The Faulkes Telescope (and other) Project(s)

Fraser Lewis

Faulkes Telescope Project

National Schools' Observatory

Liverpool John Moores University

The Open University

GO-LAB

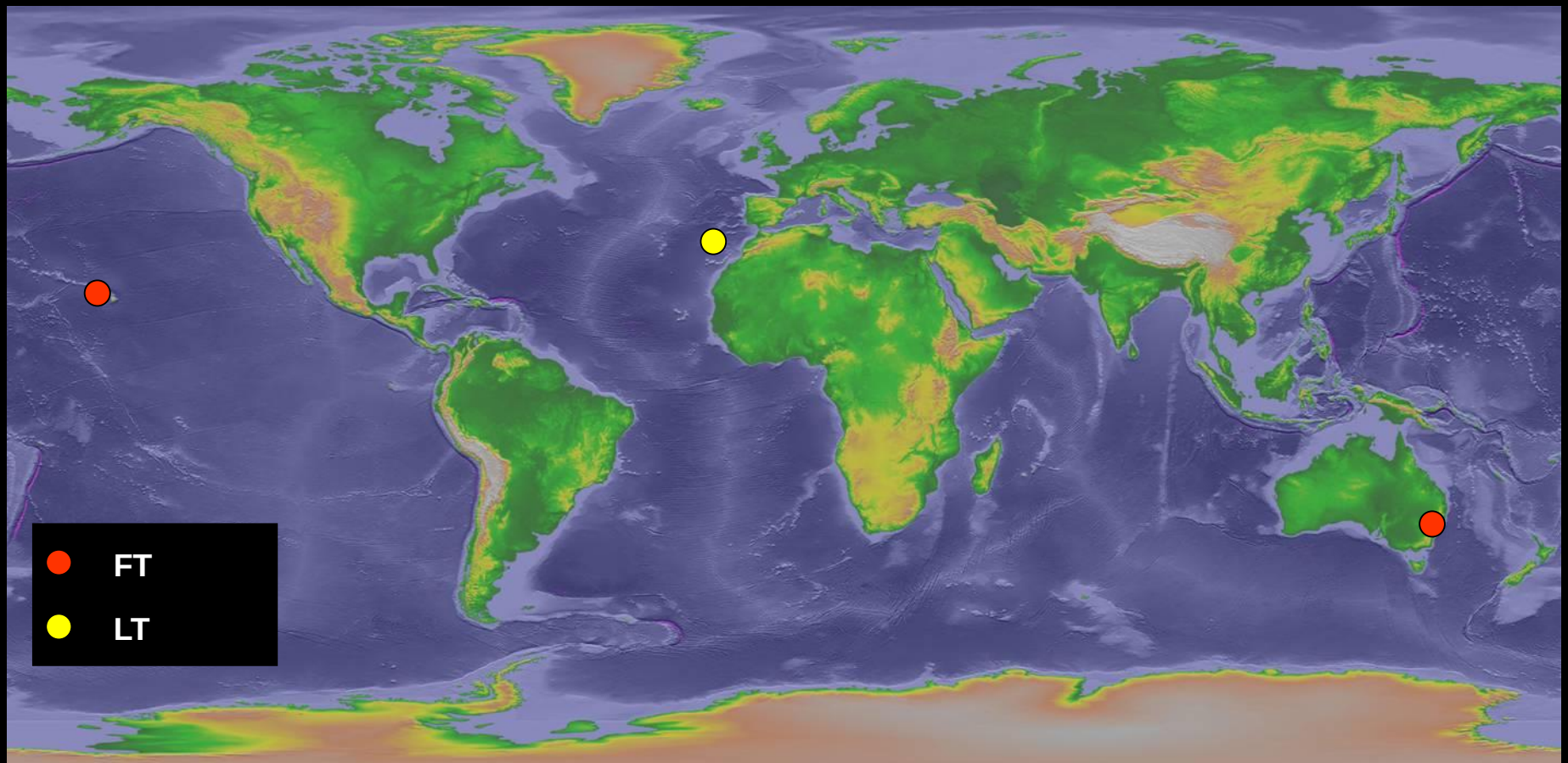
GLOBAL ONLINE SCIENCE LABS
INQUIRY LEARNING AT SCHOOL

Galileo Teacher Training Program
A LEGACY OF THE INTERNATIONAL YEAR OF ASTRONOMY 2009

AstroCymru

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

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

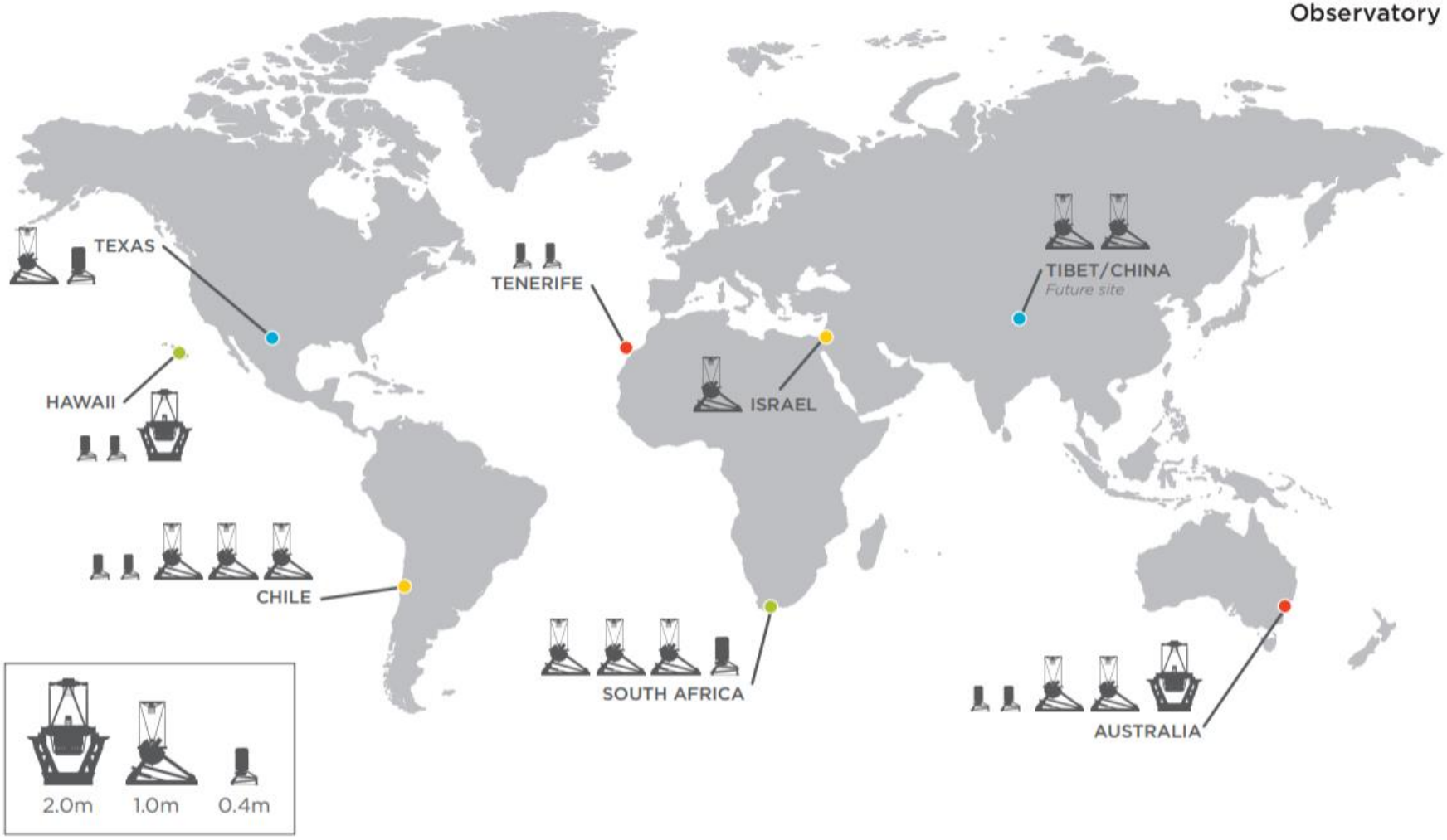


FTN

Haleakala, Maui

GLOBAL TELESCOPE NETWORK

Las Cumbres Observatory



Liverpool Telescope, La Palma

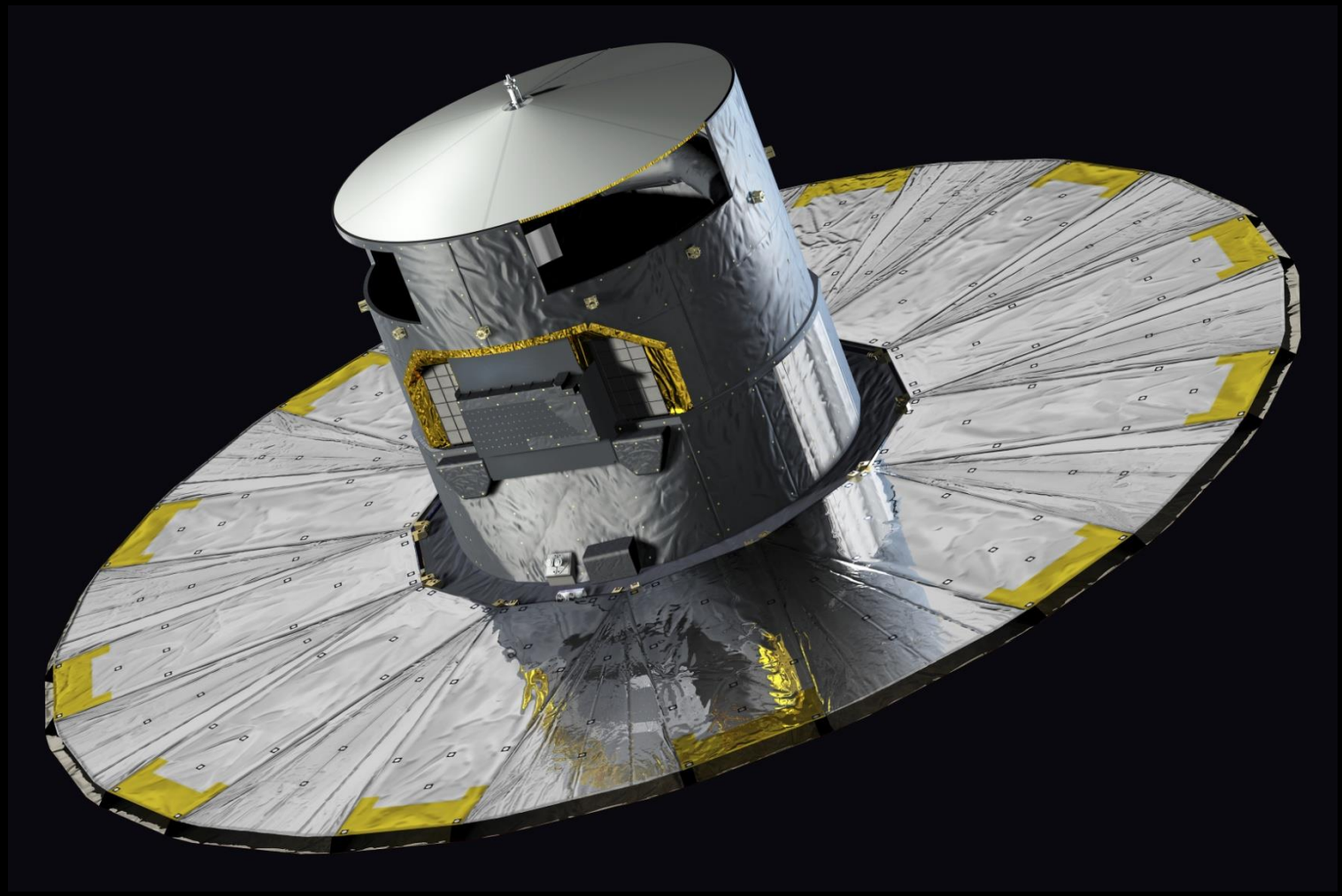
nso

LIVERPOOL JOHN MOORES UNIVERSITY






Gaia Transient Follow-up



gaia.ac.uk

http://gsaweb.ast.cam.ac.uk/alerts/alertsindex

Getting to know Gaia

- CCDs
- Signalling
- Launch
- Orbit Location
- Scientific Instruments
- Precision
- Power Systems

