Monitoring Gaia Targets with the Faulkes Telescopes

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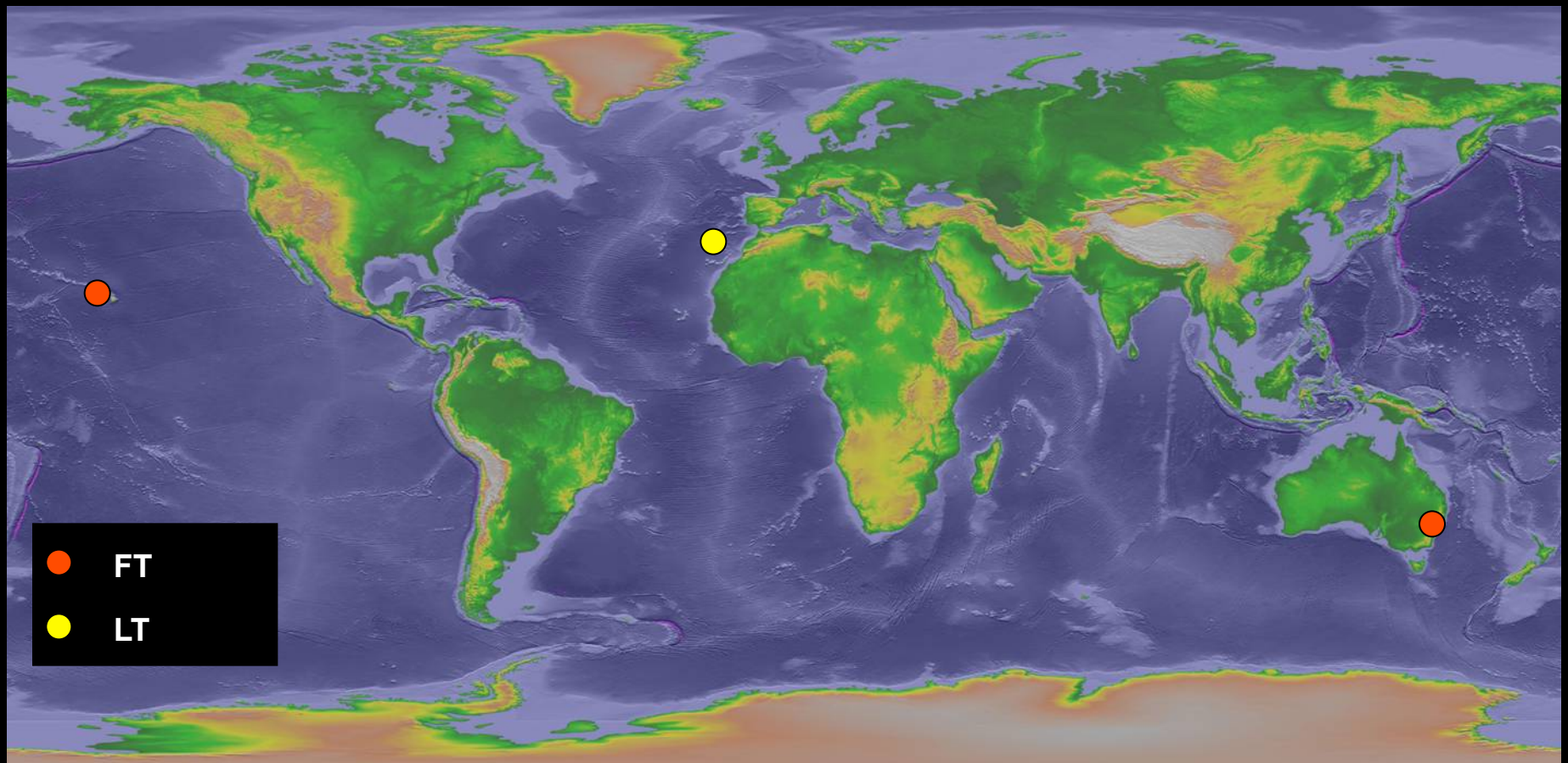
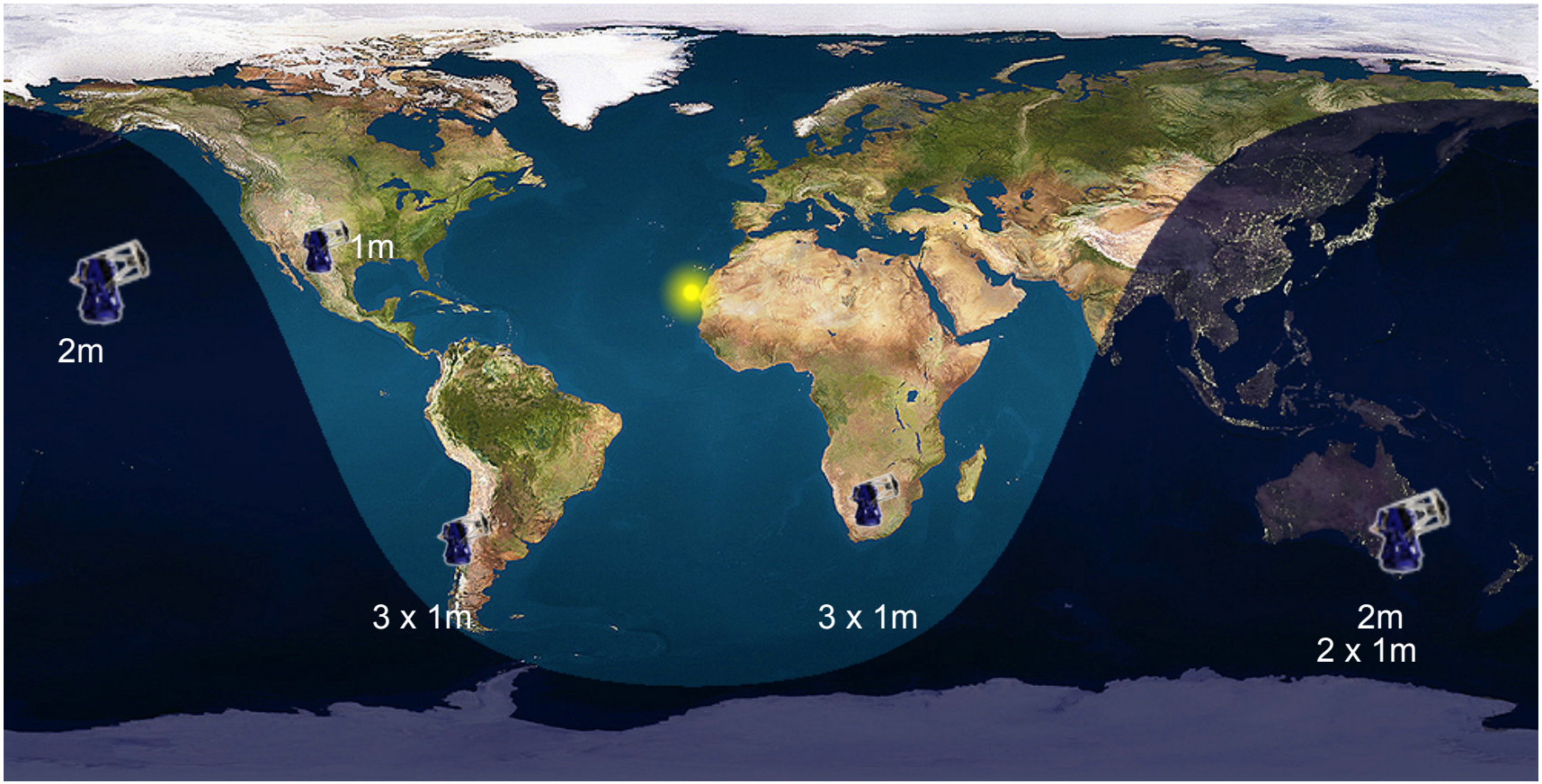
Faulkes Telescope Project
National Schools' Observatory
Liverpool John Moores University
The Open University

