



# Department of Physics Research Experience for Undergraduates

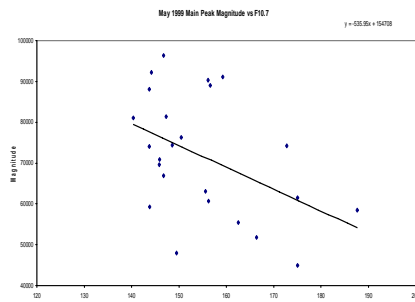
## Analysis of the Mars Global Surveyor Radial Occultation Data:

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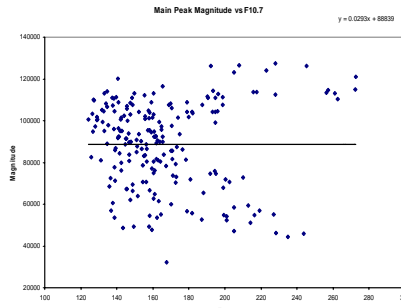
**Introduction:** The Mars Global Surveyor which was launched on November 7, 1996 was designed to orbit Mars over a two year period and collect data on the surface morphology, topography, composition, gravity, atmospheric dynamics, and magnetic field. This data will be used to investigate the surface processes, geology, distribution of material, internal properties, evolution of the magnetic field, and the weather and climate of Mars. The instruments on the nadir equipment deck consist of a camera, thermal emission spectrometer, laser altimeter, and a radio transmission relay. The main instrument that we were interested in was the radio transmission relay. The Radio Science Investigations on Mars Global Surveyor had two distinct objectives. The first was to map the planet's gravitational field and the second was to measure the atmospheric pressure and temperature in the polar regions. From the Radio Science Investigations the electron density profiles were generated allowing us to analyze that data that we have obtained this summer.



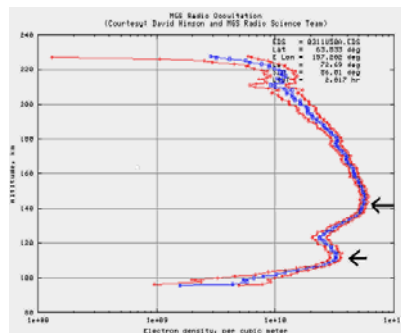
**Analysis:** Different types of data that have been obtained throughout the project



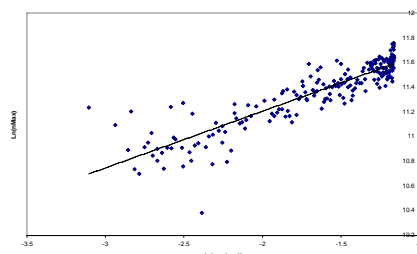
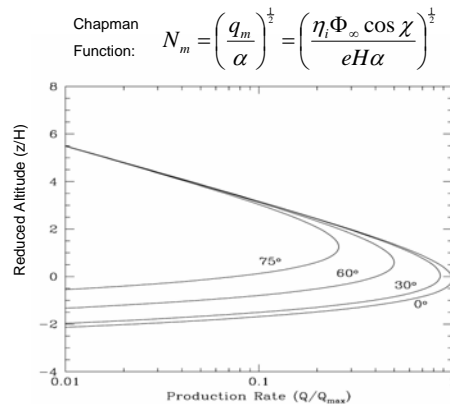
**Southern Hemisphere:** Due to some differences in the northern and southern hemispheres we have noticed that the data results do not come out as we would have expected them to. This is due to the differences in magnetic fields between the two hemispheres.



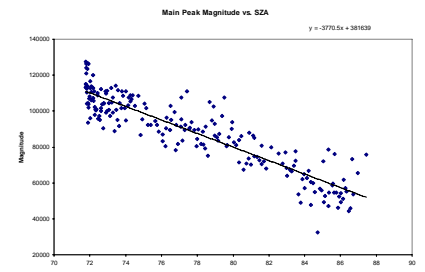
One goal of the project is to determine that as the upper peak magnitude increase, the F10.7 value also increases. The F10.7 is an index of solar activity in the ultra violet part of the light spectrum. The UV rays ionize the atmosphere and causes the formation of the upper peak in the data.