Inbox (1) - fraser.lewis68@ | Powerpoints - Google Dri | Google Calendar - Month | Gaia Alerts Index

gsaweb.ast.cam.ac.uk/alerts/alertsindex

Gaia Alerts | Alerts Index | Alerts Search | Surveys-ATels | Contact | About | Related Sites | Log in

Index to Gaia Photometric Alerts

If you publish any results based on these Gaia discoveries, we would appreciate an acknowledgement along the lines of: *We acknowledge ESA Gaia, DPAC and the Photometric Science Alerts Team (http://gsaweb.ast.cam.ac.uk/alerts).*

These are all the alerts raised to date. You might wish to view or download these as a table in CSV format.

See here for an explanation of the columns.

Show 10 entries Search:

Name	Observed	RA (deg.)	Dec. (deg.)	Mag.	Historic mag.	Historic scatter	Class	Published	Comment
Gaia16bcc	2016-08-20 16:18:45	145.75683	-41.05248	18.89			unknown	2016-08-22 14:02:55	hostless blue transient on the rise
Gaia16bcb	2016-08-20 15:01:34	43.84030	-20.73077	18.92			unknown	2016-08-22 14:00:58	candidate SN close to galaxy GALEXASC J025521.75-204350.7, GS-TEC predicts SN Ia
Gaia16bca	2016-08-20 13:20:03	208.54332	6.38838	17.54			unknown	2016-08-22 13:06:14	candidate SN in galaxy SDSS J135410.37+062318.5, GS-TEC predicts SN Ia
Gaia16bbz	2016-08-20 14:46:34	289.16431	46.35201	17.69			unknown	2016-08-22 13:04:37	candidate CV, hostless blue transient
Gaia16bby	2016-08-20 19:45:49	225.65243	23.35274	17.26			unknown	2016-08-22 13:03:35	Candidate SN near (group member?) galaxy SDSS J150236.39+232108.2, GS-TEC predicts SN Ia
Gaia16bbx	2016-07-13	28.53423	-2.68435	18.32			unknown	2016-08-22	blue transient in uncatalogued SDSS galaxy, fading

https://gaia.ac.uk

Gaia in the UK

Taking the Galactic Census

Search

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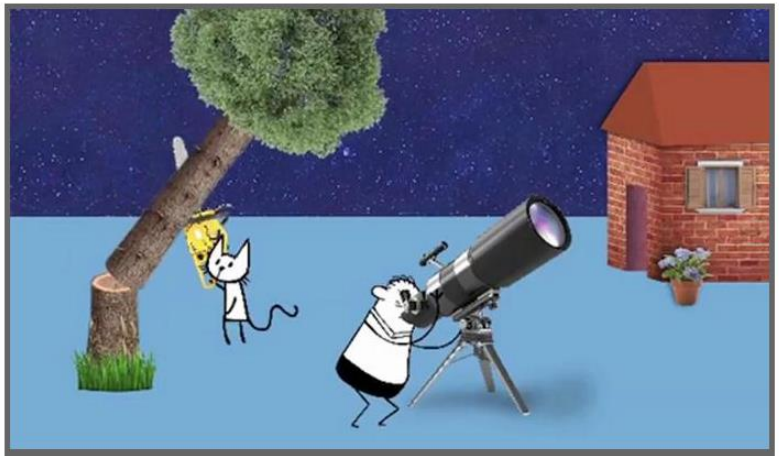


Gaia in one minute

Gaia in one minute

Why we need Gaia

How old are the stars? Watch cartoon

What's the big deal about Gaia?

Just how do you go about creating a 3D map of a galaxy? Watch cartoon

How do we benefit from

Spotting a Supernova

Background Material

Gaia Science Alerts

The detection of transient astronomical objects in real-time

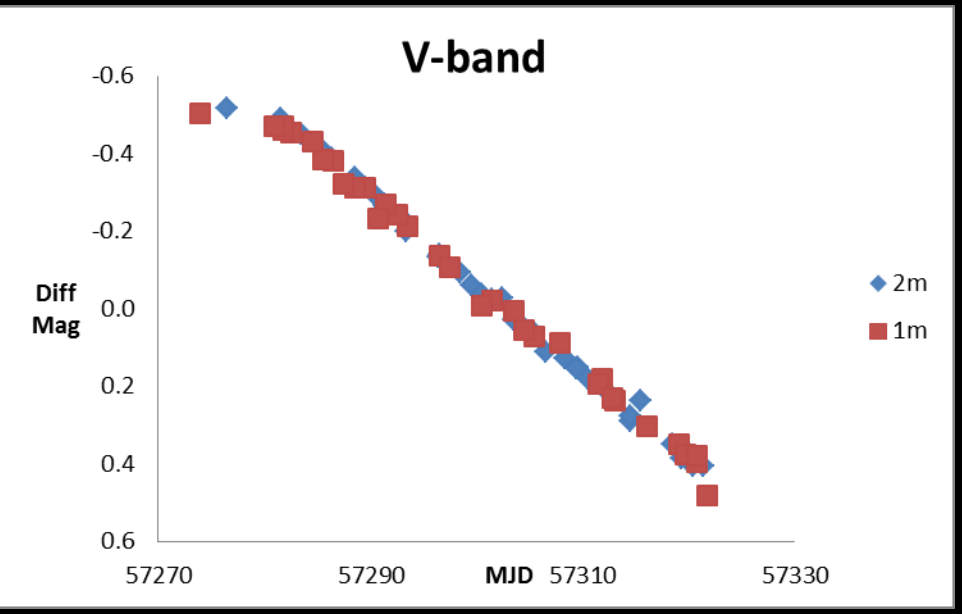
Not all stars emit light with a constant brightness and radiation output, many of them **change in brightness very suddenly** and often unexpectedly, over a variety of timescales. We call these objects **transients**.

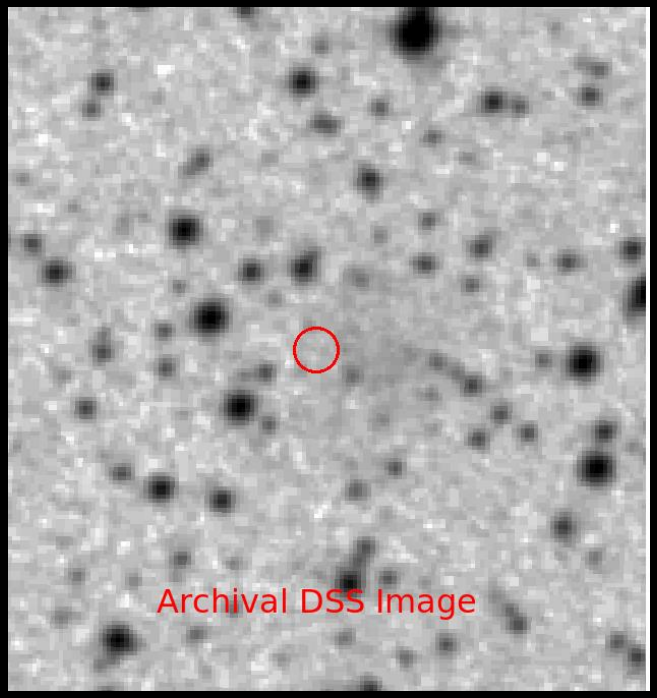
Every day, the Gaia team announces several **science alerts** which indicate new discoveries of transient objects. The discoveries themselves are made in Cambridge University at the data processing centre at the Institute of Astronomy. Here, they lead the UK's involvement within the Gaia Data Processing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

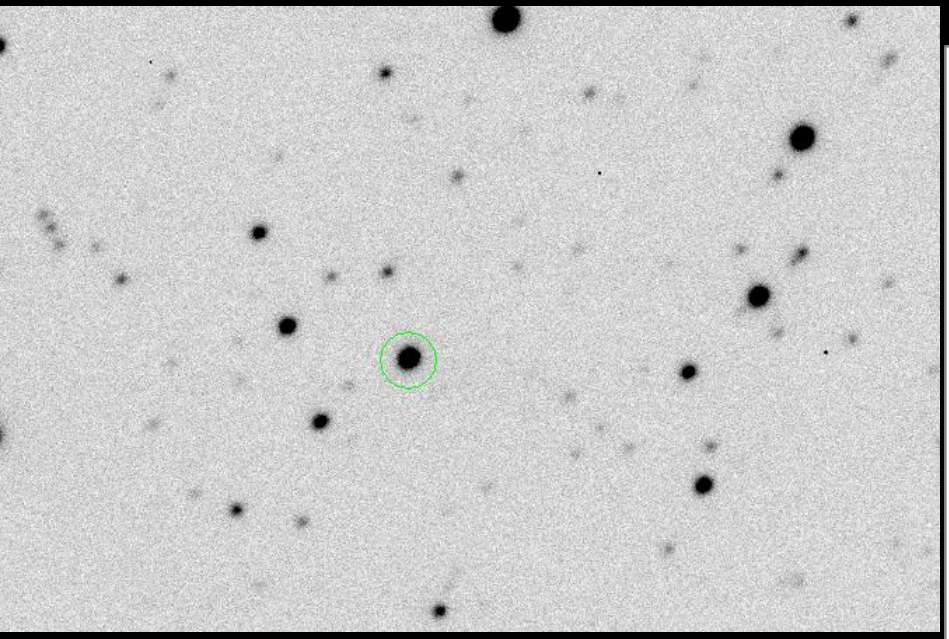
As most transients – and indeed stars – that Gaia sees are so far away from us and appear so faint, we are unable to see them with the naked eye alone. Gaia is mapping one billion stars, whereas fewer than ten thousand stars are bright enough to be seen with just the naked eye – and most of those only 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.**

