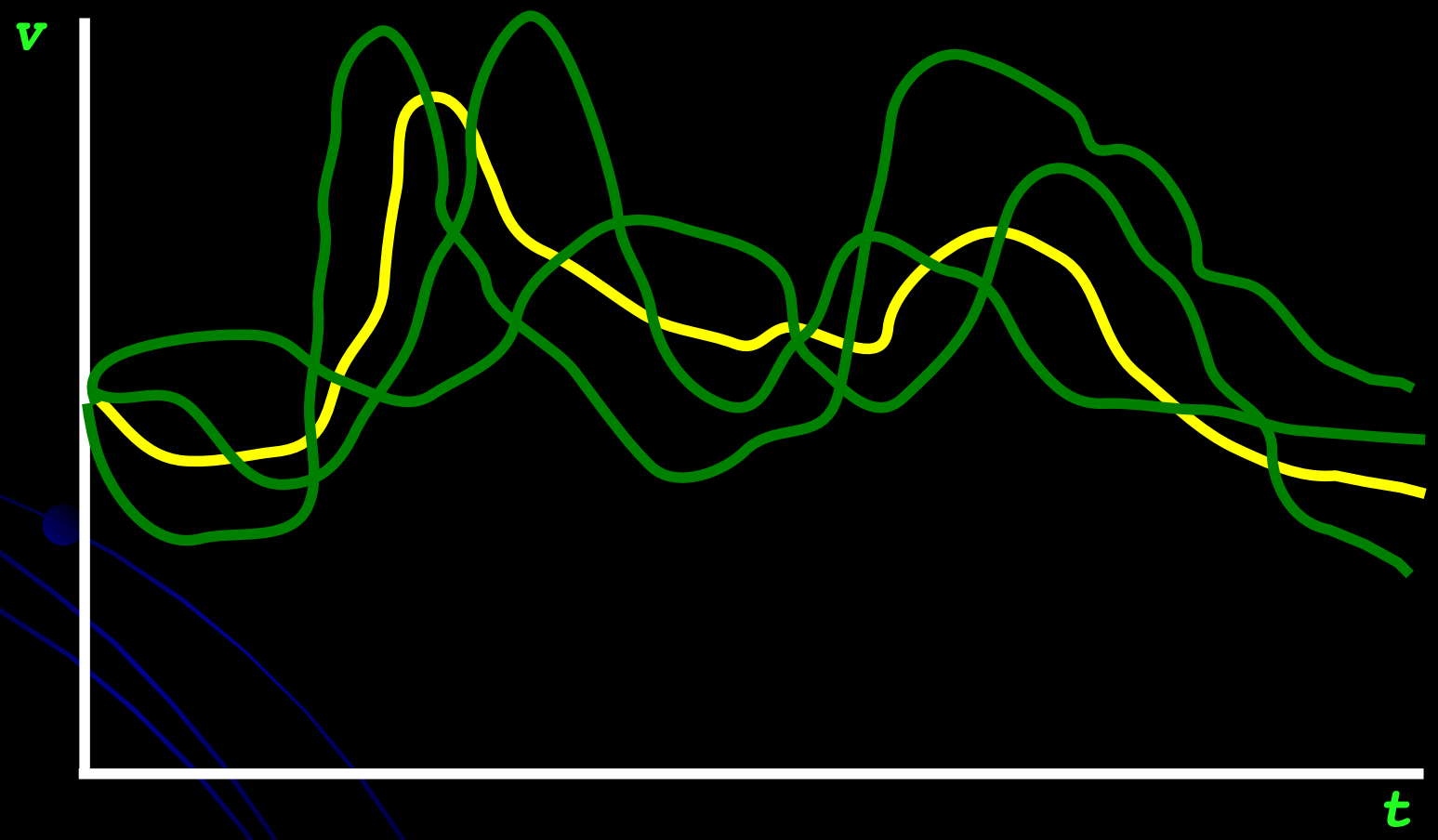