Robotic telescopes allow us to obtain images from (several) distant good quality sites

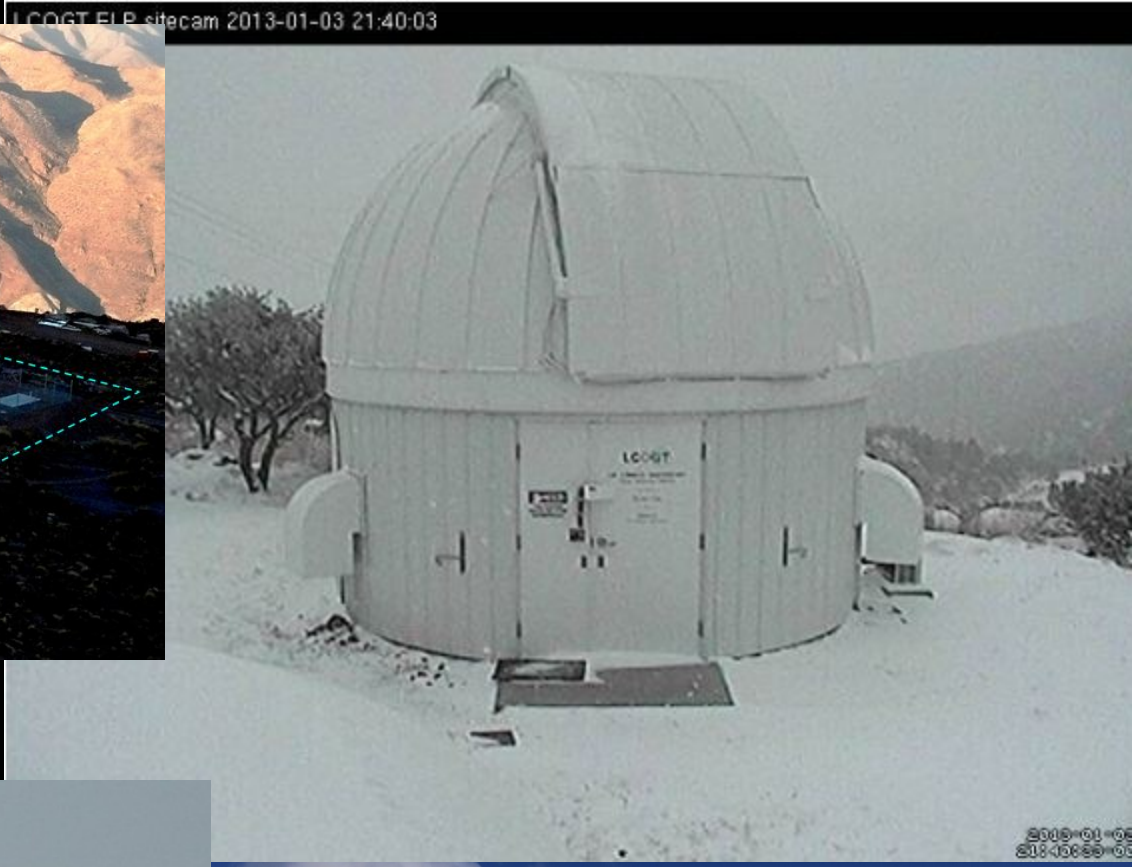
Only 3 * 2-metre telescopes that do this for education



Also 9 * 1-metre telescopes (5 more soon)