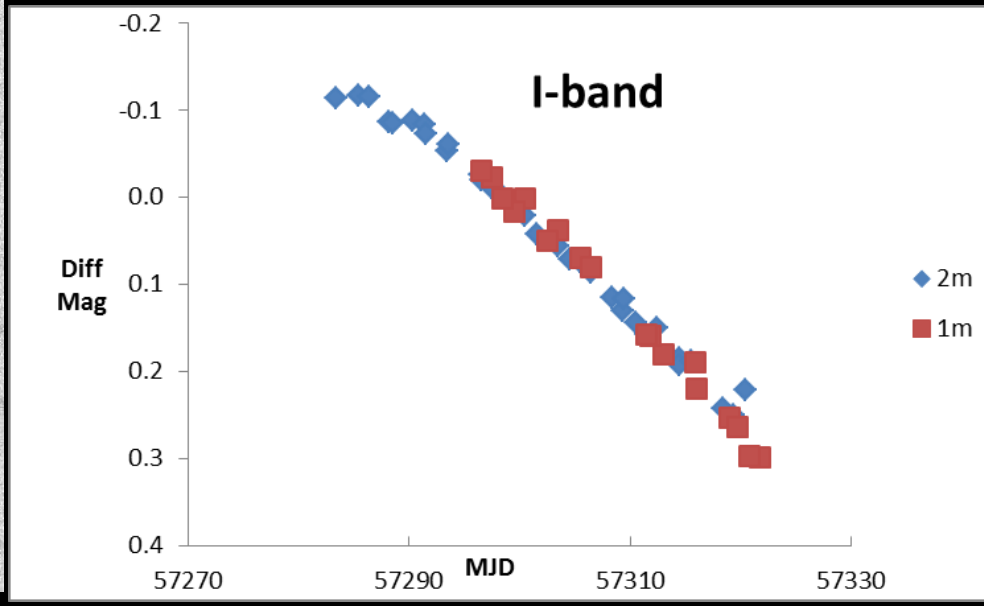
http://resources.faulkes-telescope.com/course/view.php?id=144

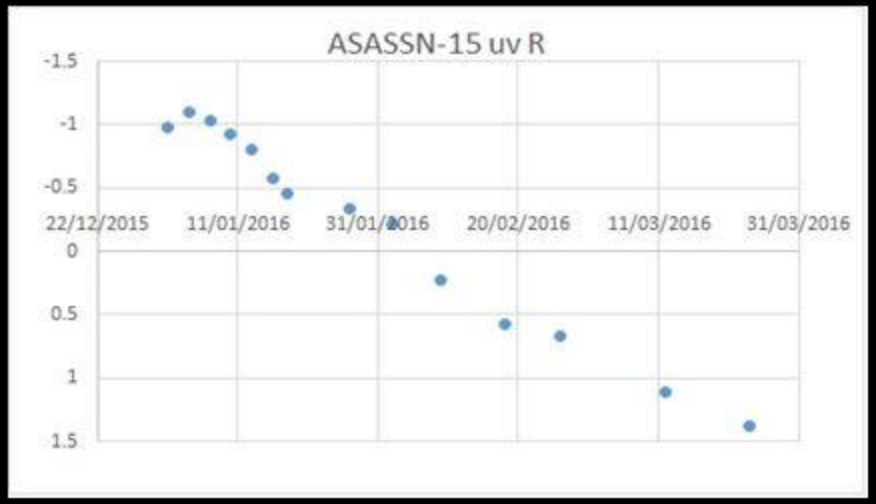
ASASSN-15oz (~250 images in 4 filters over 7 telescopes on 5 sites)










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
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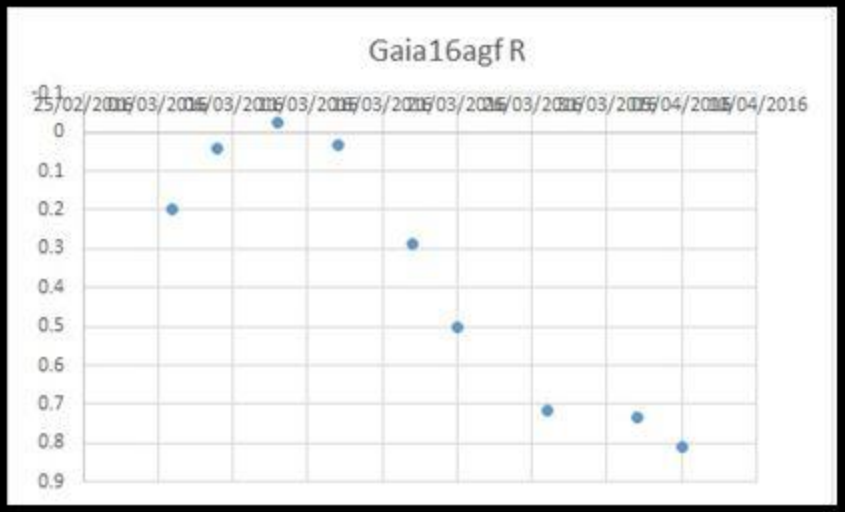
Gaia16agf R
0
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0.2
0.3
0.4
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0.6
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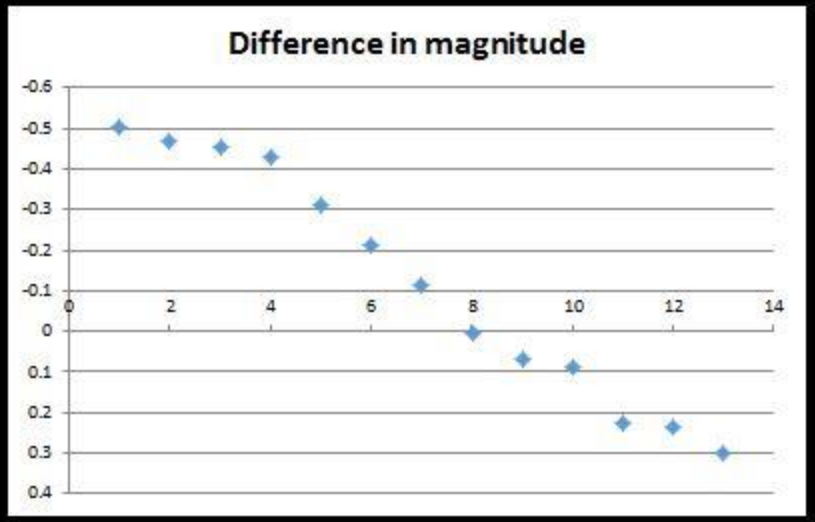
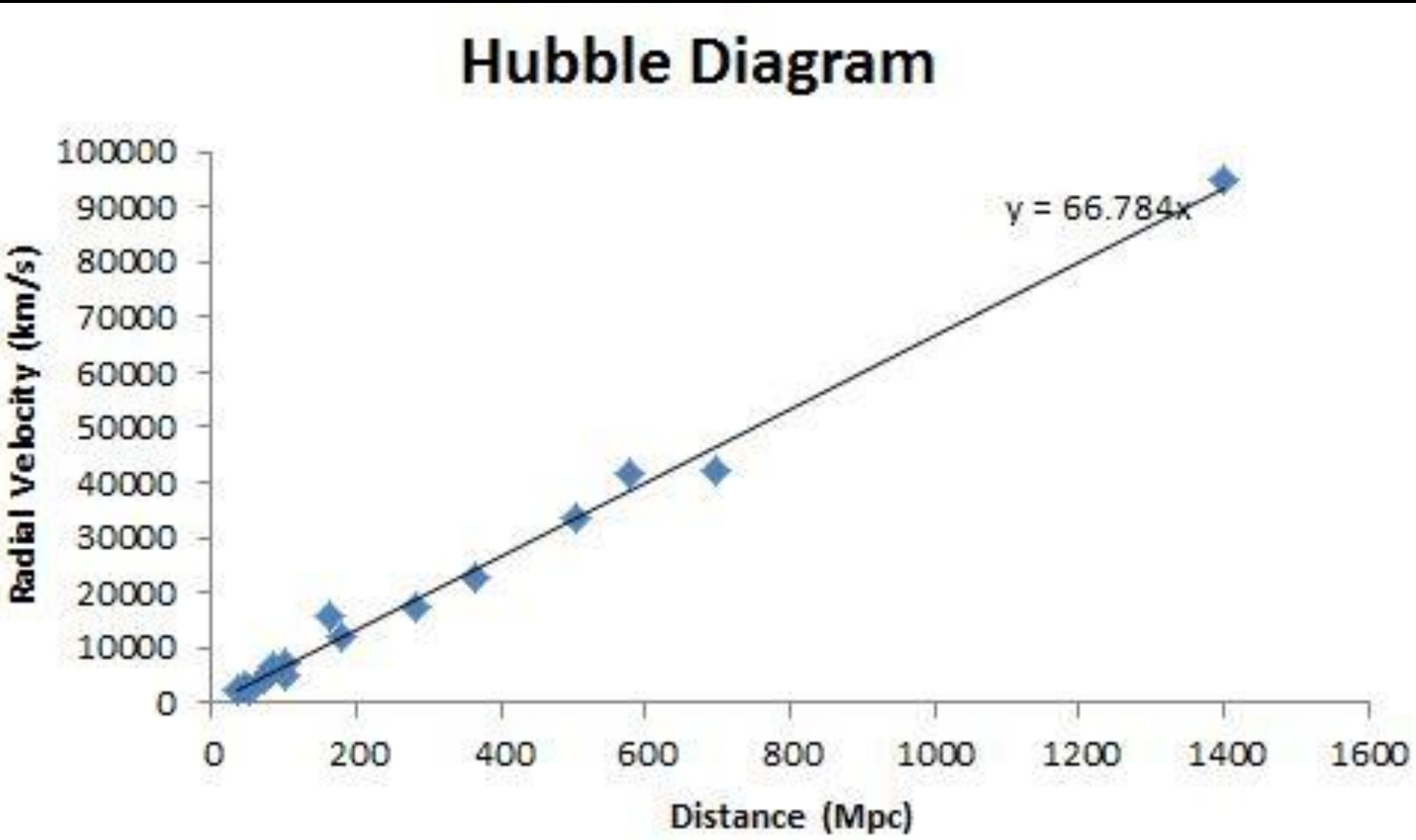
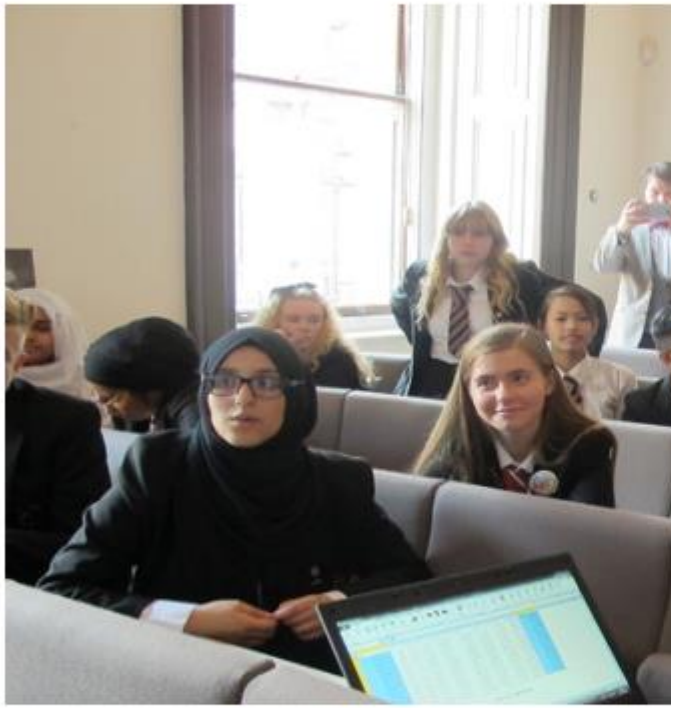
0.8
0.9


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
Radial Velocity (km/s)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
y = 66.784x
0
200
400
600
800
1000
1200
1400
1600
Distance (Mpc)

Eastbury Community Sch
a lesson in how to plot a
the Royal Astronomical S



Eastbury Community School students in action.