**Electron Density profiles:** Most of the data was obtained from graphs such as this. Each graph provides information about the upper and lower peaks, including their altitude and magnitude, along with the solar zenith angle for each day. The upper peak is formed when the UV rays ionize the atmosphere, and the lower peak is created when the x-ray part of the spectrum penetrates deeper into the atmosphere.



Day	M. Peak Mag	M. Peak Alt	L. Peak Mag	L. Peak Alt	SA	OST	days leading or lag
11/1/2000	45876	143.074	24625	112.305	86.57	115.742	8.72298
11/2/2000	44407	144.838	18167	116.261	86.46	4	8.68068
11/3/2000	55070	145.378	21405	112.522	86.34	115.719	8.63835
11/4/2000	57032	135.721	16929	117.632	86.26	2	8.59599
11/5/2000	51218	144.555	26366	114.913	86.14	114.049	8.503925
11/6/2000	54212	143.352	19258	112.079	86.03	113.4621	8.511575
11/7/2000	53428	138.652	19669	118.485	85.91	112.9161	8.4697075
11/8/2000	46175	144.044	24017	113.145	85.86	112.3495	8.4262125
11/9/2000	54692	136.973	20207	111.252	85.76	111.7825	8.3836875
11/10/2000	59513	138.36	26355	118.175	85.59	111.2152	8.34114
11/11/2000	58550	145.456	26298	115.754	85.53	110.6474	8.298554
11/12/2000	54663	135.335	14069	116.084	85.35	110.0792	8.25594
11/13/2000	47980	138.778	14174	112.021	85.31	109.5106	8.213295
11/14/2000	52761	140.786	22156	117.421	85.12	108.9416	8.17062
11/15/2000	71906	133.852	20876	115.646	85.03	108.372	8.1279
11/16/2000	57742	138.229	24371	113.615	84.95	107.8021	8.0851975
11/17/2000	50759	138.196	30200	113.597	84.84	107.2318	8.042365
11/18/2000	32336	138.651	89016	111.86	84.72	106.6609	7.999575
11/19/2000	55061	135.621	16104	113.147	84.58	106.0996	7.95672
11/20/2000	59964	138.17	20078	113.583	84.47	105.5179	7.9138425
11/21/2000	47858	133.661	21410	111.024	84.36	104.9457	7.8709275
11/22/2000	66855	133.595	32909	115.37	84.23	104.3731	7.8279825
11/23/2000	62776	132.721	23873	111.154	84.11	103.8002	7.785015
11/24/2000	65009	139.06	26717	115.575	83.98	103.2227	7.742025
11/25/2000	62158	139.532	23722	118.21	83.87	102.6534	7.699005
11/26/2000	48833	131.983	24504	109.308	83.79	102.0796	7.65597
11/27/2000	53056	136.828	29251	114.305	83.64	101.5055	7.6129125
11/28/2000	77862	137.648	29265	114.064	83.5	100.9311	7.5698225
11/29/2000	69567	140.971	45272	119.688	83.41	100.3566	7.526745
11/30/2000	66513	142.053	27610	112.108	83.28	99.7819	7.4836425



The above graph is a representation of the Chapman function which is also represented in another form to the left. As the solar zenith angle increases the magnitude of the peak decreases which can be seen on both graphs.

**Conclusion:** This summer we have been able to help support the theory that as the magnitude of the main peak increases that the F10.7 index also increases. Early on we were having a hard time showing this because we were using the smallest occultation seasons which did not provide enough data points to give an accurate representation of what was really going on. Other than the early on difficulties our results typically reflected what we expected them to.