Investigations of hypervelocity impact flashes using commercially available recording equipment.

Tilo Hohenschläger | PH 700 – Project Presentation 28th March 2013

[1]commons.wikimedia.org/wiki/File:Dark_side_of_the_moon.jpg

Centre for Astrophysics and Planetary Science
CAPS

Overview

→ Introduction

→ Method

→ Results

→ Conclusion

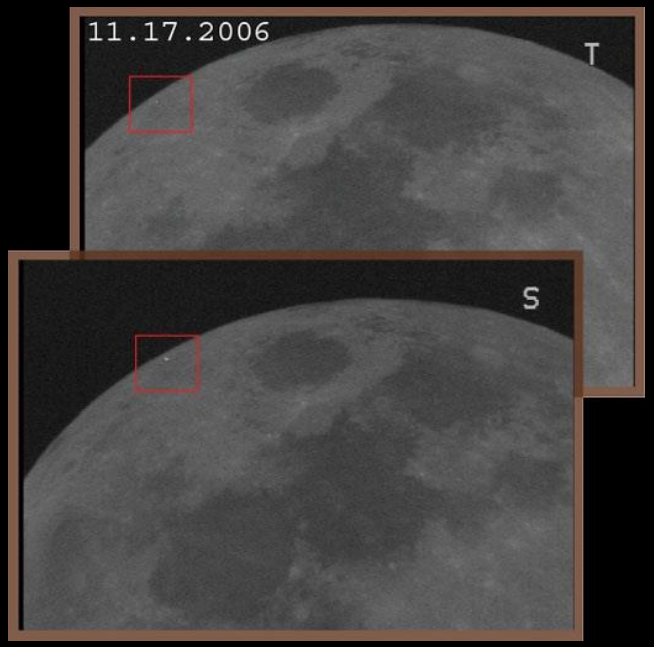
Introduction

→ Definition

- speed of impact exceeds speed of compression waves
- extreme transient densities and temperature
- melting, vapourisation → luminous phenomena

→ Motivation

- Database of impact videos, images and spectra
- Calibration Data
- Amateur astronomers



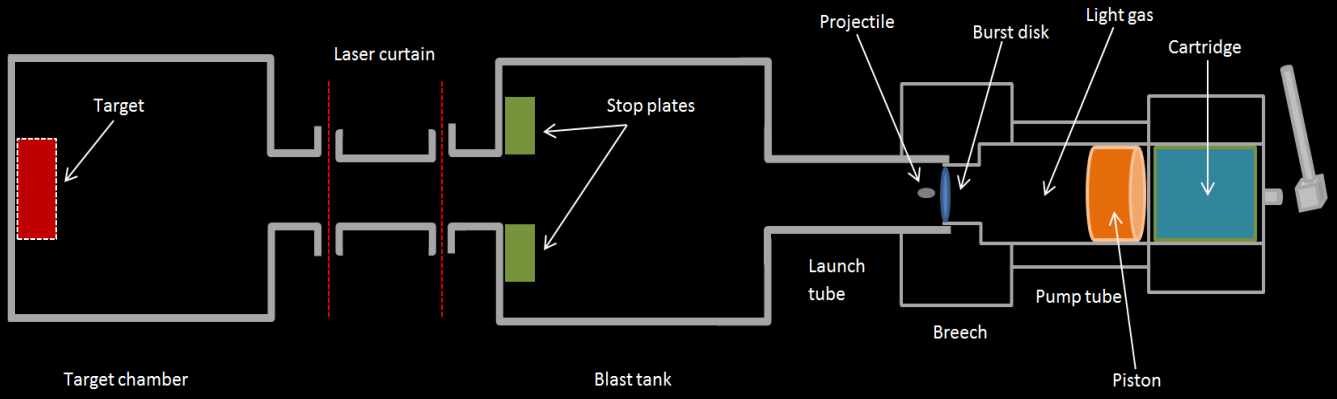
→ Review

- Friichtenicht (1965), Eichhorn (1975)
- Burchell, Cole, and Ratcliff (1996)
- Madiedo et al., Margonis et al. EPSC 2012

[2] http://www.nasa.gov/centers/marshall/news/lunar/photos.html

Method

→ Two stage light gas gun (LGG)

