

Solar Siblings

www.oursolarsiblings.com

Our Solar Siblings (OSS) is an Australian-based high school level astronomy curriculum replacement project open and free to any interested high school. OSS is an education partner of LCO.global. We provide curriculum materials, training and support to teachers to facilitate the non-trivial and effective use of these robotic telescopes within the everyday high school classroom in order to improve a variety of outcomes for all students. We also provide direct mentoring to students undertaking independent research projects. This classroom approach is primarily driven by three major sequential projects. In the first, students examine telescopes, the night sky, the objects it contains and plan their observation sessions with the LCO telescopes. In the second, students learn about how and why we use fits images in the context of colour imaging as a means to explore and understand objects in the cosmos leading onto covering the structure of the universe and the big bang. The third project has material for Yrs 11/12, the IB and for independent research projects.



ALIGNING THE COLOURS IN THE IMAGE
The blue, green and red images may not be lined up exactly. To correct this, we need to zoom in and line up the images accurately.

STEP 1 Using Ctrl + and Ctrl - to zoom closely into a star in your image.

If your image is not aligned correctly, you may notice that the Green and/or Red image of the star is offset from the Blue image of the star.

STEP 2 To align the image, you will move the green and/or the red layer.

To move a layer, first turn off the layer you do not want to move by clicking on the eye icon.

STEP 3 Select the layer you want to move, then select the **Move tool** from the toolbar.

STEP 4 If necessary, repeat this for the other layer you need to line up. You might need a few tries to get the two layers to align with the blue layer exactly.

Now click and hold down the left mouse button on the actual image and drag the selected layer around until it is lined up as best you can. (Try also holding Ctrl and/or Alt while doing this).

Discovering Deep Sky Objects

In the list below, we have given you the names of 16 different types of object in the universe. It is not a complete list. These, however, form a good list of objects that are relatively easy to image, quite beautiful to look at and represent a good range of types of objects in the universe.

1. Young Open Cluster
2. Old Open Cluster
3. Globular Cluster
4. Spiral Galaxy
5. Barred Spiral Galaxy
6. Elliptical Galaxy
7. Irregular Galaxy
8. Starburst Galaxy
9. Lensoidal Galaxy
10. Interacting Galaxies
11. Dwarf Galaxy
12. Galaxy Cluster
13. Emission Nebula
14. Star forming region
15. Planetary Nebula
16. Reflection Nebula

TASK
Pick one of type of object from the above list and answer the questions that follow.

Student Name(s): _____

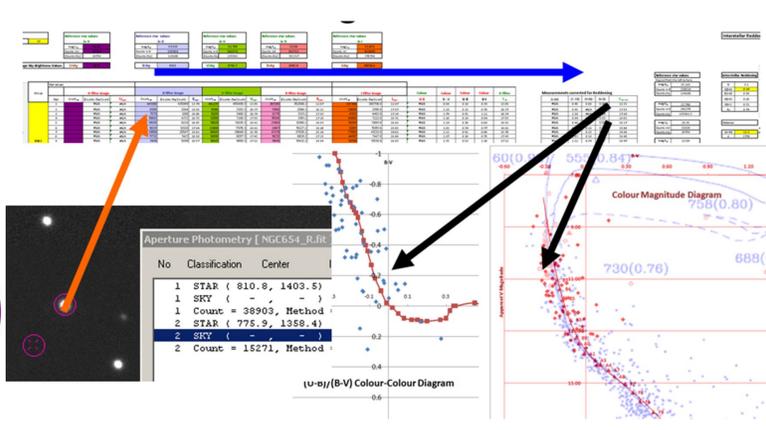
Type of Object: _____

QUESTIONS
What type of object is this? Give a short description of this type of object that you will share with the class.

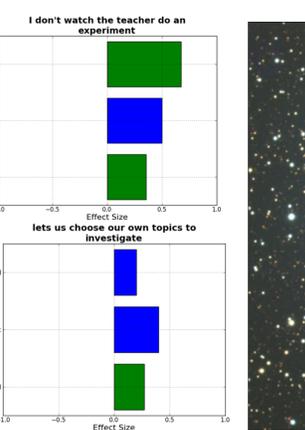
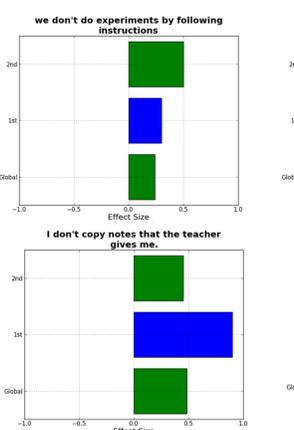
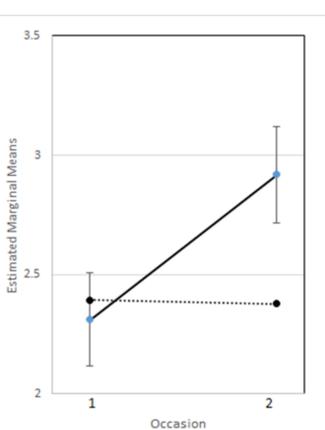
Each of the objects in the list above are related to each other in many ways. The below diagrams can be used to represent certain relationships between them. Try and place the objects in the list into likely boxes using the groups and tips provided.