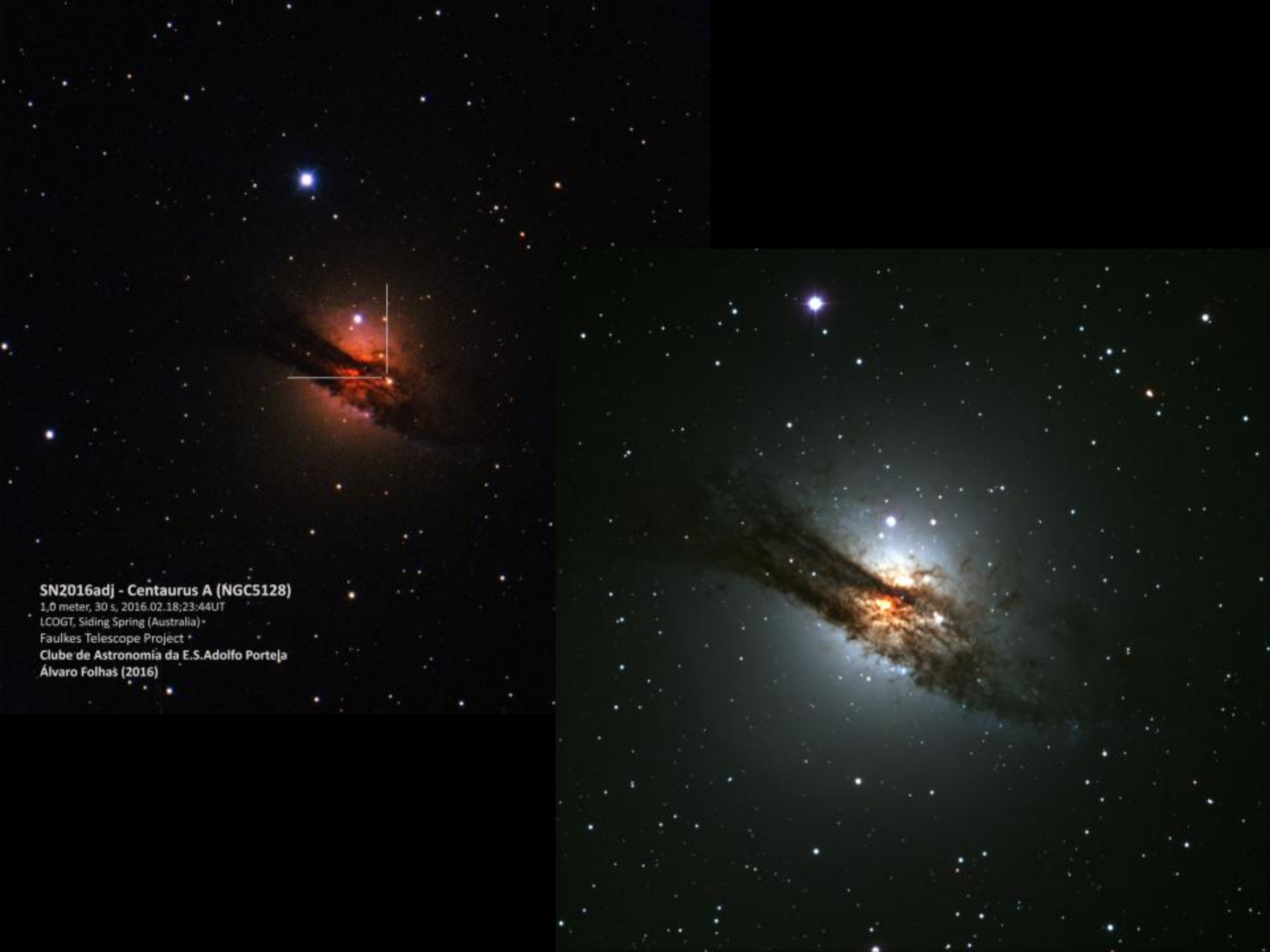
Las Cumbres Observatory


LCOGT FLP sitecam 2013-01-03 21:40:03
LCOGT


14/09/2012 12:40

Also 3 * 0.4 metres

Hawaii, Australia and Tenerife


SN2016adj - Centaurus A (NGC5128)
1,0 meter, 30 s, 2016.02.18;23:44UT
LCOGT, Siding Spring (Australia)
Faulkes Telescope Project
Clube de Astronomia da E.S.Adolfo Portela
Álvaro Folhas (2016)

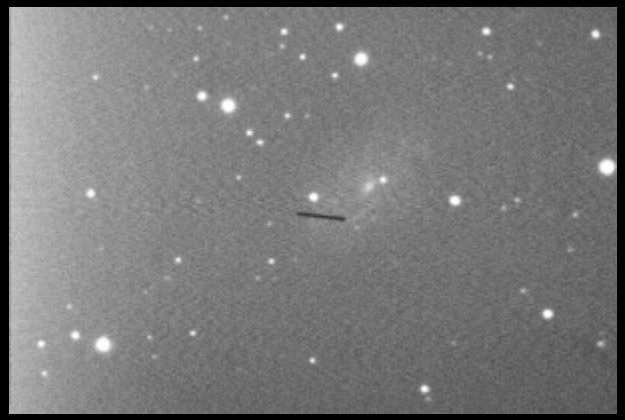
Astronomy is easy to inspire people with

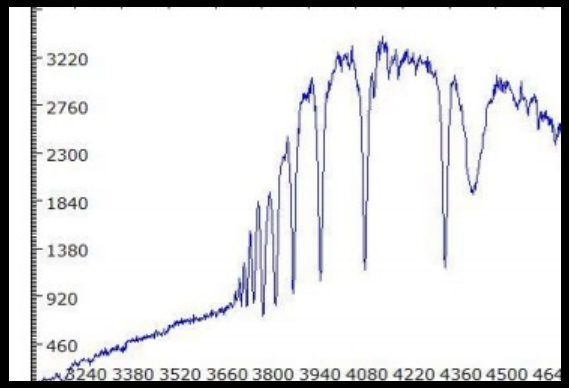
But it's usually a small part of the school curriculum

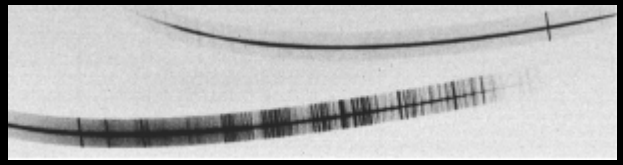
So we need to introduce maths, IT, chemistry, biology … and we encourage schools to collaborate, especially internationally

FLOYDS Spectrograph

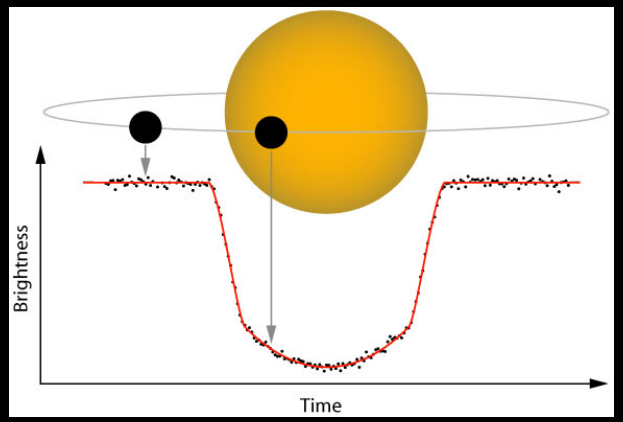
Both 2-metre telescopes have a low-resolution spectrograph so as well as imaging objects, spectra can be taken (320 – 1000 nm; R 400 – 700)