Megan Greet (Head of physics), Jamie Paton (teac
School were delighted to be invited to the Royal A
that teenagers really can carry out genuine scienti
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

Eastbury Physics
@EastburyPhysics

Follow

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

Stop Press

In conjunction with PI Andy Newsam (NSO, LJMU) we have been successful in UKRI bid to develop a pilot project in Citizen Science

“Developing opportunities for in-depth citizen science using robotic telescopes”

Our intention is to develop these resources based on Gaia supernovae (especially Type !a) as imaged by Faulkes Telescopes/LCO/Liverpool Telescope

What Is Citizen Science ?

Best and most successful example is Galaxy Zoo

https://www.zooniverse.org/

However, Galaxy Zoo relies on thousands of users and perhaps does not offer lots of opportunities for them to analyse and learn

So our approach will be to work with fewer users (perhaps tens) but provide them with the chance to learn and contribute

What Will Our Users Do

Photometry of Archive Datasets ~ 30 Type Ia Sne

Use of Excel

Upload their finished light-curves

Use the Gaia Alerts stream to suggest and observe new targets

Learn about supernovae

Learn about the expansion of the Universe

Learn about Gaia !

Difficulties

Remit of Citizen Science is to do as much as or as little as you choose

So we must make this modular

And each module must encourage the user to find out more

What Next

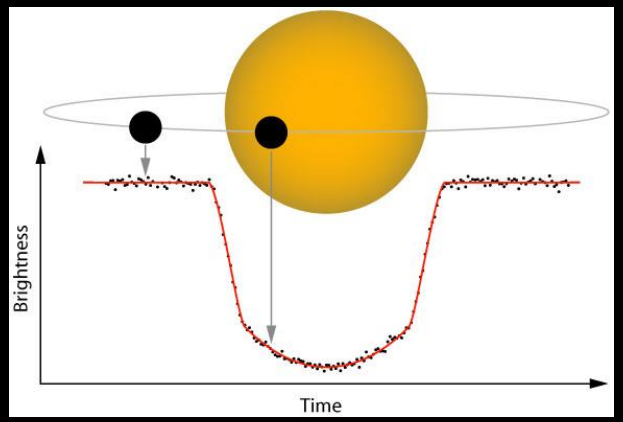
This is a pilot project so if we are successful, we may be able to chase more funding

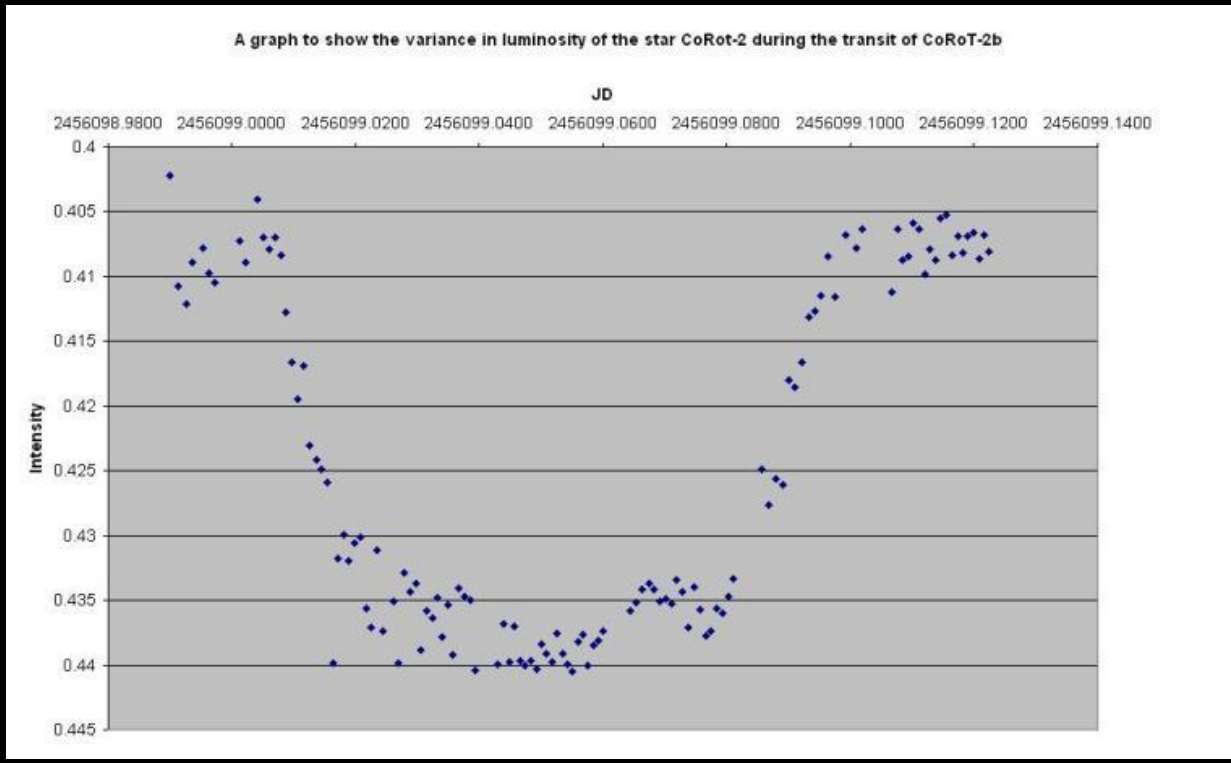
Would our users be interested in other Gaia targets ?

Can we feed this forward to LSST, etc. ?

PLEASE HELP ! If you have teachers or schools that you believe would be interested, please let me know ?!

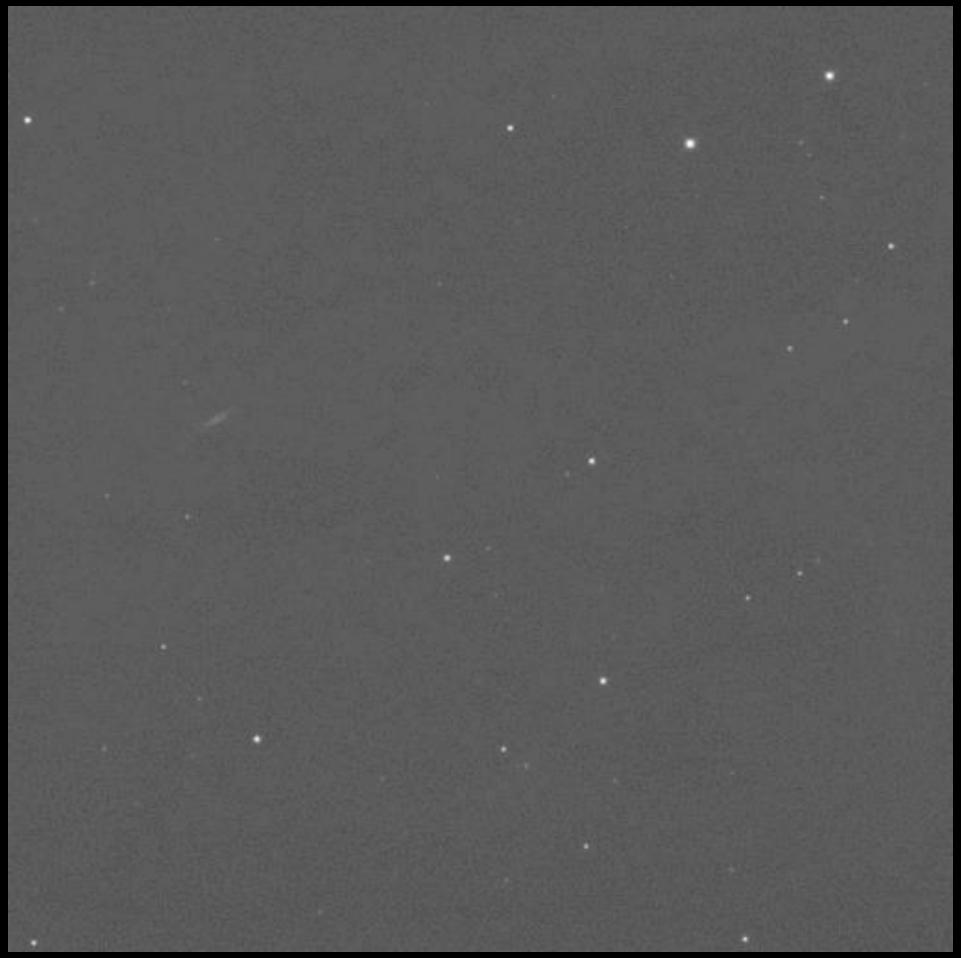
Exoplanet transits

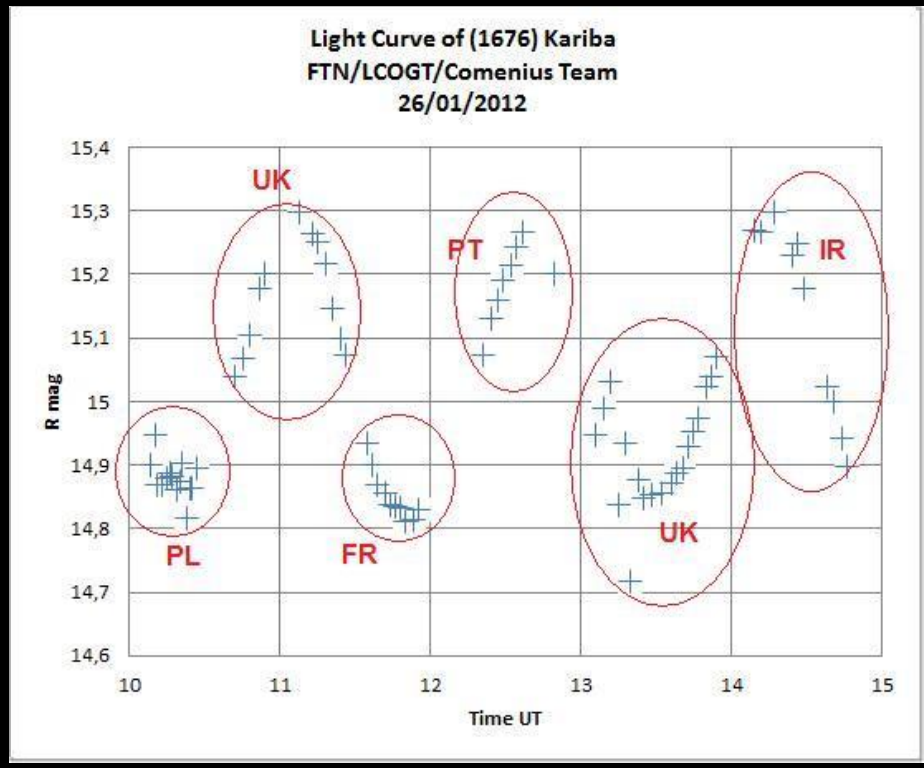




CoRot 2b: David Hardy & Thomas Ham (Cardiff schools), July 2012

Asteroid rotation





Aug. 2011

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30 August 2011 Last updated at 19:31

Asteroid spotter Hannah hopes for her name in the stars

Student Hannah Blyth was on a month-long work placement

A sixth-former who went on work experience to study astronomy and discovered two new asteroids is hoping to have one named after her.