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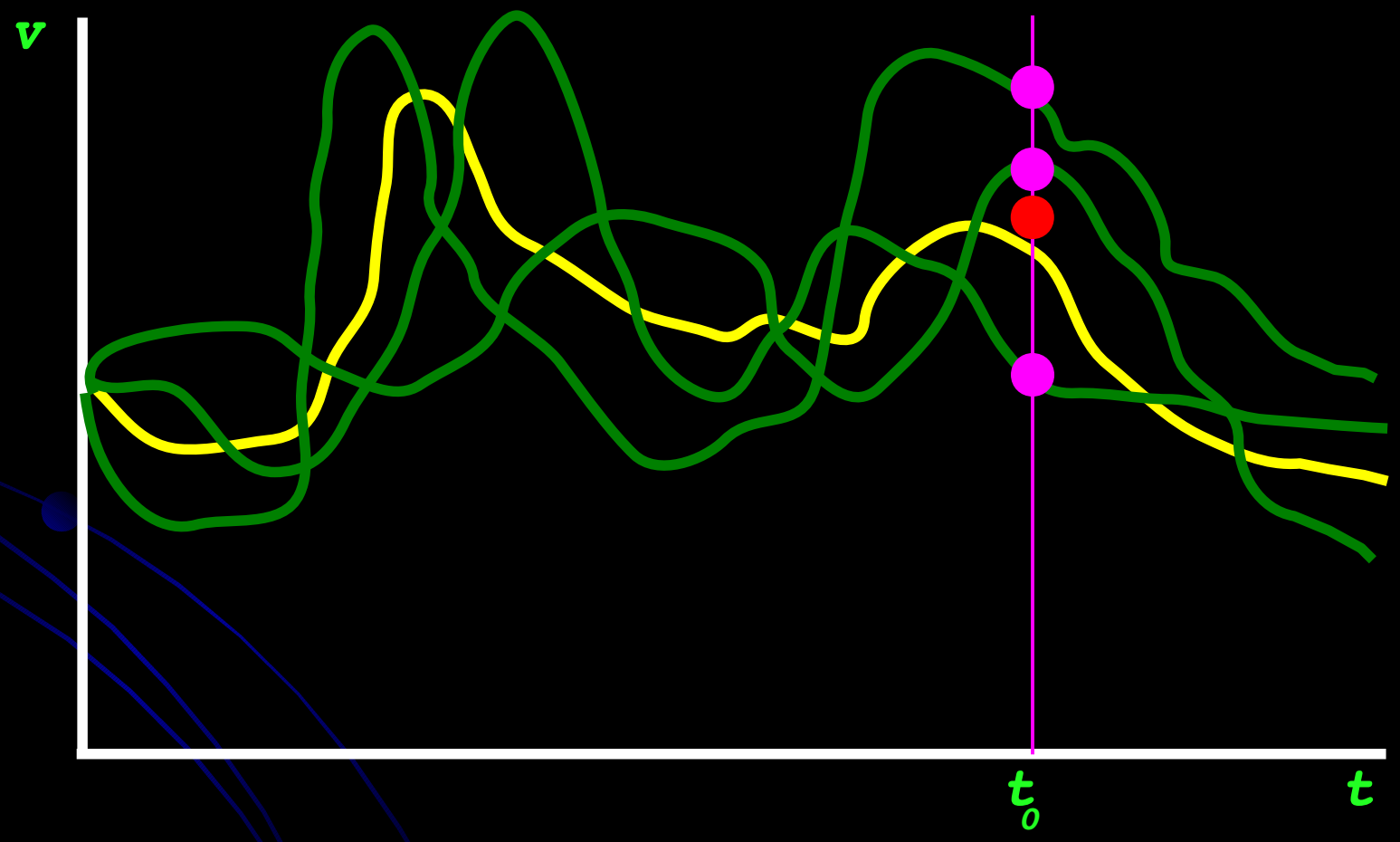