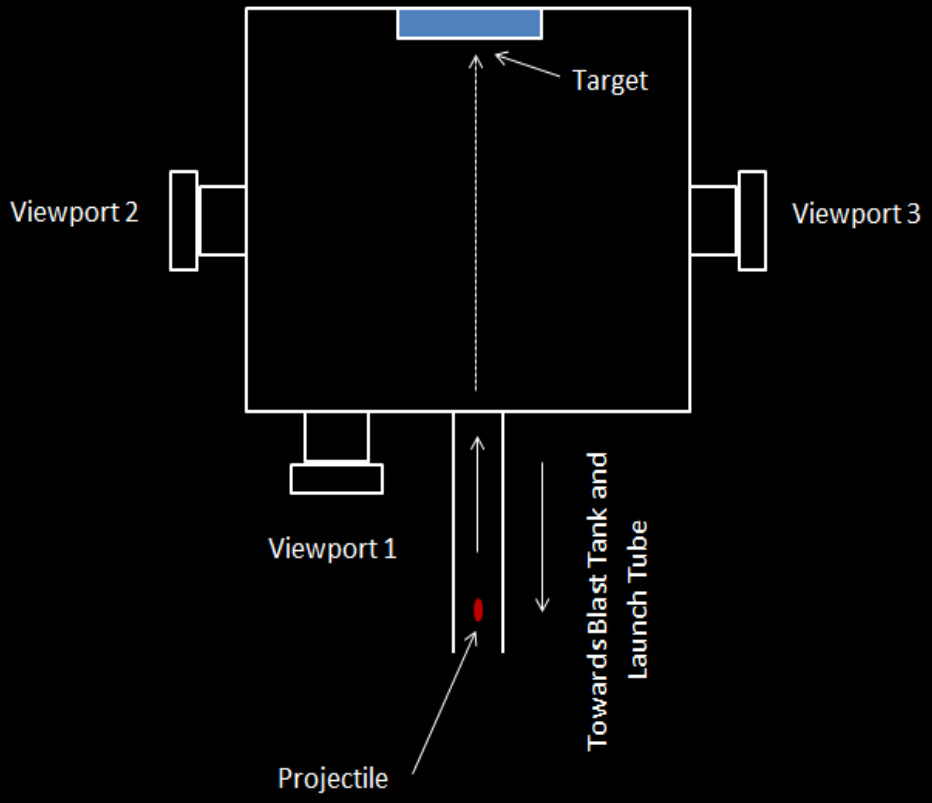


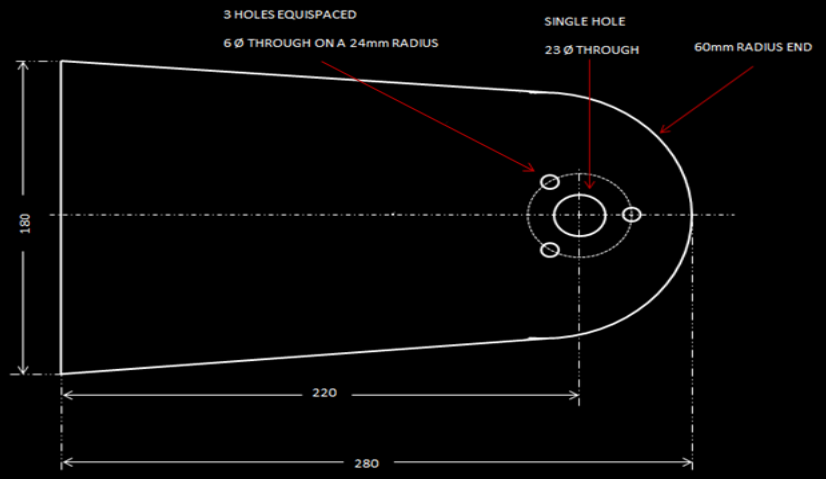
→ Digital Cameras and Spectrometer

[3&4] http://www.europe-nikon.com/en_GB/product/digital-cameras/slr/consumer; [5] http://www.oceanoptics.com/Products/usb650.asp