THE AUSTRALIAN

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Student's asteroid find the equivalent of seeing a dark grey building in black space 482 million km away

August 31, 2011 10:58AM

of a large building hurtling through space 482 million kilometres d after the Welsh student who spotted it during her summer

g a month's work experience with astronomers at the University of when she spotted the asteroid that now bears her name.

ik of painstakingly examining images recorded by the university's two n the Hawaiian island of Maui. Thousands of asteroids orbit between ifficult to spot against the inky blackness of outer space.

d by experts from Harvard University, who decided to name the our of its finder.

that Miss Blyth, from St John's Sixth Form College in Cardiff, spotted - more than many astronomers discover in a career.

DiscoveryNews. ... saw a dust devil spin on Mars.

EARTH | SPACE | TECH & GADGETS | ANIMALS | HISTORY | ADVENTURE | HUMAN | AUTOS

Discovery News > Space News > 18 Year Old Student Discovers Comet Break-Up

18-YEAR-OLD STUDENT DISCOVERS COMET BREAK-UP

During a summer internship, the British student also helped with the discovery of over 20 asteroids

By Ian O'Neill
Sat Sep 3, 2011 07:47 PM ET
(3) Comments | Leave a Comment

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Like | Nick Howes and 402 others like this. | Share 149 | Tweet 296

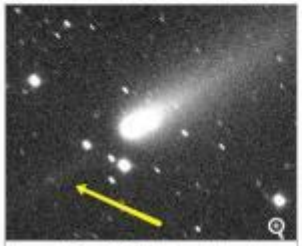

Image of Comet 213P Van Ness taken by Hannah Blyth, processed by N. Howes, F

THE GIST

- Analyzing photographs of a comet taken by student Hannah Blyth, astronomers had broken apart.
- During her summer placem Faulkes Telescope Project previously unknown aster

It's an event that any profes consider to be a once- in-a- 18-year-old British student, of a comet she was studyir summer work experience p pound (dollar) Faulkes Tele Cumbres Observatory Glob

the telegraph .com.au

WEATHER Today Tomorrow

min 11°C - max 24°C

SPORT

Bennett's secret Ne

TWO days before the Drag match of the season, Wa

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Breaking News | Sydney/NSW | National | World | Weird | Classmate | Tributes | Galleries | Photo Sales

Weather: Sydney 11°C - 24°C . Sunny

Breaking News

Asteroid Hannahblyth named after British teen who spotted it during internship

From: NewsCore August 31, 2011 9:04AM

Recommend | Send | 2 people recommend this

A BRITISH teenager spoke of her deli discovered during a northern summe

Hannah Blyth, 16, was working alongside ast Wales when she spotted the chunk of rock th million miles (480 million km) from Earth.

She had been given the task of painstakingly Faulkes Telescope on the Hawaiian island of and Jupiter and are difficult to spot against th

Her discovery was confirmed by experts from

Tags > finds 22 new asteroids

US teen Hannah Blyth finds 22 new asteroids, hopes to have one named after her

Student Hannah Blyth was on a month-long work placement. Image showing Hannah Blyth's asteroid discoveries. A sixth-former who went on work experience to study astronomy and discovered two new asteroids is hoping to have one named after her. Hannah Blyth was using a remote-controlled telescope to stare into the night sky when she helped spot 22 new asteroids between Mars and Jupiter. Fellow stargazers hope one will be named 'Hannahblyth' after

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'There's a rock out there with my name on it': Astronomy student on work experience discovers asteroid that will be named after her

By CHRIS SLACK

Last updated at 9:39 PM on 30th August 2011

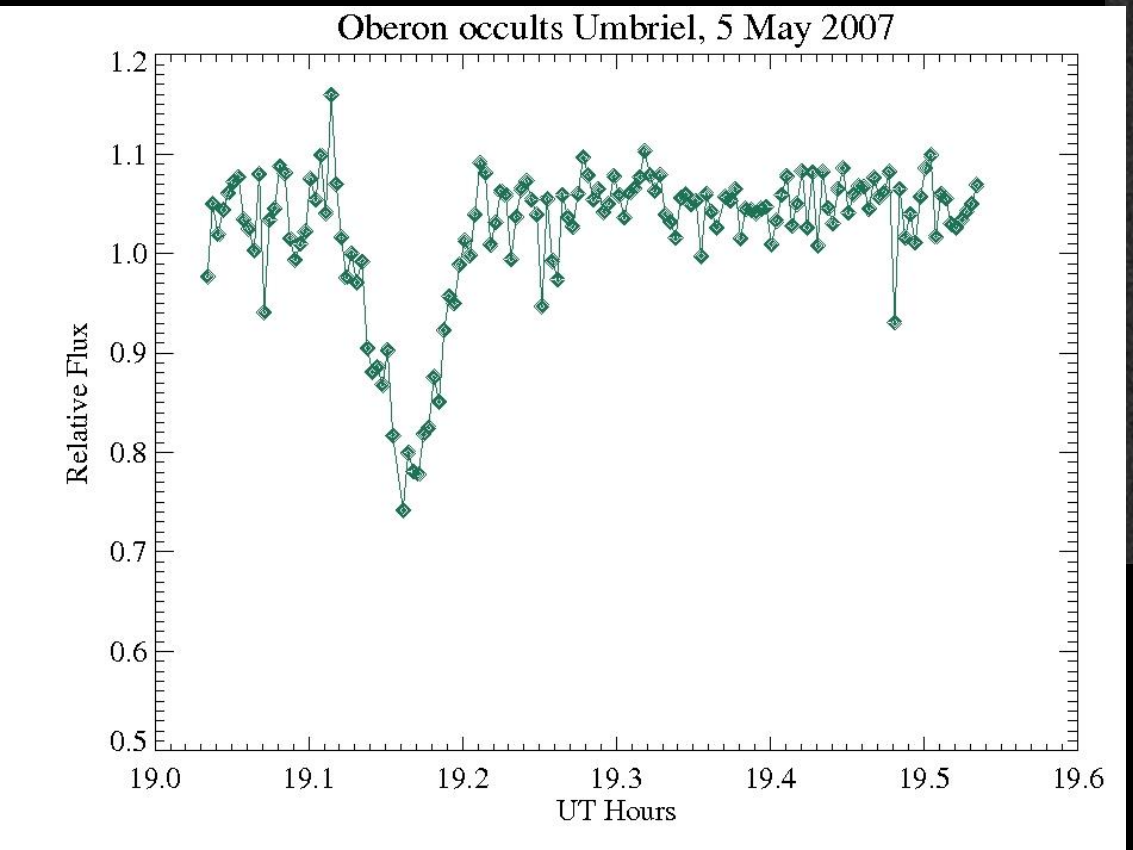
Comments (7) | Add to My Stories | Share | Like 51

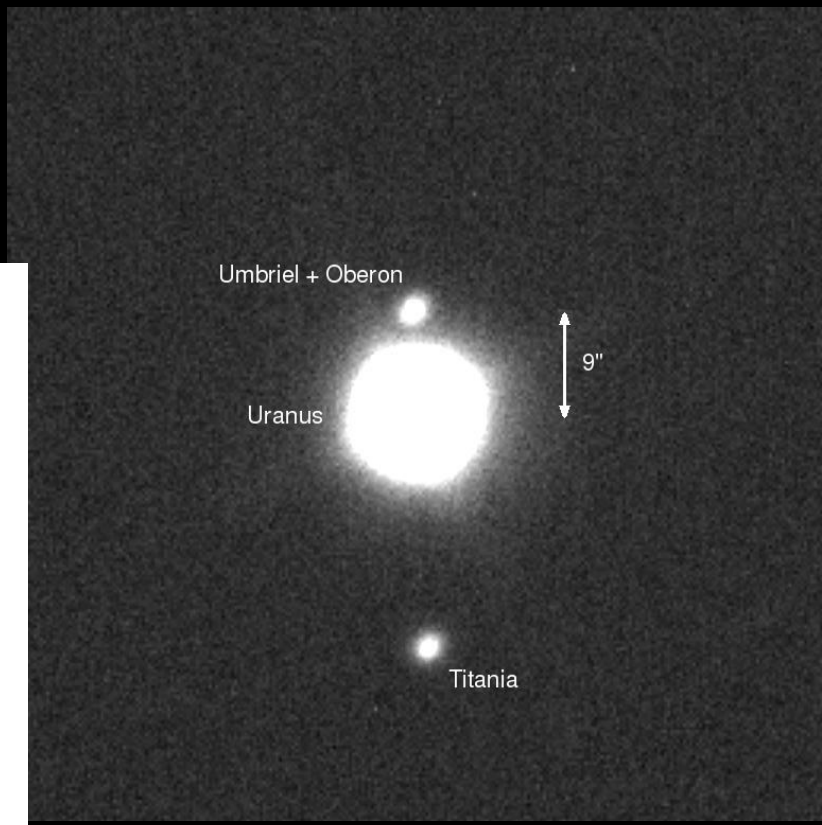
A schoolgirl who discovered 22 new asteroids during work experience at an astronomy project has discovered one of them will be named after her.