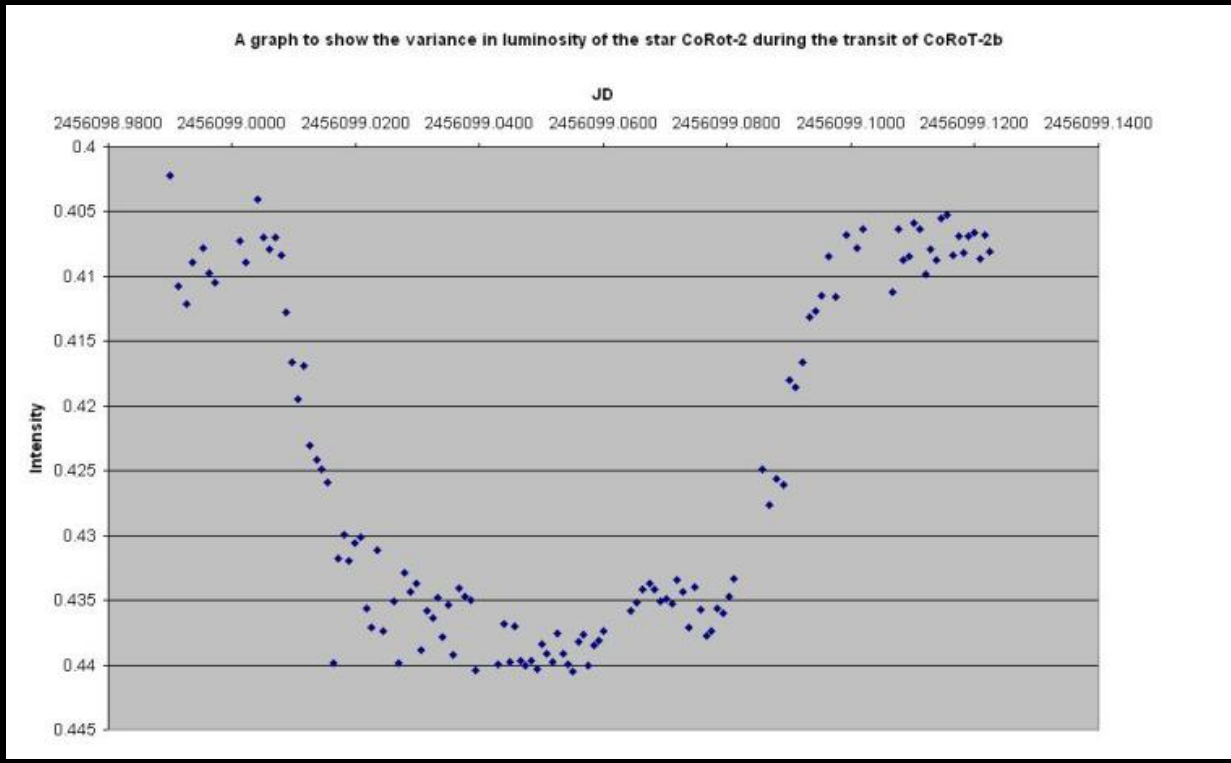




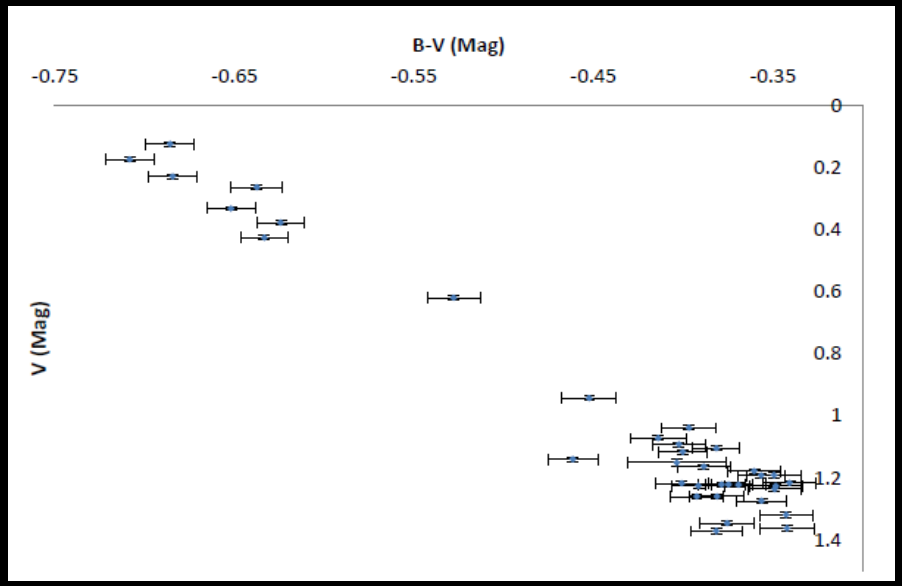


Exoplanet transits

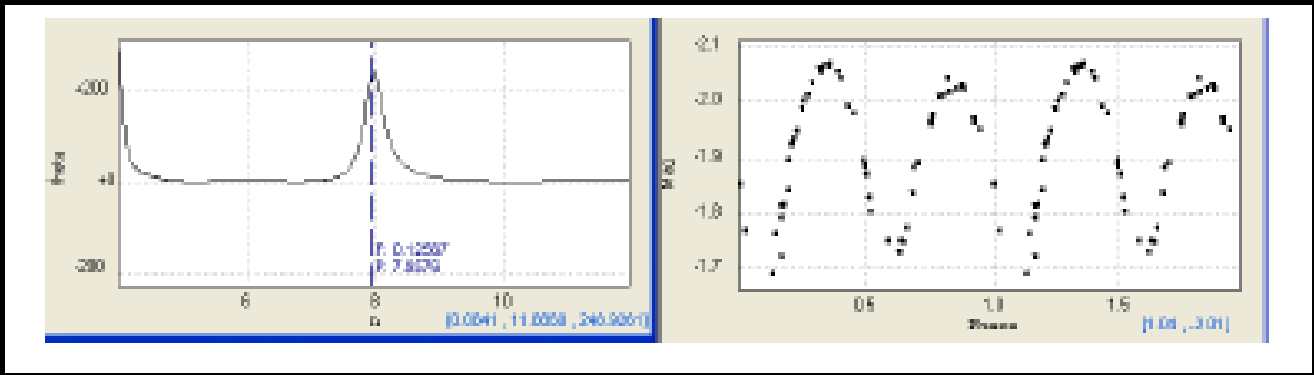




CoRot 2b: David Hardy & Thomas Ham (Cardiff schools), July 2012



LT Car RR Lyrae CMD
Joe Setchfield – USW u'grad



V0664 Pup EW (contact) type eclipsing binary
Lee Cavendish – USW u'grad

Schools in research publications

ACKNOWLEDGMENTS

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We thank Ricardo Schmidt and Marco Bonati of CTIO for building the Dark Energy Camera CCD system and Juan Estrada and the entire CCD production effort at Fermilab for creating the CCD detector. Fermilab is operated by the Fermi Research Alliance, LLC under contract no. DE-AC02-07CH11359 with the United States Department of Energy.

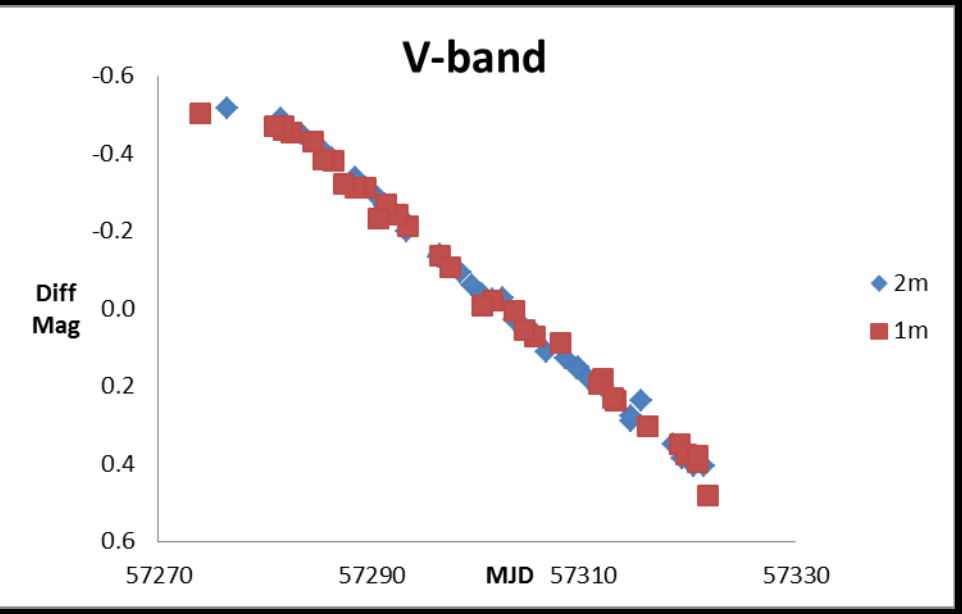
PE and PJC acknowledge support from Science Foundation Ireland. FL would like to acknowledge support from the Dill Faulkes Educational Trust.

