

The Correlation Between Curvature of Novae Magnitude and Location of the Novae

Robert Sullenger & Tri Nguyen
Deer Valley High School, Antioch, CA
Teacher: Jeff Adkins

Abstract

The main purpose of this experiment was to find a correlation between the location of novae and their magnitude in M31 the Andromeda Galaxy. It was believed that the magnitude of the novae inside M31 the Andromeda Galaxy; Epochs 6, 7, 10, & 11; would have a correlation compared to the novae on the outside of M31 the Andromeda Galaxy; Epochs 1-5, 8, 9, & 12-16.

Purpose

The question to be addressed in this research is to determine if there is a correlation between the locations of the Novae in M31, Andromeda galaxy, whether novae in the center of the galaxy have a different curvature in their magnitude apposed to those on the outside of the galaxy.

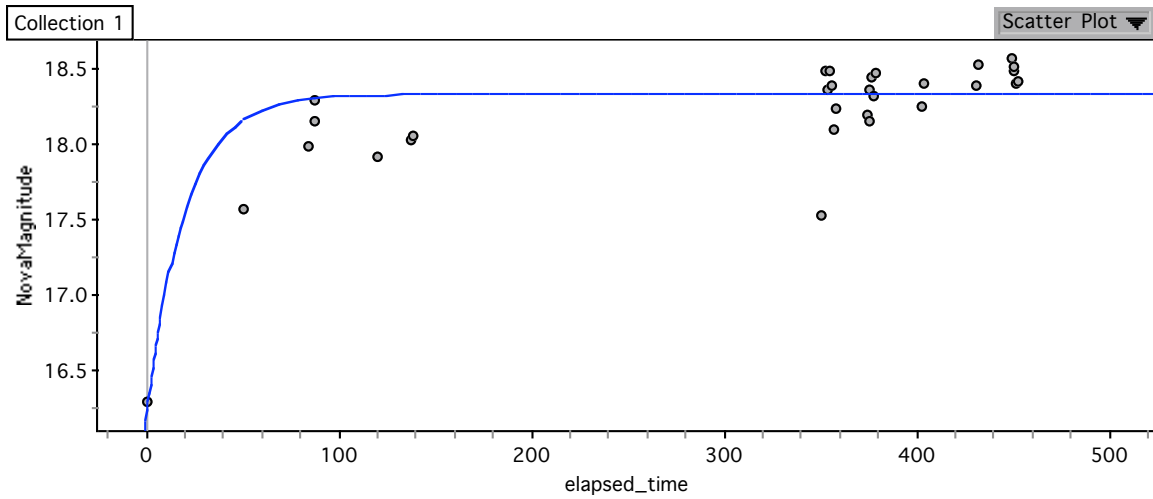
Procedure

Mr. Adkins's 2nd, 4th, and 6th period classes provided the data that was used. They graphed the novae; magnitude vs. elapsed time. Using their findings, a new graph was plotted of curvature vs. elapsed time over the already existing data. To make data and graphs more consistent, data of novae that appeared in three or more epochs were only used.

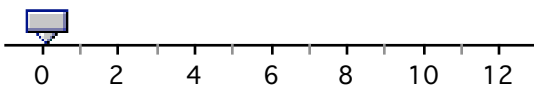
After graphing the curvature, the three variables were adjusted to make the curvature match the data of magnitude vs. elapsed time. These variables are: constant, coefficient, and shift up. Shift up moves the curve of the graph up or down, the coefficient determines how much the graph curves, and the constant determines the magnitude of the curve. After adjusting the curvature to the existing data, the first and second derivatives are used to calculate kappa, which is equation of the curvature.