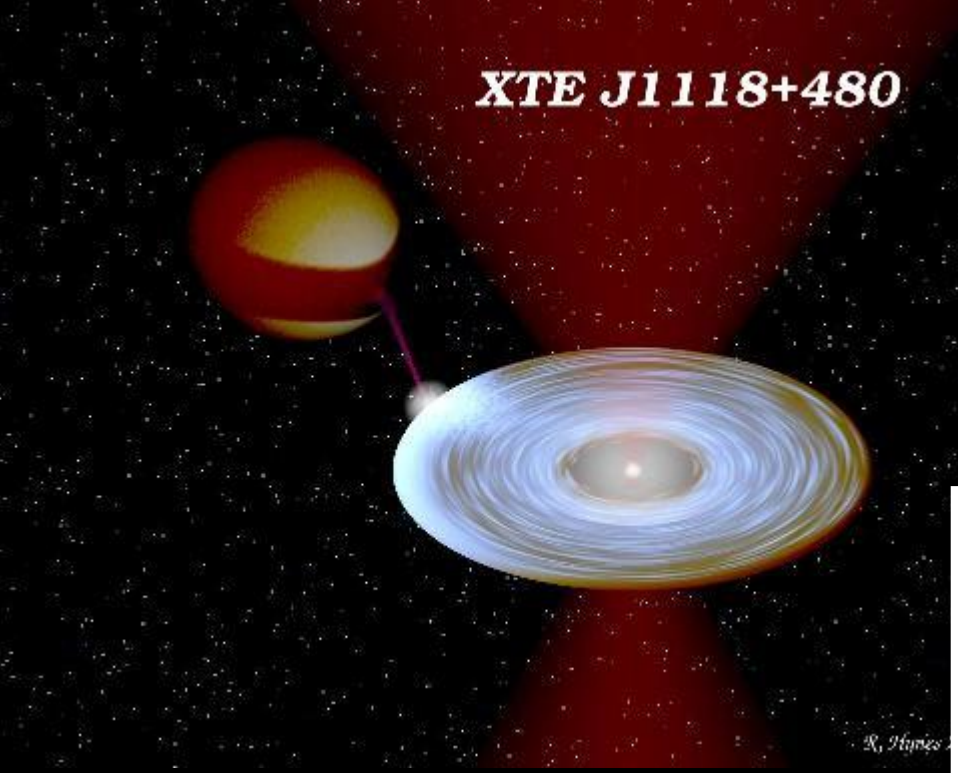
Hannah Blyth, 16, was using a a remote controlled telescope at the University of Glamorgan's Faulkes Telescope Project when she spotted the new asteroids more than 300 million miles away.

Mutual Events of Uranian Moons

A. Christou (Armagh Observatory),
M. Hidas (LCO, UC Santa Barbara),
F.Lewis (FT)

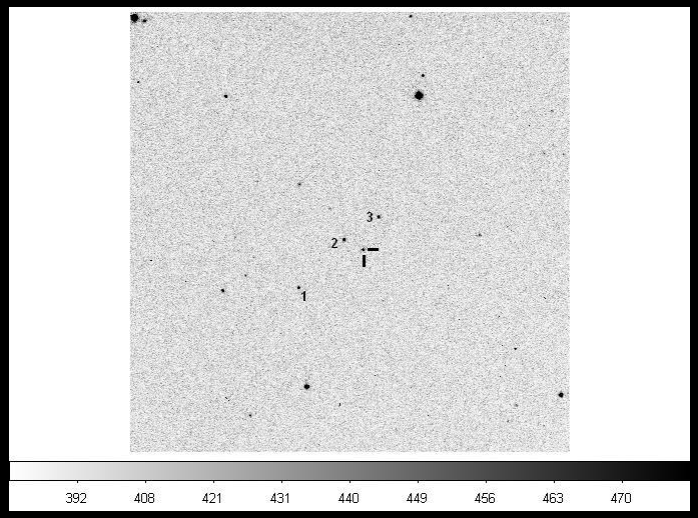


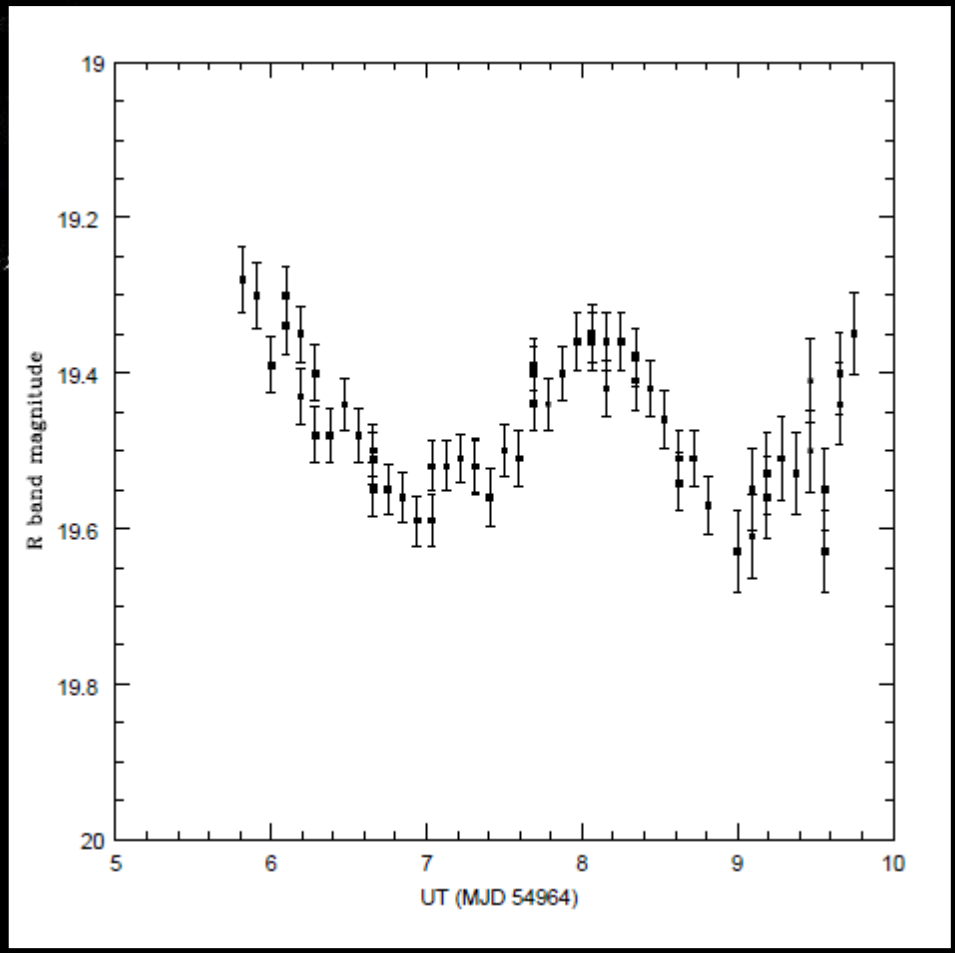




A nearby and ‘easy-to measure’ black hole !

Black Holes In My School
(BHIMS; Rosa Doran, NUCLIO, Portugal)





Draft version August 1, 2018
Preprint typeset using LaTeX style emulateapj v. 08/22/09

TWO BRIGHT MINI-OUTBURSTS END THE 12−YEAR LONG ACTIVITY OF THE BLACK HOLE CANDIDATE SWIFT J1753.5−0127

G.-B. Zhang[1,2,3,4], F. Bernardini[4,5,6], D.M. Russell[4], J.D. Gelfand[4,7], J.-P. Lasota[8,9], A. Al Qasim[4,10], A. AlMannaei[4], A.W. Shaw[11], F. Lewis[12,13], J.A. Tomsick[14], R.M. Plotkin[15], P.A. Charles[16], J.C.A. Miller-Jones[15], D. Maitra[17], J. Homan[18,19], P. Kobel[20], D. Perez[20], and R. Doran[21]

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[14]Space Sciences Laboratory, 7 Gauss Way, University of California, Berkeley, CA 94720-7450, USA
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[18]Eureka Scientific, Inc., 2452 Delmer Street, Oakland, CA 94602, USA
[19]SRON, Netherlands Institute for Space Research, Sorbonnelaan 2, 3584 CA Utrecht, The Netherlands
[20]Gymnase du Bugnon-Sévelin, Avenue de Sévelin 44, 1004 Lausanne, Switzerland and
[21]NUCLIO - Núcleo Interactivo de Astronomia, Largo dos Topázios, 48, 3 Frt, PT2785–817 S. D. Rana, Portugal

Draft version August 1, 2018

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.

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Elebert et al. 2009
MNRAS

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Lewis et al. 2010
A&A

Faulkes Telescope Monitoring of LMXBs

→ We are monitoring about 50 LMXBs with the two 2-m Faulkes Telescopes since 2005–2007 (Lewis et al. 2008) – about half are regularly detected in quiescence

→ Fully robotic, queue scheduled. Typically use V, R, i' filters, sometimes g', r', i', y or z'

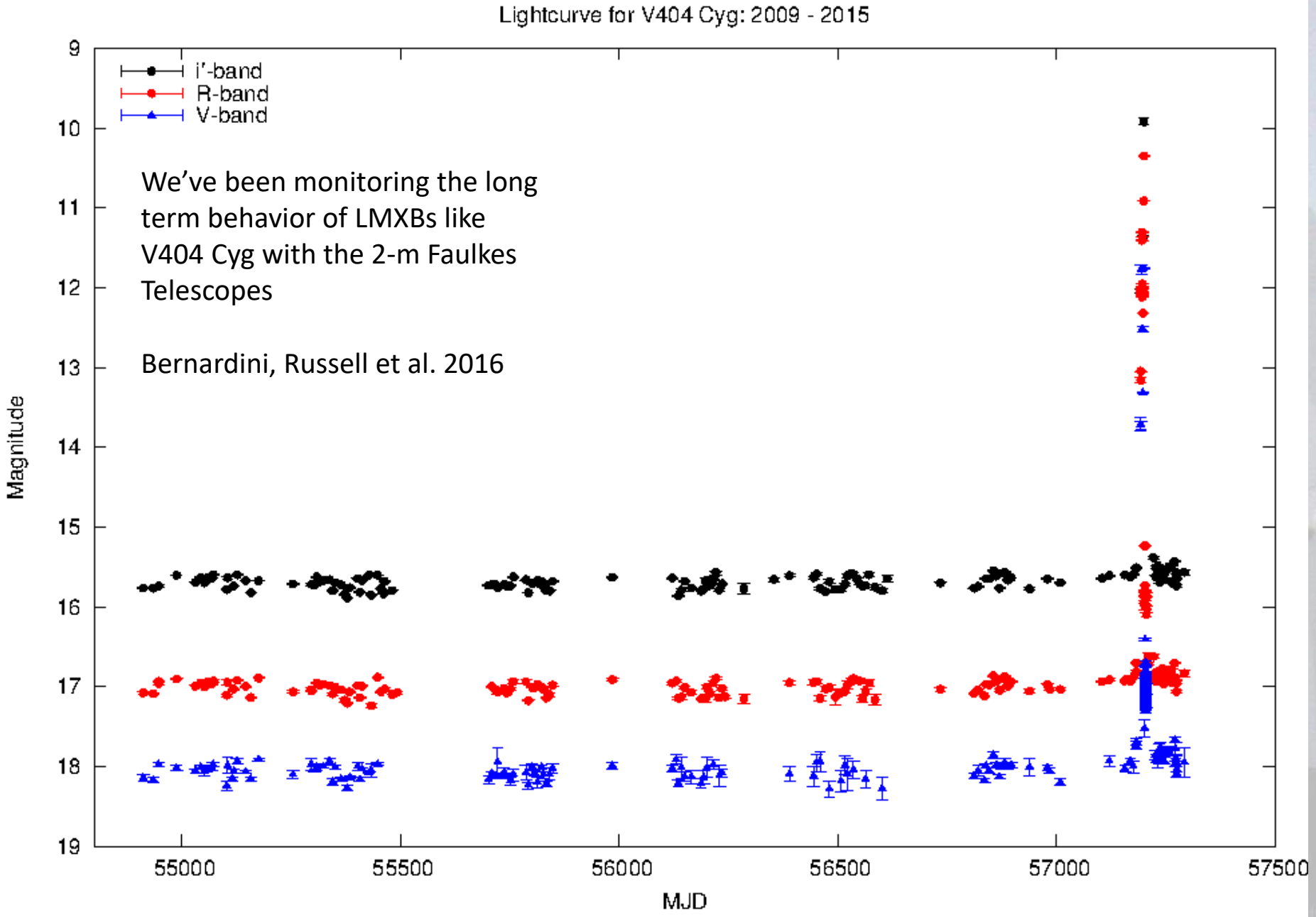
→ Cadence: about once a week or so, can increase frequency if necessary (e.g. outbursts)