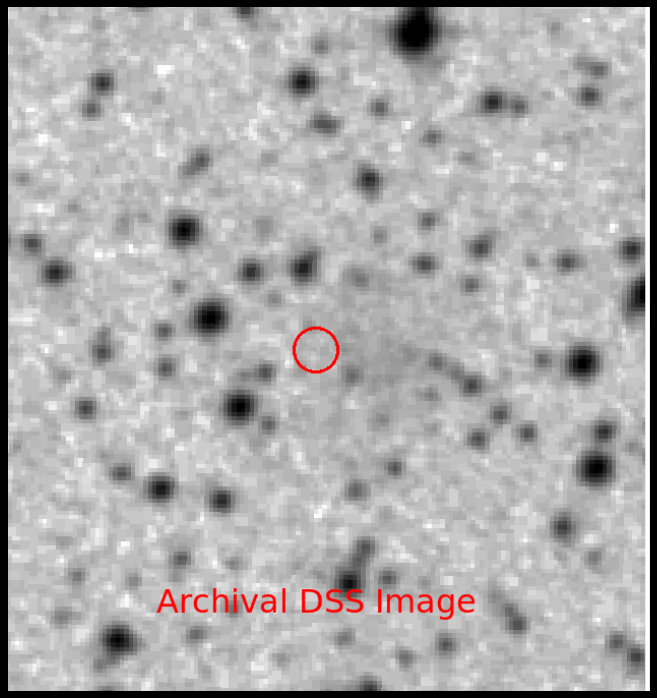
Elebert et al. 2009
MNRAS

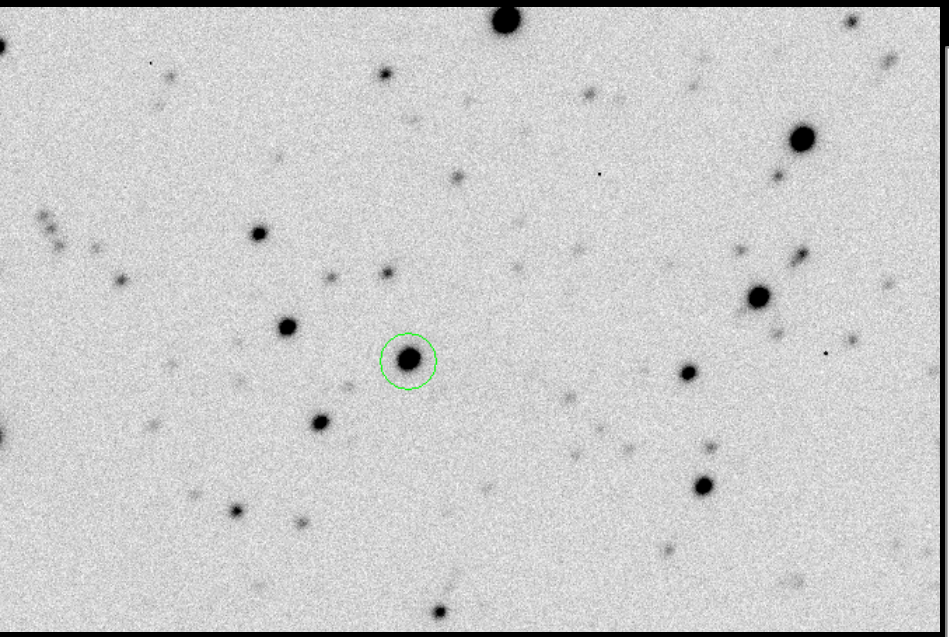
Acknowledgements. FL would like to acknowledge support from the Dill Faulkes Educational Trust. DMR acknowledges support from a Netherlands Organization for Scientific Research (NWO) VENI Fellowship. The Faulkes Telescope Project is an educational and research arm of the Las Cumbres Observatory Global Telescope (LCOGT). RXTE/ASM results are provided by the RXTE/ASM teams at MIT and at the RXTE SOF and GOF at NASA's GSFC. The Westerbork Synthesis Radio Telescope is operated by the ASTRON (Netherlands Institute for Radio Astronomy) with support from the Netherlands Foundation for Scientific Research (NWO). PGJ acknowledges support from a VIDI grant from the Netherlands Organisation for Scientific Research. DS acknowledges a STFC Advanced Fellowship. The Peters Automated Infrared Imaging Telescope (PAIRITEL) is operated by the Smithsonian Astrophysical Observatory (SAO) and was made possible by a grant from the Harvard University Milton Fund, the camera loan from the University of Virginia, and the continued support of the SAO and UC Berkeley. We thank the staff and students of Paulet High School (Burton-on-Trent, England), The Kingsley School (Leamington Spa, England), Czacki High School (Warsaw, Poland), St. Brigid's School (Denbigh, Wales) and St David's Catholic College (Cardiff, Wales) for contributing to the Faulkes LMXB Observing Program and Schools' Initiative (FLOPSI) and Alison Tripp for scheduling these observations. We thank the anonymous referee for their comments and swift reply.

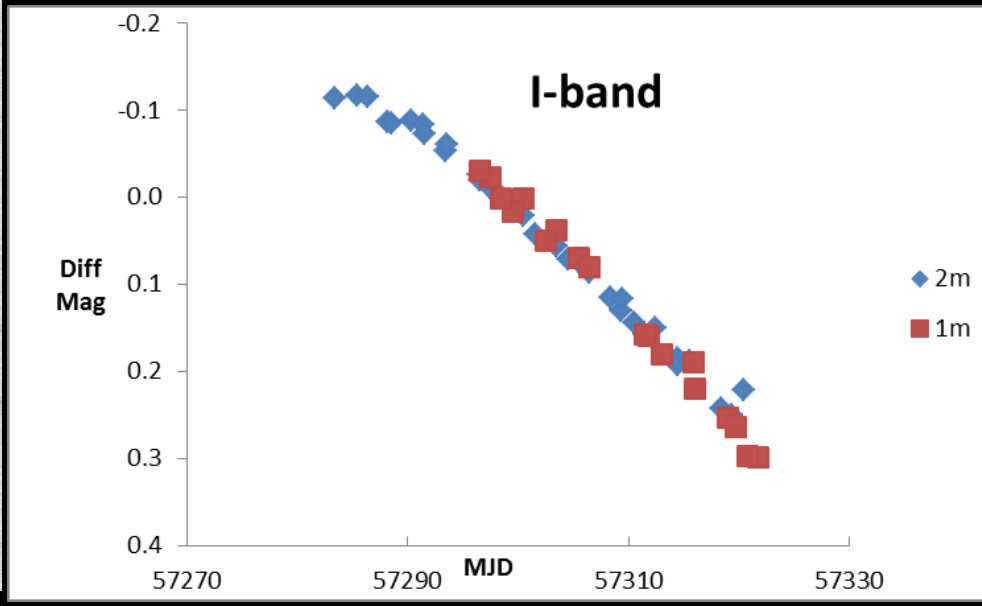
Lewis et al. 2010
A&A

ASASSN-15oz (~250 images in 4 filters over 7 telescopes on 5 sites)