Method

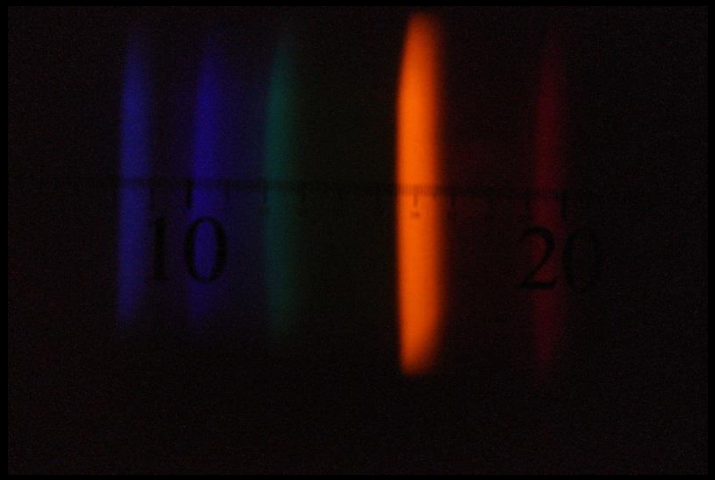
- Exposure $\approx \frac{1}{f^2} \cdot t \cdot iso \cdot mv^2$

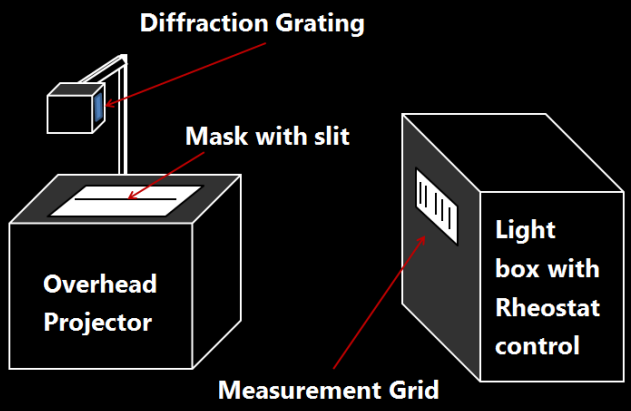




Method

→ Camera calibration

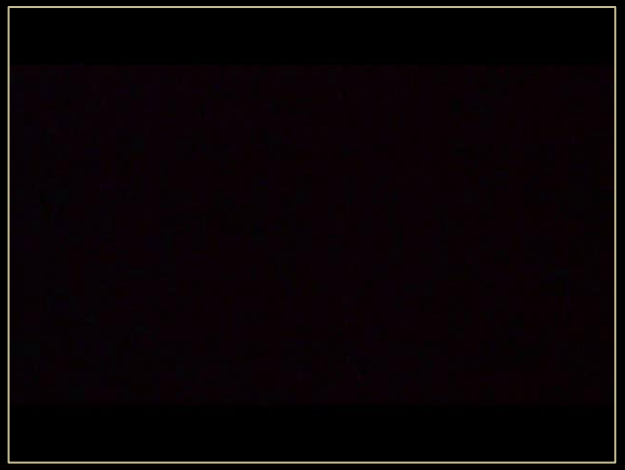


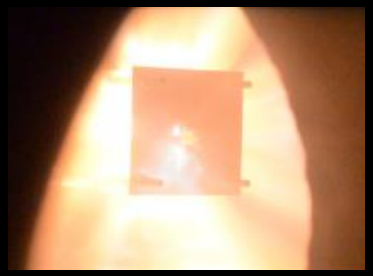
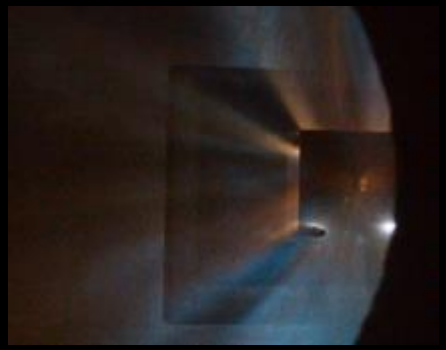
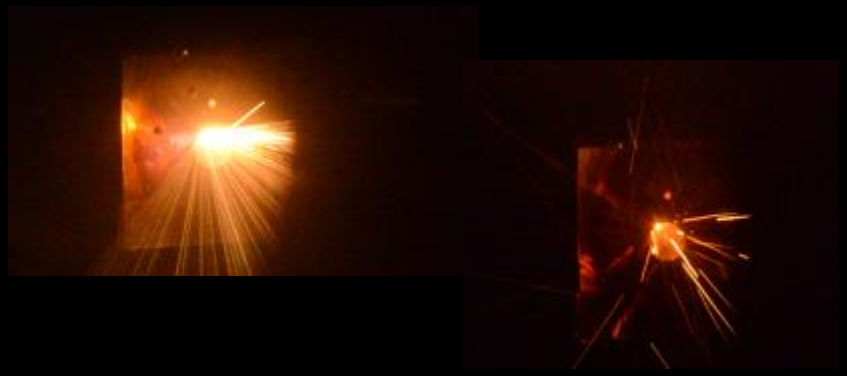