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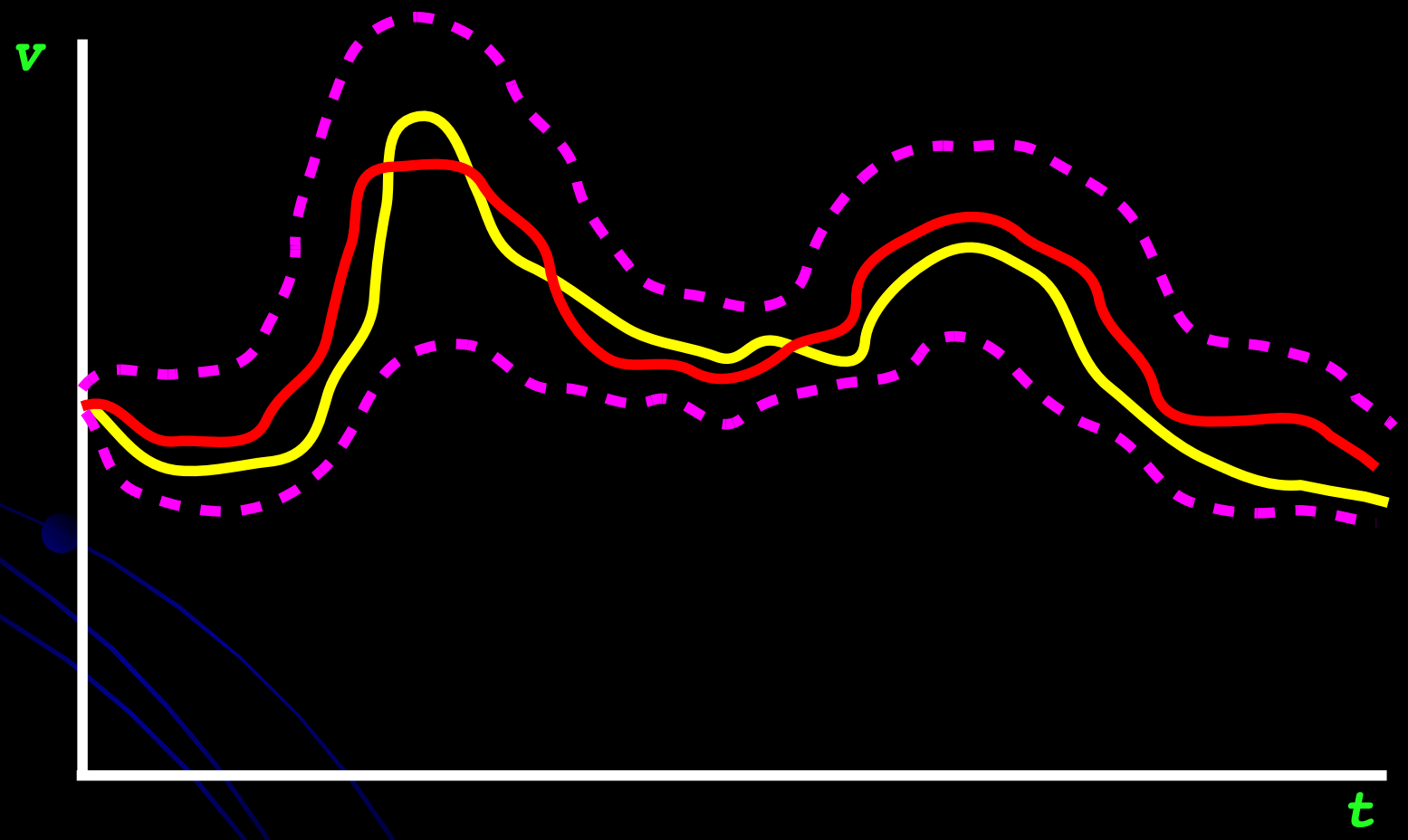
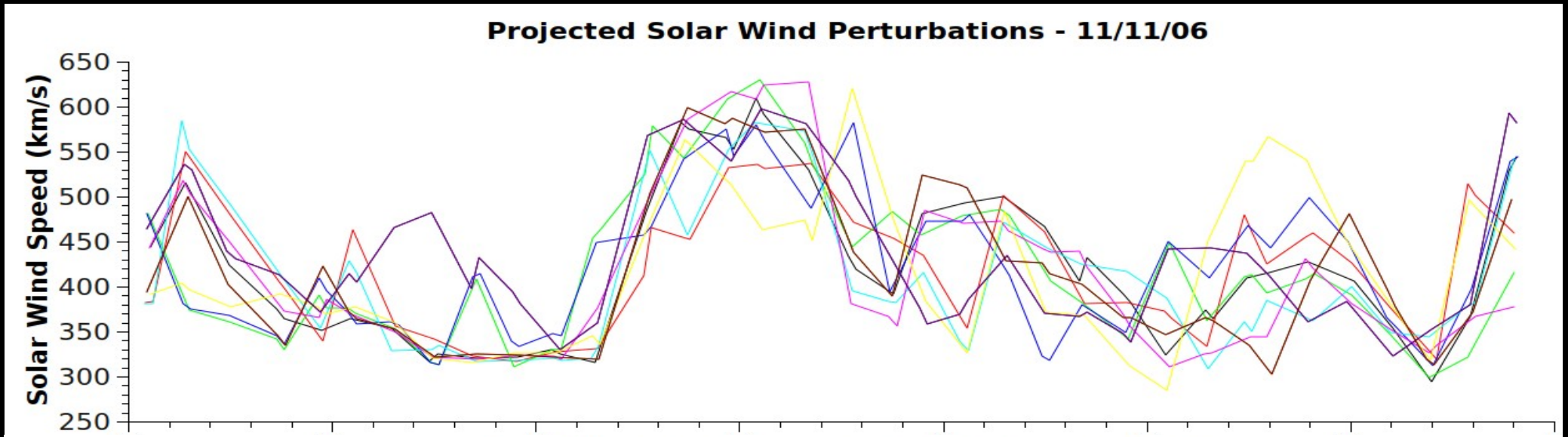
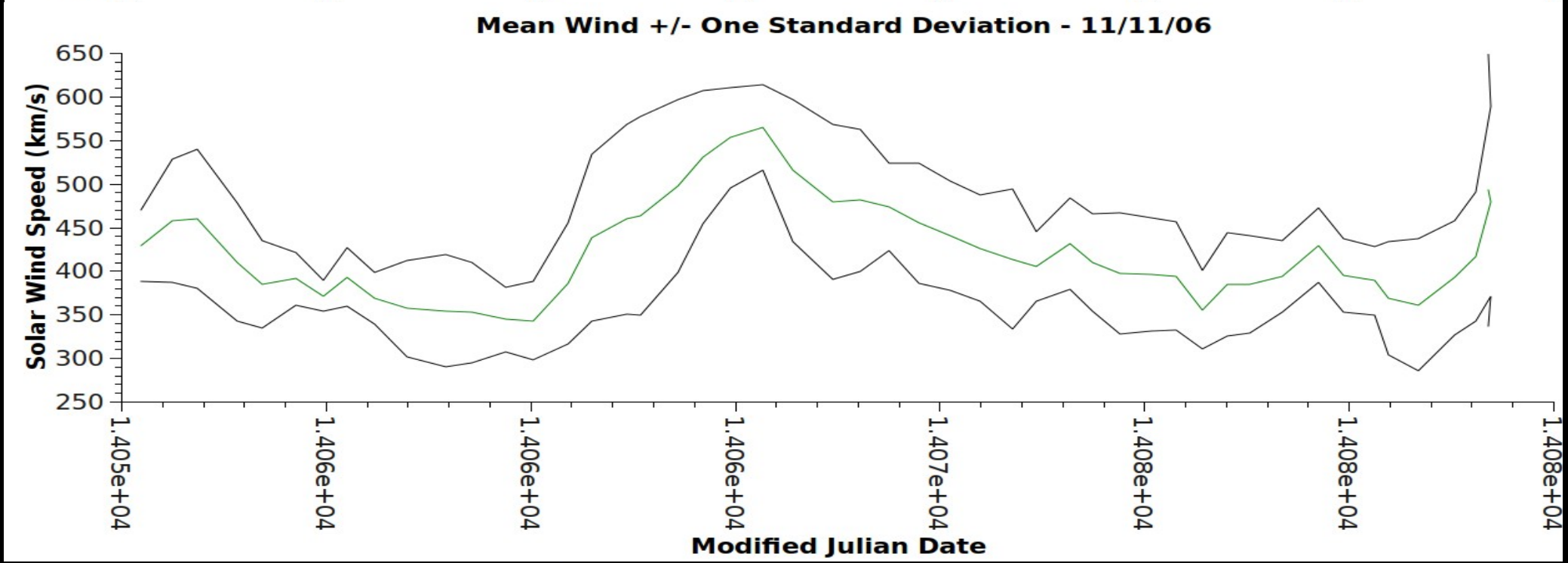


Results


Projected Solar Wind Perturbations - 11/11/06
Solar Wind Speed (km/s)
650
600
550
500
450
400
350
300
250


Mean Wind +/- One Standard Deviation - 11/11/06
Solar Wind Speed (km/s)
650
600
550
500
450
400
350
300
250
1.405e+04
1.406e+04
1.406e+04
1.406e+04
1.407e+04
1.408e+04
1.408e+04
1.408e+04
Modified Julian Date

Future Work

- Compare model results with observations
- Determine model covariance matrix
- Determine covariance matrix for observed data
- Produce a Bayesian weather model