Getting Started

Supernovae mark the end of a star's life. Here you will find some materials that will help you learn about them and show you how to measure one for yourself and see how it fades over time.

Work your way through each of the sections below in order to create a light curve for the **Gaia supernova target Gaia16agf.**

Don't forget to let us know how you get on!

News forum

1 What is Gaia?

This section contains some background information about the Gaia satellite and the Gaia Science Alerts. These information sheets will introduce students to the mission and its objectives.

Introducing: Gaia
Gaia Science Alerts

2 Background Science

This area contains general introductory information to some of the science topics that are involved in supernovae and photometric measurements. Students should read through these in order to gain an understanding of what it is t science behind it.

Stellar Lifecycles
An Introduction to Supernovae
Photometry in Astronomy
Calculating Magnitudes

3 Instructions

These materials will guide students through how to perform apparent photometry on a supernova target and plot a light curve in order to see how the object fades over time.

There are instructions for two different software packages, SalsaJ and Makali'i. It is up to you which one you use and you can find the free download links within the instructions.

You will need to complete the **Photometry with SalsaJ/Makali'i** worksheet first before starting the **Supernovae with SalsaJ/Makali'i** worksheet.

You will also find a **'Finder Chart'** which they will need to use in order to identify the supernova target and your check star. The **'Apparent Photometry'** spreadsheet will help students with their calculations.

This will all become clear as you proceed through the instructions.

Photometry with Makali'i
Supernovae with Makali'i
Photometry with SalsaJ
Supernovae with SalsaJ
Finder Chart
Apparent Photometry

4 Data - Gaia16agf

Here you will find a zip folder containing the observations of the Gaia target that students will be analysing. There should be 17 images in this folder and they are named according to their date of observation. For example, **"1 – 20** observation in the data set and was taken on the 2nd March 2016.

Gaia16agf

5 What Next?

When you have completed this activity, you can use your results to calculate how quickly the Universe is expanding and how old it is.

To do this, see the **Hubble's Expansion of the Universe** course

Hubble's Expansion of the Universe

Spotting a Supernova

Background Material

Gaia Science Alerts

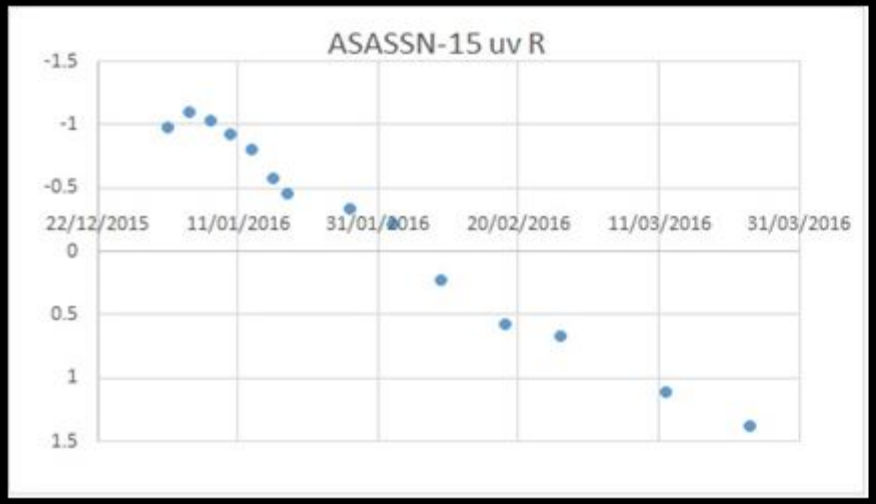
The detection of transient astronomical objects in real-time

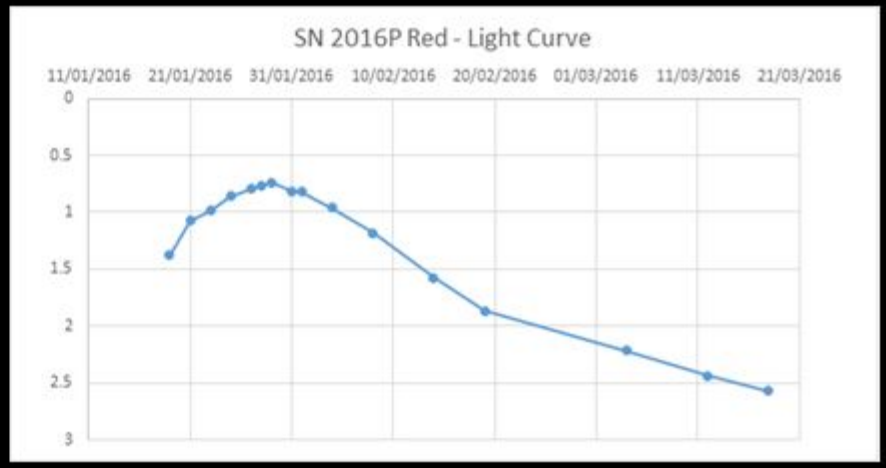
Not all stars emit light with a constant brightness and radiation output, many of them **change in brightness very suddenly** and often unexpectedly, over a variety of timescales. We call these objects **transients**.

Every day, the Gaia team announces several **science alerts** which indicate new discoveries of transient objects. The discoveries themselves are made in Cambridge University at the data processing centre at the Institute of Astronomy. Here, they lead the UK's involvement within the Gaia Data Processing and Analysis Consortium (DPAC).