[6] www.sciencefirst.com/Spectroscope-Set-15.htm ; [7] Sadler PM. Projecting Spectra for Classroom Investigations. The Physics Teacher. 29(7). 1991. Pp. 423-427

Results

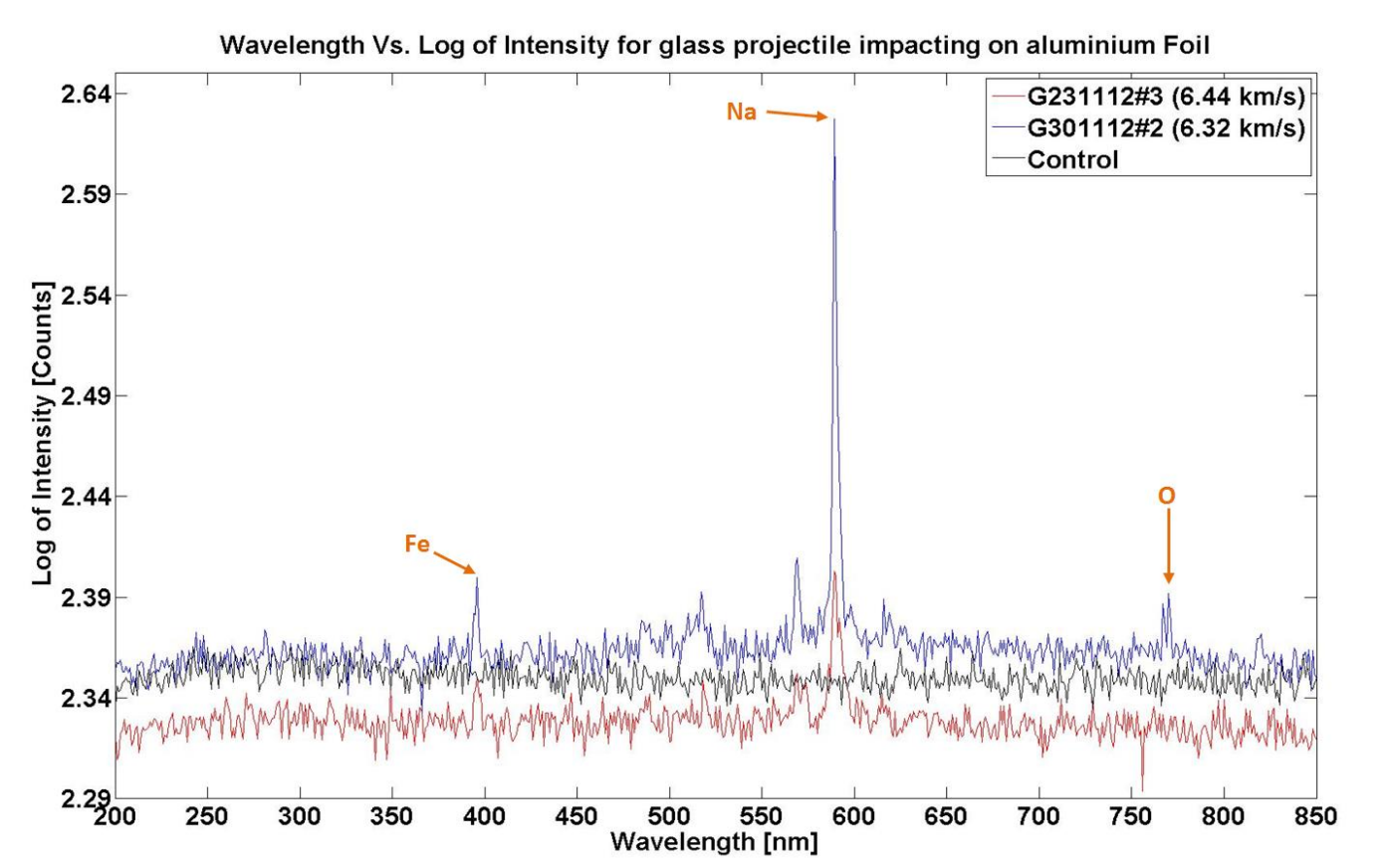
→ Impact flashes



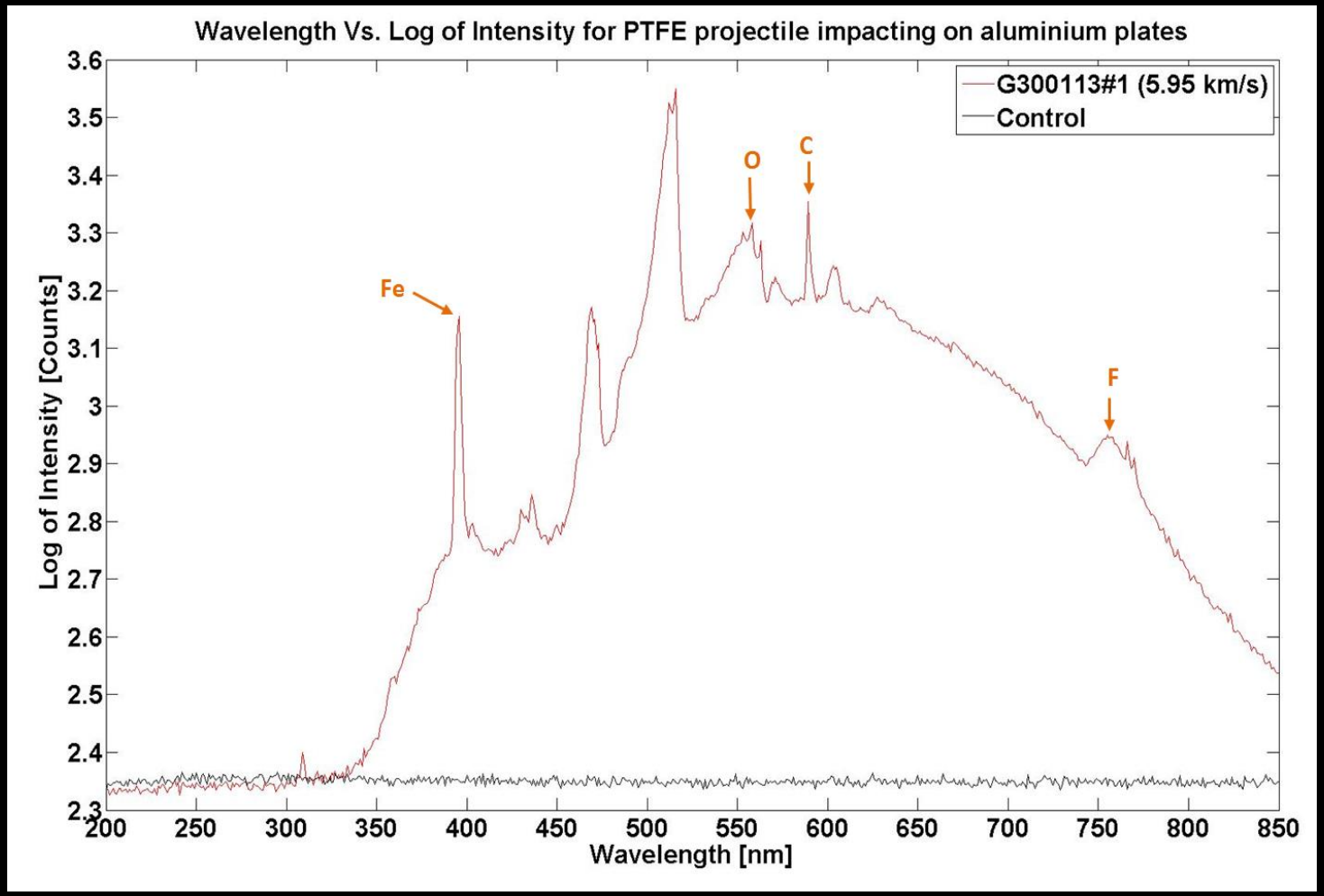




Results

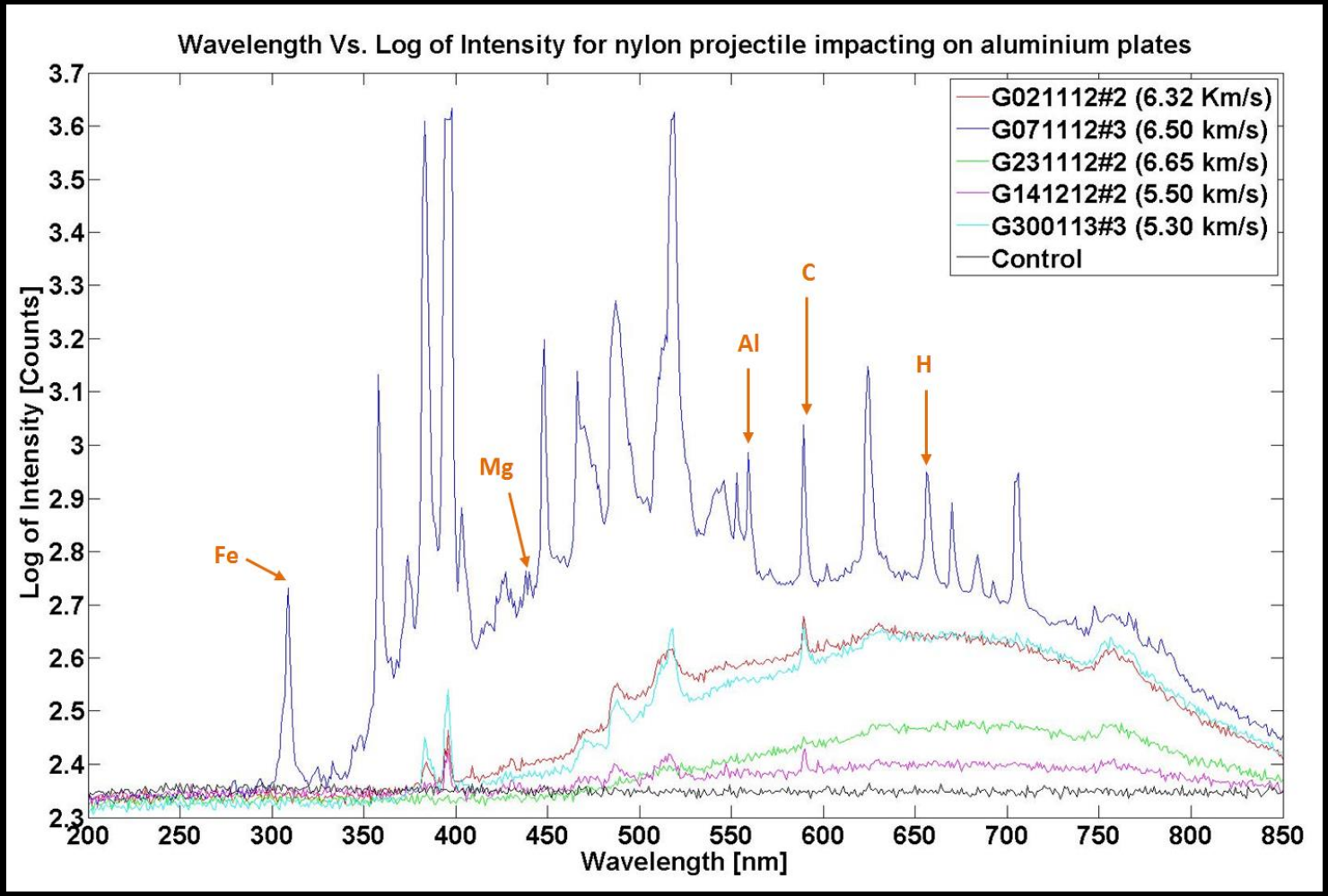
→ Impact spectra



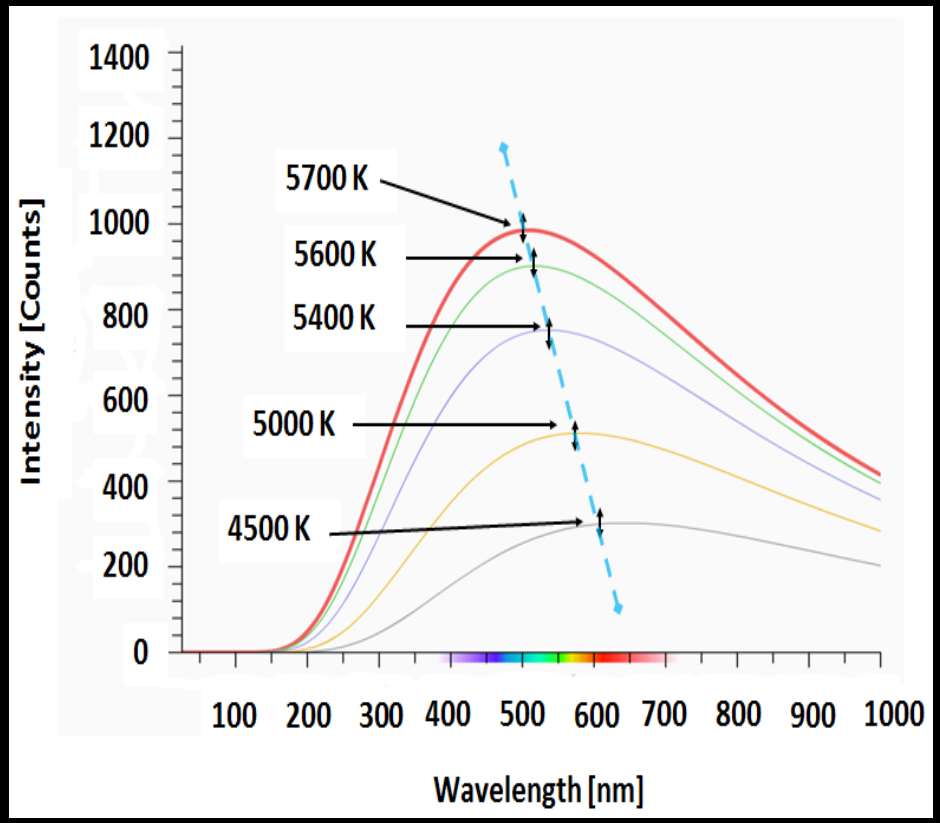