→ Tracking the X-ray variations of XRBs in quiescence is generally not possible, so optical monitoring provides the best means to measure mass accretion rate variability between outbursts

FTN (Haleakala on Maui, Hawaii)

FTS (Siding Spring, Australia)

Long term optical monitoring of V404 Cyg



X-ray Binary New Early Warning System (XB-NEWS)

We received a grant to develop a pipeline that automatically:

1. Interrogates the LCO data archive several times per day (can do e.g. once/hour or less – minimum is 1 min)
2. Downloads all data of our target list, and calibration files
3. Flux calibrates the data, checks for flat reduction errors
4. Produces light curves in near real-time and puts them online
5. Alerts us when a new outburst is happening (or other interesting activity)
6. Reduces all our 13 years of data
7. Make the pipeline publicly available (github) with a user manual

We will then be able to alert the community of a new outburst at the very early stages (via an ATel) and trigger multi-wavelength observations

- The grant funds a Researcher at NYUAD: Dan Bramich (Oct 2017 – Sep 2019)
- We expect the first XB-NEWS announcements in the next few months
- Current status: astrometry done (using GAIA positions), photometry via source extractor (aperture and PSF) done, flux calibration done in most filters using ATLAS-REFCAT2 catalogue (which includes PanSTARRS DR1; got y-band separately) and APASS BVgriz all-sky catalogue, alerts and webpages in progress, fixing some issues

Stay tuned for XB-NEWS alerts!

John Dennehy
June 18, 2018

SHARE

Emirati astronomer collaborates with NYUAD on black holes research

▶ Thabet Al Qaissieh built an observatory as a hobby and is now working with one of the most prestigious universities in the world

Emirati astronomer Thabet Al Qaissieh built Al Sadeem Observatory at his family's farm in Al Wathba. Antonie Robertson / The National

An Emirati amateur astronomer who built an observatory on his family's farm is collaborating with NYU Abu Dhabi on research into black holes.

Images taken at Thabet Al Qaissieh's Al Sadeem observatory in Al Wathba are helping to verify if a new system discovered in March contains a black hole.

The "black hole candidate" is about the size of Abu Dhabi, one of the brightest discovered in years and is about 10,000 light years from Earth. That's close in astronomical terms, although too far to affect Earth. But this research could help if one day a black hole turns up next door.

David Russell, an assistant professor of physics at NYUAD, is leading the university's research team.

"When this system developed and became really bright, we thought let's observe this with a telescope. I contacted Sadeem... and we started getting fantastic data," he said.

According to Prof Russell, it's 90 per cent certain that the system is a black hole, but more research is needed. Other telescopes around the world are also being used.

"It feels surreal," Mr Al Qaissieh said of the joint effort with NYUAD. "We are working with top-notch scientists to study objects beyond my wildest imagination. If all goes well, it could be something we contribute to space discovery."

EDITOR'S PICKS


Crown Prince of Abu Dhabi unveils one of Middle East's biggest defence groups
Government


Middle East 'must spend billions' to confront climate change
Environment

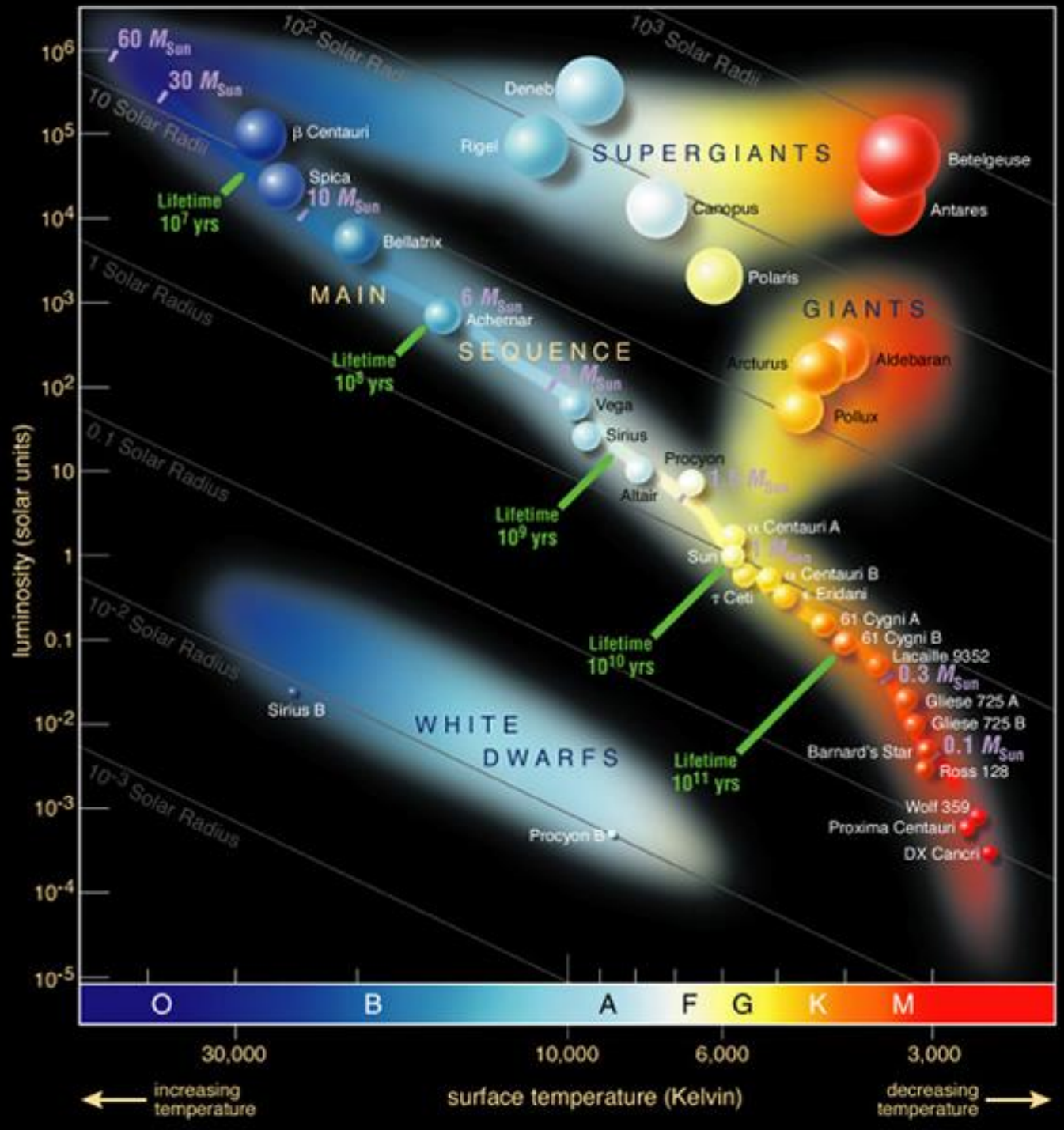

How Iraqi conflict altered art
Art


The Debt Panel: 'I maxed out my credit card after leaving the UAE. What happens now?'
Money


Natacha Atlas shakes off her 'belly-dancing' image with new music
Music

Thabet Al Qaissieh and his team at Al Sadeem Observatory ended up taking >4000 images for us in 2018-19

Article in "The National"


luminosity (solar units)
10^6
10^5
10^4
10^3
10^2
10
1
0.1
10^{-2}
10^{-3}
10^{-4}
10^{-5}
60 M_{Sun}
30 M_{Sun}
10^2 Solar Radii
10^3 Solar Radii
10 Solar Radii
1 Solar Radius
0.1 Solar Radius
10^{-2} Solar Radius
10^{-3} Solar Radius
β Centauri
Spica
10 M_{Sun}
Lifetime 10^7 yrs
Bellatrix
MAIN
SEQUENCE
6 M_{Sun}
Achernar
Lifetime 10^8 yrs
Deneb
Rigel
SUPERGIANTS
Canopus
Betelgeuse
Antares
Polaris
GIANTS
Arcturus
Aldebaran
Pollux
2 M_{Sun}
Vega
Sirius
Procyon
1.5 M_{Sun}
Altair
Lifetime 10^9 yrs
α Centauri A
1 M_{Sun}
Sun
α Centauri B
ε Eridani
τ Ceti
Lifetime 10^{10} yrs
61 Cygni A
61 Cygni B
Lacaille 9352
0.3 M_{Sun}
Gliese 725 A
Gliese 725 B
Barnard's Star
0.1 M_{Sun}
Ross 128
Lifetime 10^{11} yrs
Wolf 359
Proxima Centauri
DX Cancri
Sirius B
WHITE
DWARFS
Procyon B
O
B
A
F
G
K
M
30,000
10,000
6,000
3,000
increasing temperature
surface temperature (Kelvin)
decreasing temperature

The Colour Magnitude Diagram (CMD)

The Colour Magnitude Diagram (or CMD) is a plot of observational data (see Figure 1) which shows how a population of stars can be plotted in terms of their brightness (or luminosity) and colour (or surface temperature). The fact that we are able to interpret a star's colour as a measure of its temperature is based on the idea that stars can be considered as black-body sources, enabling us to use **Wien's Law**. It is this temperature which we can use to plot the star's **spectral type** on the x-axis.

The first work in this area was conducted, in 1911, by the Danish astronomer Ejnar Hertzsprung, who produced a graph of stars' magnitudes against their colours. Independently in 1913, the American Henry Russell, showed that there did appear to be some sort of relationship between a star's luminosity and its temperature, and that stars fell into distinct groups. Such a plot is now known as a Hertzsprung-Russell (or H-R) diagram. These theoretical diagrams have since been reproduced for stellar populations such as open and globular clusters and even for galaxies.

If all stars were alike, all those with the same luminosity would have equal temperature and we might expect hotter stars to always be brighter than cooler ones. The diagram below suggests that stars populate specific areas of the CMD. In fact, Figure 1 goes even further and overlays a set of lines denoting where stars of equal radii lie.