As most transients – and indeed stars – that Gaia sees are so far away from us and appear so faint, we are unable to see them with the naked eye alone. Gaia is mapping one billion stars, whereas fewer than ten thousand stars are bright enough to be seen with just the naked eye – and most of those only with very dark sky conditions!) However, these objects can be seen from the ground by harnessing the power of **robotic telescopes** such as the Faulkes Telescopes. Gaia's science alerts (GSA) provide accessible data that **schools** and amateurs can use to make their own follow-up observations to confirm these transient objects and gather more information about their **properties and characteristics.**

http://resources.faulkes-telescope.com/course/view.php?id=144


ASASSN-15 uv R
-1.5
-1
-0.5
0
0.5
1
1.5
22/12/2015
11/01/2016
31/01/2016
20/02/2016
11/03/2016
31/03/2016


SN 2016P Red - Light Curve
11/01/2016
21/01/2016
31/01/2016
10/02/2016
20/02/2016
01/03/2016
11/03/2016
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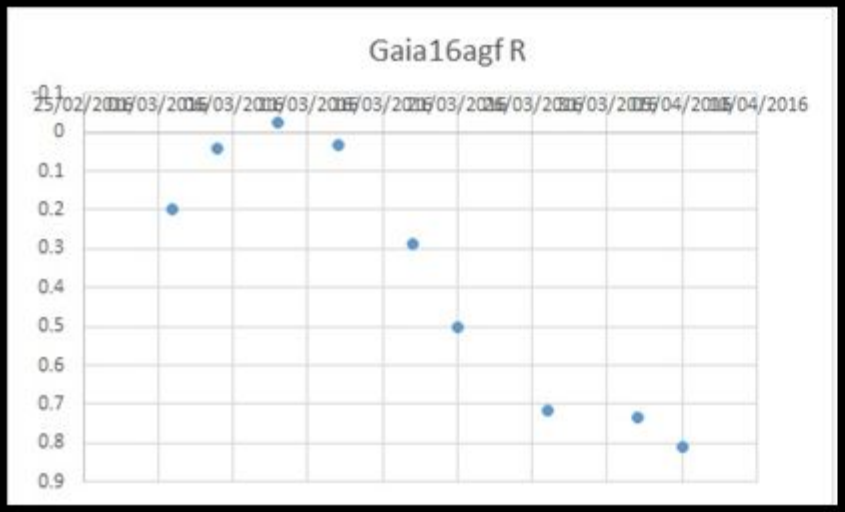
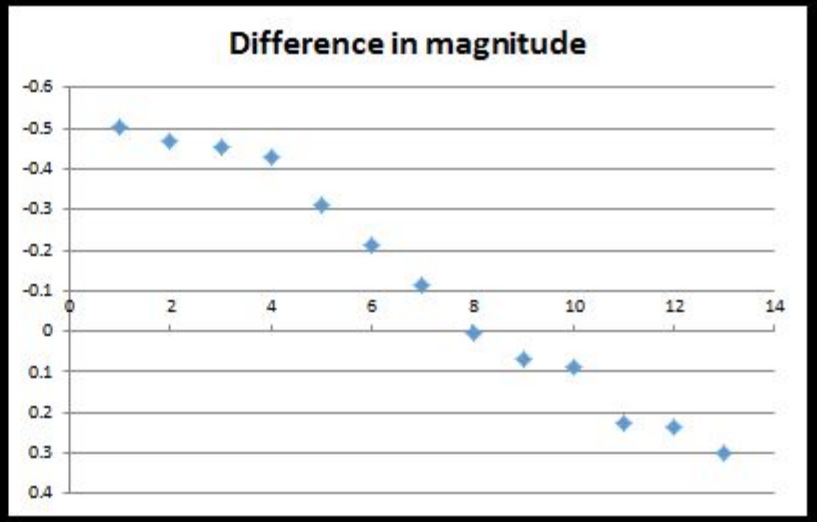
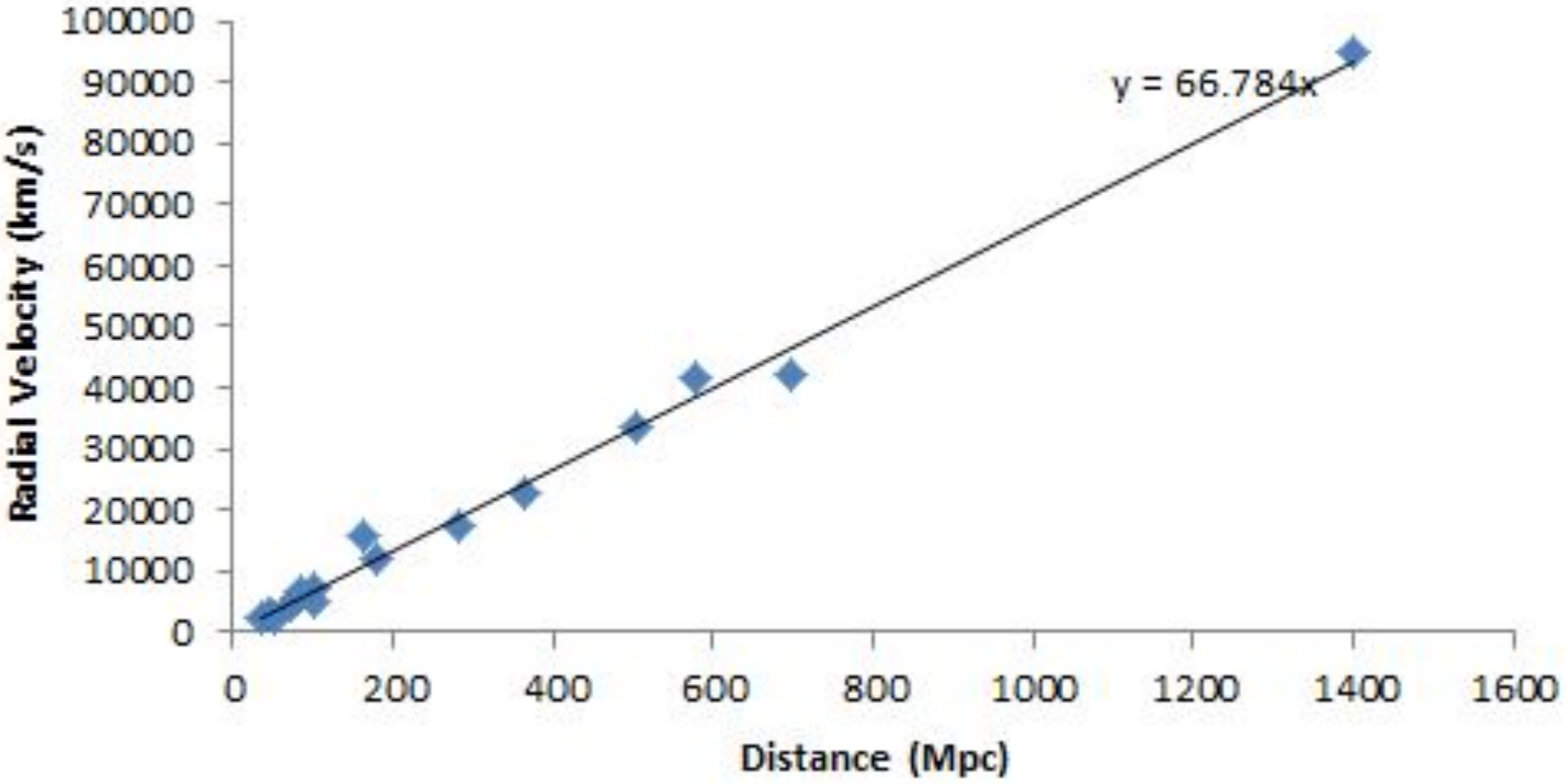
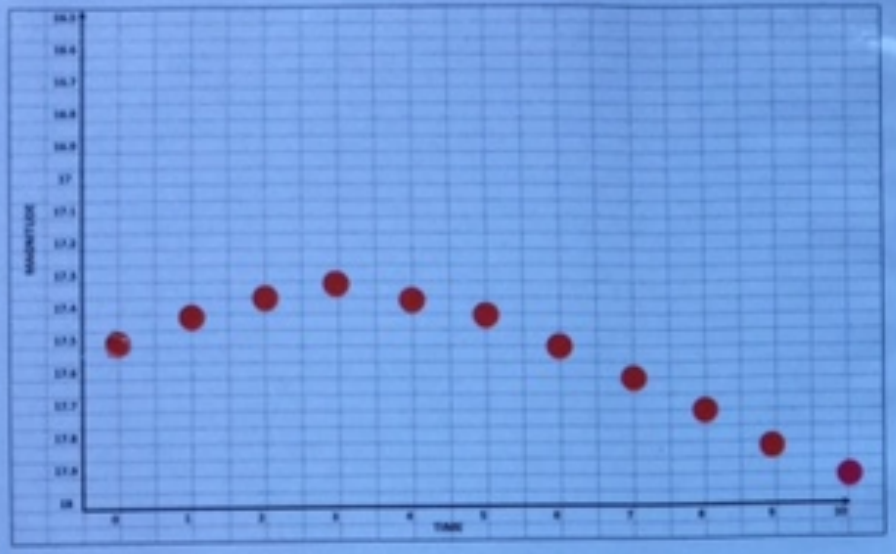
0
0.5
1
1.5
2
2.5
3