The Milky Way

- Shows type of object
- Has a single member in the system
- Has a bar or spiral arms
- Count and label
- Has a star like the sun



OSS's aims are to 1) Increase students' understanding and appreciation for the Universe around them; 2) Increase students' appreciation for the true methodology and approach of science; 3) Increase the probability of students choosing science other than as a potential personal interest, as a topic for higher level study or as a potential future career path; 4) Involve the nontrivial use of real astronomical data from a real research grade telescope; 5) Enable students to take their research to a natural scientific conclusion in the form of a scientific publication. We focus on Year 10 in Australia which is the last year of compulsory science before they choose to continue or discontinue physics in Year 11/12. Our endeavour is to shift this ratio. Year 10 is also the main year that astronomy is in the national curriculum. There are currently a variety of astronomical publications resulting from student research as well as educational publications describing the outline, design, effectiveness and other issues.



THE ASTRONOMICAL JOURNAL, 149:190 (7pp), 2015 June
© 2015, The American Astronomical Society. All rights reserved. doi:10.1088/0004-6256/149/6/190

PHOTOMETRIC AND PROPER MOTION STUDY OF THE NEGLECTED OPEN CLUSTER NGC 2215

M. T. FITZGERALD^{1,2}, L. INWOOD³, D. H. MCKINNON², W. S. DIAS^{5,6}, M. SACCHI⁴, B. SCOTT⁷, M. ZOLINSKI⁷, L. DANAIA⁴, AND R. EDWARDS⁷

¹Department of Physics & Astronomy, Macquarie University, Sydney, Australia
²School of Education, Edith Cowan University, Joondalup, WA, Australia
³Denison College, Bathurst Campus, Australia
⁴School of Teacher Education, Charles Sturt University, Bathurst, Australia
⁵UNIFEL, Instituto de Física e Química, Universidade Federal de Itajubá, MG, Brazil
⁶Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo, Cidade Universitária, Brazil
⁷West Kildonan Collegiate, Winnipeg, Manitoba, Canada

Received 2012 April 20; accepted 2015 April 1; published 2015 May 18

ABSTRACT

Optical *UBVRi* photometric measurements using the Faulkes Telescope North were taken in early 2011 and combined with 2MASS JHK_s and WISE infrared photometry as well as UCAC4 proper motion data in order to estimate the main parameters of the galactic open cluster NGC 2215 of which large uncertainty exists in the current literature. Fitting a King model we estimate a core radius of 1.12 ± 0.04 (0.24 ± 0.01 pc) and a limiting radius of 43 ± 0.5 (0.94 ± 0.11 pc) for the cluster. The results of isochrone fits indicates an age of $\log(t) = 8.85 \pm 0.10$ with a distance of $d = 790 \pm 90$ pc, a metallicity of $[Fe/H] = -0.40 \pm 0.10$ dex, and a reddening of $E(B - V) = 0.26 \pm 0.04$. A proportion of the work in this study was undertaken by Australian and Canadian upper secondary school students involved in the Space to Grow astronomy education project, and is the first scientific publication to have utilized our star cluster photometry curriculum materials.

OSS officially began in October 2014. The in-class approach, though, has been rigorously evaluated and continuously reformed in response to student and teacher feedback over the past seven years. Evaluation of the content knowledge and attitudinal results from the students paints a fairly clear picture that the OSS materials have a strong impact on their classroom practices and understanding but also that there are many areas that also need to be addressed and aspects that need to be improved. Nevertheless, the 430 students (out of 5000+) who presented both pre and post data pre-2015 show a moderate strength (Cohen's $d = 0.368$) and statistically significant ($p < 0.0001$) content knowledge gain as well as a variety of strong changes in the nature of their experiences in the classroom. More recent shifts using the newer approaches are of the order of Cohen's $d = 1.0$. We seem to have solved the content knowledge problem, we are more focused at the current level of development on shifting students' attitudes towards science and their understandings of the nature of science and scientific inquiry. Please see our latest newsletter online and the materials near the poster.