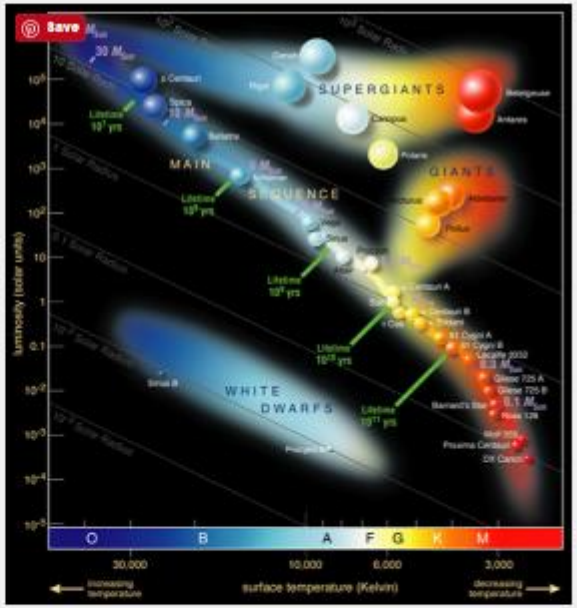


Figure 1: A colour magnitude diagram.
Credit: ESO (http://www.eso.org/public/images/)

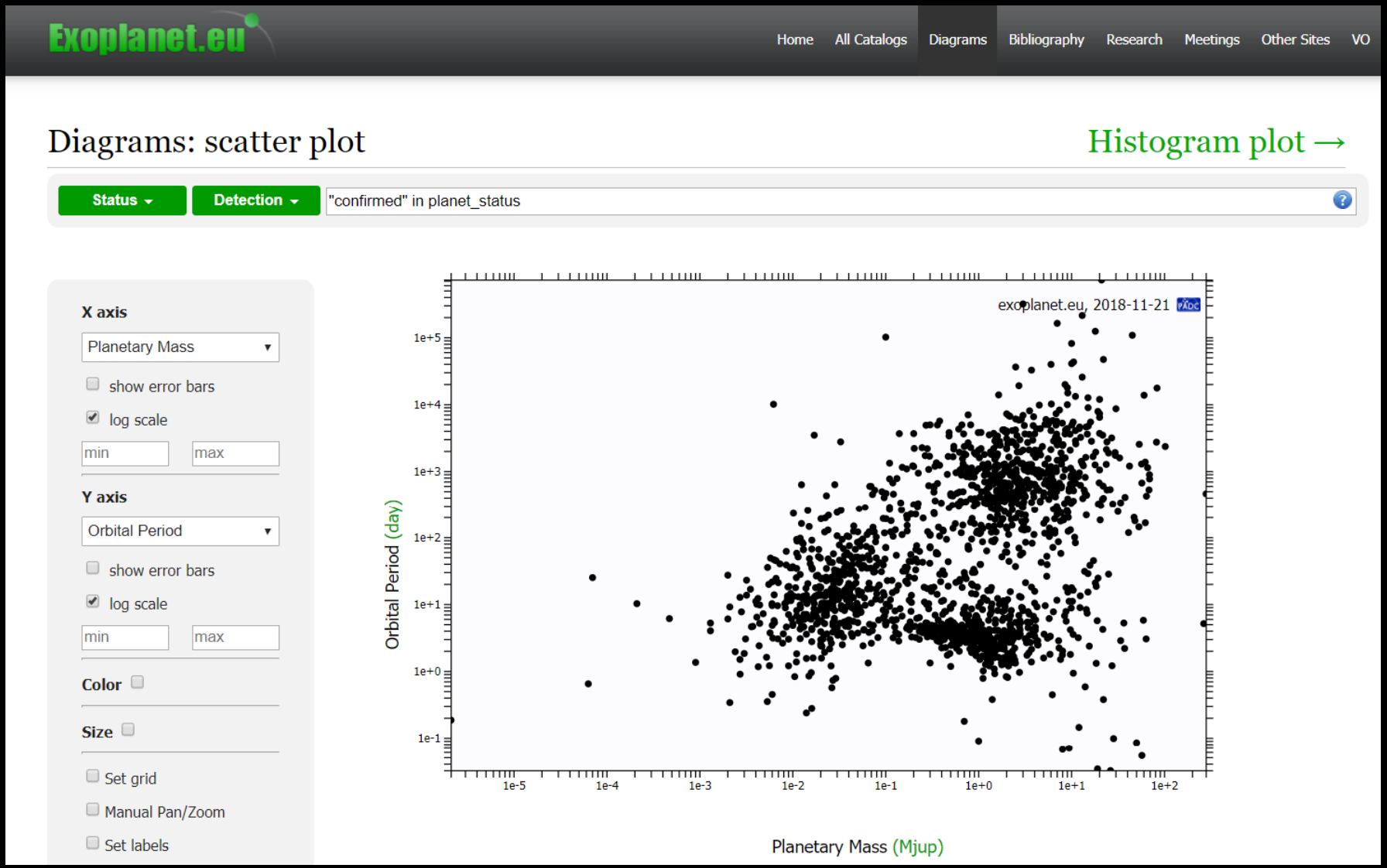
There appear to be four distinct areas where the stars lie:

- A diagonal band of stars running from bright, blue stars to faint, red stars, known as the **main sequence**
- A horizontal strip of extremely bright stars with a range of colours from blue to red (denoting a range of temperatures from hot to cool), known as **supergiants**
- A grouping of red stars lying above (so brighter than) and to the right of the main sequence, known as **red**

Inquiry-based 'teacher-free' activity for students to learn about open clusters and HR diagrams as well as photometry (and all the nasty maths)

Can choose any one of 28 datasets or take their own observations with FT/LCO

https://www.schoolsobservatory.org/discover/projects/exoplanets/main



https://www.schoolsobservatory.org/discover/projects/clusters/main

first two of seven IBSE (guided) activities

Open Clusters
Exoplanets
Variable Stars
Supernovae
Compact Objects (black holes and neutron stars)
Asteroids
Computer Simulations

National Schools Observatory

Established (2004) to provide schools in the UK and Ireland with access to the Liverpool Telescope through a guided observing system, together with astronomy related content, news and learning activities.

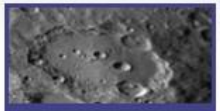
NSO Projects and Activities (no password)

Activities View Edit Grant

Here we have a selection of astronomy-related activities that combine elements of science, maths and ICT. The **projects** are collaborative ventures, with students from different schools working together to achieve the same goal, such as determining the path of an asteroid. **Workshops**, on the other hand, are self-contained lessons that can be downloaded and presented to individuals or groups.

For more detailed information, please select the appropriate link:

NSO Projects



NSO Workshops

edexcel

GCSE Astronomy

Maths and ICT

Name	Description	Age	Time
Moonsaic : 1 - 5	Assemble some mosaics of the Moon at different phases	7-14	1 hour
Hunting for Asteroids	Detect and calculate the velocity of nearby asteroids	7-16	1 hour
Lunar Craters	Investigate cratering on the surface of the Moon	7-16	1 hour
Quiz Corner	A few quizzes to test your knowledge of astronomy	11-16	15 mins
3-Colour Imaging	Learn about creating 3-colour images using LTImage	11-18	1 hour
Gravity Workshop	See how the effect of gravity changes on different planets	14-19	1 hour
Galaxy Classification	Identify the different types of galaxy in the Universe	14-19	1 hour
Sunspots Workshop	Look for patterns in surface activity on the Sun	14-19	1 hour
Seeing Workshop	Investigate why stars twinkle and why it's a problem	14-19	1 hour
Tides Workshop	Discover what causes the tides in Earth's oceans	14-19	1 hour

Investigations | Calculations | Physics | GCSE Astronomy | Activity

OpenScience Observatories at the Observatorio del Teide

from September 2016

COAST

PIRATE

telescope.org

telescope@open.ac.uk

What is “Down to Earth”?

A STEM project based around the science of asteroids, comets, meteorites and impacts

Inquiry-based science education (in several languages)

Multi-disciplinary (astronomy, geography, geology, physics, maths, IT) and suitable for many age groups

Extremely Relevant !

Chelyabinsk meteor, 15/02/13

Loan Boxes

Dinosaur fossils

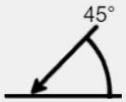
Ammonites

Meteorites

Projectile diameter

8100 m

Trajectory angle



Projectile velocity

Projectile density

Porous rock

Target density

Igneous rock

Distance from crash site

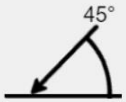
119 km

Reset ? Submit

Projectile diameter

8100 m

Trajectory angle



Projectile velocity

Projectile density

Porous rock

Target density

Igneous rock

Distance from crash site

119 km

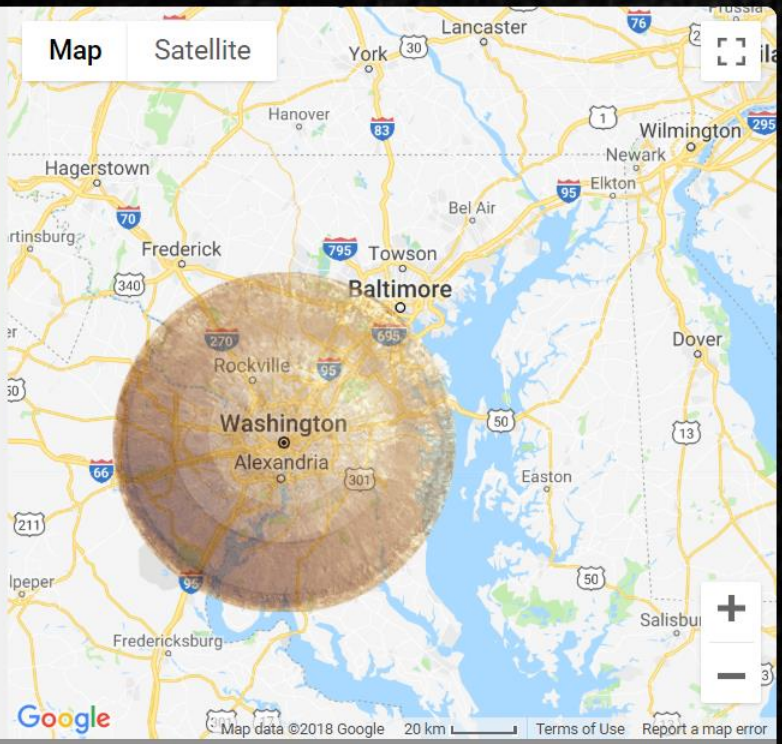
Reset ? Submit

Impact values

Parameter	Value
Crater depth	1,211 m
Crater width	107,844 m
Ejecta thickness	81.46 m
Break-up altitude	87,701 m
Wind velocity	3,073 m/s
Richter magnitude	10
Sound pulse amplitude	143 dB

New York

Click the map to place the crater...



Some of Other (FT) Projects

VR/AR material via RAL, Gaia, ISS

Please talk to me or
e-mail me your ideas

fraser.lewis@faulkes-telescope.com

http://faulkes-telescope.com

http://resources.faulkes-telescope.com

http://education.down2earth.eu

http://www.schoolsobservatory.org.uk/

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