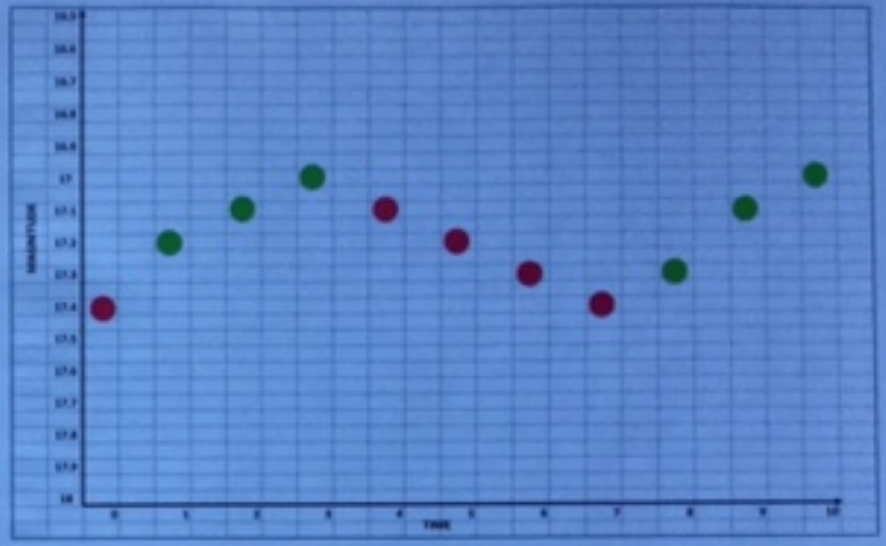

Gaia16agf R
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

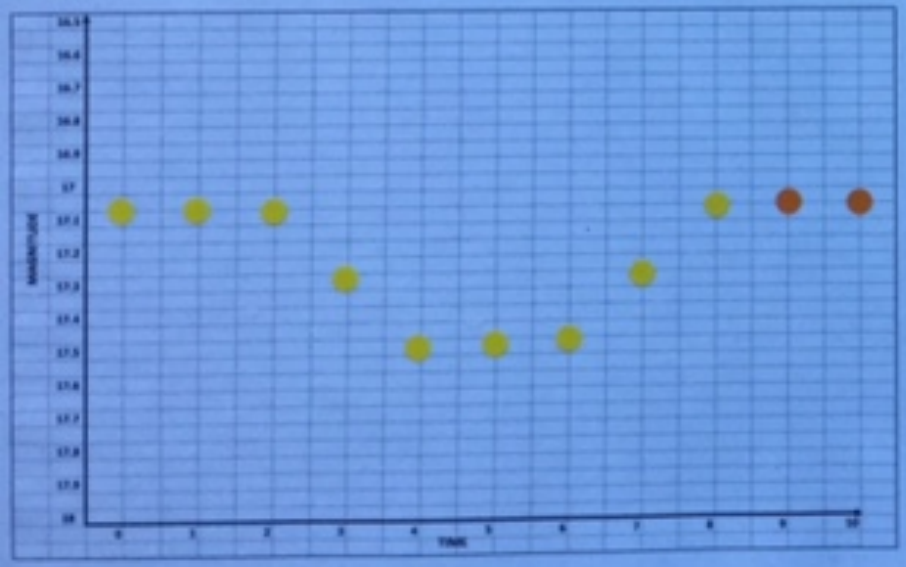

Difference in magnitude
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0
2
4
6
8
10
12
14

Hubble Diagram









Time	Magnitude
0	16.8
1	17.2
2	17.2
3	16.8
4	16.8
5	17.1
6	17.8
7	17.8
8	17.1
9	16.8
10	16.8

Time	Magnitude
0	17.4
1	17.2
2	17.1
3	17.0
4	17.1
5	17.2
6	17.3
7	17.4
8	17.3
9	17.1
10	17.0

Time	Magnitude
0	17.5
1	17.4
2	17.35
3	17.3
4	17.35
5	17.4
6	17.5
7	17.6
8	17.7
9	17.8
10	17.9

Eastbury Community School give Gaia astronomers a lesson in how to plot a Supernova lightcurve at the Royal Astronomical Society

Eastbury Community School students in action.

Megan Greet (Head of physics), Jamie Paton (teacher) and sixteen students from Eastbury Community School were delighted to be invited to the Royal Astronomical Society on Wednesday to demonstrate that teenagers really can carry out genuine scientific research. In partnership with the Institute for Research in Schools, led by Becky Parker, Eastbury were selected as the pilot school to analyse data from the Gaia project. This is a wonderful opportunity to enhance the enrichment work being

THE INSTITUTE for RESEARCH in Schools

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Eastbury Physics
@EastburyPhysics

Follow

Us giving presentation @RoyalAstroSoc on supernovae found in data from #GaiaMission provided by @ResearchInSch

Please come find me or
e-mail me your ideas

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http://schoolsobservatory.org.uk