

1) The current model for gamma ray bursts (GRBs) assumes that internal shocks are responsible for the emission of  $\gamma$ -rays. Internal shocks occur when the fast expanding shell collides with slowly expanding shells. The light curve of a GRB depends on the initial state and the expanding speed of the photosphere. This research focuses on examine the photon scattering process when and after the shells collide. Using Monte Carlo Methods and computer simulations, we exam two different models of GRB with different parameters for the models. The results for the non-expanding centered photon model shows that changing the radius of the photosphere for cases with the same opacity and changing the opacity for cases with opacity  $> 100$  do not change the observed light curve. For the non-expanding uniformly distributed photon model, cases with the same opacity but different radius produce the same observed light curve. However, cases with different opacity do not produce the same observed light curve. Lastly, we simulate the expanding centered photon model at different velocities and compare the results with the data from GRB 7475. The goodness tests,  $\chi^2$ , with  $\alpha = 0.001$  show that null hypothesis can be rejected for the case with the expanding velocity of  $v=0.2c$ .

2) Timeline:

12/01/2013-12/05/2013:

- \* Met with Dr. Davide Lazzati and planned the project.

01/01/2014-09/01/2014

- \* Worked on the non-expanding models for GRB and began to write the thesis.

10/01/2014 - 03/01/2015:

- \* Completed the non-expanding models and began to work on the expanding model.

- \* Began to write the methods section and the results section for the thesis.

04/01/2015 - 06/03/2015:

- \* Completed the expanding model for GRB.

- \* Completed and submitted the final version of the thesis.

- \* Presented the project.