Data

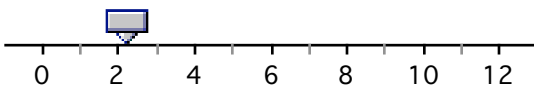
Field 2 Epochs 31-61



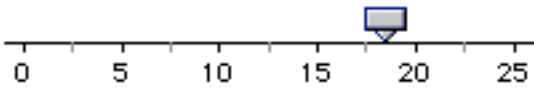
coeff = 0.05



const = 2.15



shiftup = 18.3



$$B = Ce^{-kt}$$

$$\text{First Derivative: } B' = -kCe^{-kt}$$

$$\text{Second Derivative: } B'' = k^2Ce^{-kt}$$

$$\text{Kappa: Max K: } K = \frac{\text{second}}{(1+(\text{first})^2)^{1.5}}$$

Collection 1

	epoch	date	elapsed...	NovaName	RAh	RAm	RA s	DECdeg	DECmin	DECsec	x	y	NovaMag...	standards	discover...	first	second	kappa	<new>
1	31	6/25/02	0	smiles	0	41	51.00	41	24	12.5	398.0	312.00	16.29	28,26	C & C	-0.1075	0.005375	0.00528316	
2	32	7/21/02	26	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	error on p...			-0.0292972	0.00146486	0.00146297	
3	33	8/14/02	50	smiles	0	42	50.91	41	24	12.4	399.9	313.20	17.56	27,26	C & C	-0.00882...	0.000441...	0.000441...	
4	34	9/17/02	84	smiles	0	42	50.90	41	24	12.3	400.2	313.20	17.99	27,26	C & C	-0.00161...	8.06012e...	8.06009e...	
5	35	9/20/02	87	smiles	0	42	50.93	41	24	13.2	400.0	311.00	18.15	27,26	C & C	-0.00138...	6.93741e...	6.93739e...	
6	36	9/21/02	88	smiles	0	42	50.88	41	24	12.5	401.1	312.20	18.29	27,26	C & C	-0.00131...	6.59907e...	6.59905e...	
7	37	10/23/02	120	Smiles	0	42	50.91	41	24	12.5	400.1	313.00	17.92	28,26	C & C	-0.00026...	1.33233e...	1.33233e...	
8	38	11/10/02	138	Smiles	0	42	50.90	41	24	12.3	400.3	312.70	18.03	27,26	C & C	-0.00010...	5.41685e...	5.41685e...	
9	39	11/11/02	139	Smiles	0	42	50.90	41	24	12.5	400.2	312.30	18.06	27,26	C & C	-0.00010...	5.15266e...	5.15266e...	
10	40	6/11/03	351	Smiles	0	42	50.28	41	23	49.8	410.4	345.40	17.53	27,26	C & C	-2.56768e...	1.28384e...	1.28384e...	
11	41	6/13/03	353	Smiles	0	42	50.91	41	24	12.6	399.9	312.10	18.48	27,26	C & C	-2.32333e...	1.16166e...	1.16166e...	
12	42	6/14/03	354	Smiles	0	42	50.91	41	24	12.6	399.9	312.10	18.36	27,28	C & C	-2.21002e...	1.10501e...	1.10501e...	
13	43	6/15/03	355	Smiles	0	42	50.89	41	24	12.5	400.1	312.20	18.48	27,28	C & C	-2.10224e...	1.05112e...	1.05112e...	
14	44	6/16/03	356	Smiles	0	42	50.92	41	24	12.6	399.8	312.00	18.39	27,26	C & C	-1.99971e...	9.99854e...	9.99854e...	
15	45	6/17/03	357	Smiles	0	42	50.96	41	24	12.5	399.2	312.30	18.10	27,28	C & C	-1.90218e...	9.51091e...	9.51091e...	
16	46	6/18/03	358	Smiles	0	42	50.94	41	24	12.6	399.5	312.10	18.23	27,26	C & C	-1.80941e...	9.04706e...	9.04706e...	
17	47	7/4/03	374	Smiles	0	42	50.95	41	24	12.6	399.5	312.30	18.19	27,28	C & C	-8.13021e...	4.0651e-11	4.0651e-11	
18	48	7/5/03	375	Smiles	0	42	50.97	41	24	12.6	399.2	312.20	18.15	27,28	C & C	-7.7369e...	3.86685e...	3.86685e...	
19	49	7/6/03	376	Smiles	0	42	50.95	41	24	12.5	399.4	312.20	18.36	27,28	C & C	-7.35652e...	3.67826e...	3.67826e...	
20	50	7/7/03	377	Smiles	0	42	50.96	41	24	12.6	399.1	312.10	18.44	27,28	C & C	-6.99773e...	3.49887e...	3.49887e...	
21	51	7/8/03	378	Smiles	0	42	50.97	41	24	12.5	399.2	312.30	18.32	27,28	C & C	-6.65645e...	3.32823e...	3.32823e...	
22	52	7/9/03	379	Smiles	0	42	50.96	41	24	12.6	399.2	312.30	18.47	27,28	C & C	-6.33181e...	3.16591e...	3.16591e...	
23	53	8/2/03	403	Smiles	0	42	50.85	41	24	12.3	400.3	312.10	18.25	27,28	C & C	-1.90711e...	9.53553e...	9.53553e...	
24	54	8/3/03	404	Smiles	0	42	50.82	41	24	12.5	400.8	312.10	18.40	27,28	C & C	-1.81409e...	9.07047e...	9.07047e...	
25	55	8/30/03	431	Smiles	0	42	50.89	41	24	12.1	399.7	312.40	18.39	27,28	C & C	-4.70286e...	2.35143e...	2.35143e...	
26	56	8/31/03	432	Smiles	0	42	50.89	41	24	12.3	399.7	312.20	18.53	27,28	C & C	-4.4735e...	2.23675e...	2.23675e...	
27	57	9/17/03	449	Smiles	0	42	50.89	41	24	12.4	400.1	312.00	18.57	27,28	C & C	-1.91204e...	9.56021e...	9.56021e...	
28	58	9/18/03	450	Smiles	0	42	50.89	41	24	12.4	399.8	312.00	18.48	27,28	C & C	-1.81879e...	9.09395e...	9.09395e...	
29	59	9/19/03	451	Smiles	0	42	50.89	41	24	12.5	399.8	311.90	18.51	27,28	C & C	-1.73009e...	8.65043e...	8.65043e...	
30	60	9/20/03	452	Smiles	0	42	50.89	41	24	12.4	399.7	311.90	18.40	27,28	C & C	-1.64571e...	8.22855e...	8.22855e...	
31	61	9/21/03	453	Smiles	0	42	50.88	41	24	12.4	399.9	311.90	18.42	27,28	C & C	-1.56545e...	7.82724e...	7.82724e...	

	Inside Max Kappa	Outside Max Kappa
Highest	0.0661292	0.198166
Average	0.035893	0.030369
Lowest	0.00511676	0.00528316

Inside refers to fields that are on the inside of M31, Andromeda galaxy; fields 6, 7, 10, and 11. Outside refers to fields that are on the outside of M31, Andromeda galaxy; fields 1-5, 8, 9, and 12-16.

Analysis

The data was developed using FathomX 2a. The max kappa of each field was recorded and the highest and lowest max kappa was determined along with calculating the average max kappa for the inner and exterior fields of M31, Andromeda galaxy.

If someone were to recreate this experiment, it is advised that more novae field and epoch data is used to improve the results. The experiment could also be expanded to other galaxies, not just M31 the Andromeda Galaxy, to discover if this correlation is present in other galaxies.

Conclusion

After interpreting the data, there is no correlation found between the locations of the novae in the center of the galaxy and the outside compared to the magnitude of the novae. The average values for the inside (0.035893) and outside (0.030369) kappa of the galaxy are similar so there was no relationship between the edge of the outside and internal area of the Andromeda galaxy.