Results



Results


Wavelength Vs. Log of Intensity for nylon projectile impacting on aluminium plates
G021112#2 (6.32 Km/s)
G071112#3 (6.50 km/s)
G231112#2 (6.65 km/s)
G141212#2 (5.50 km/s)
G300113#3 (5.30 km/s)
Control
Fe
Mg
Al
C
H
Log of Intensity [Counts]
Wavelength [nm]
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
200
250
300
350
400
450
500
550
600
650
700
750
800
850

Conclusion



- **Wien's Law** $T = \frac{2.898 \cdot 10^{-3}\ m\ K}{\lambda_{max}}$

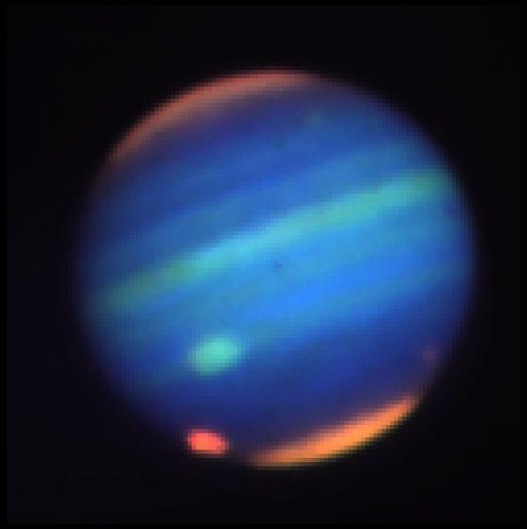
Shot ID	Wavelength (nm)	Temperature (K)
G021112#2	655±10	4424±69
G071112#3	506±10	5727±69
G231112#2	673±10	4306±69
G141212#2	646±10	4486±69
G300113#1	594±10	4878±69
G300113#3	658±10	4404±69

[8] http://astro.unl.edu/classaction/animations/light/bbexplorer.html

Conclusion

→ Future Work

- Sapphire viewport
- New spectrometer
- Basalt / Basalt
- extending Database
- Astronomical societies



[9] www.boulder.swri.edu

Thank you!

Dr Mark C. Price
Mr Mike J. Cole
Prof Mark J. Burchell

Dr Penelope J. Wozniakiewicz
Dr Dave M. Pickup
Dr Victoria Fitzgerald

Mr Ricky Hibbert
Mr Andy Morris
Mr Dina Pasini

Questions?