



Global Sky Partners

Report on activities **Dec 2019 - Aug 2021**



Executive Summary

The primary aim of this program is to inspire, educate and provide authentic scientific experiences through the use of the LCO robotic telescope network. Through this opportunity, LCO aims to inspire audiences in underrepresented communities and the developing world, reaching audiences who would not normally be able to take part in programs involving professional scientific equipment.

The 2020 cohort of Global Sky Partners ran from 1 Dec 2019 to 1 August 2021. This period covers 3 observing semesters for LCO, instead of the usual 2 semesters. Twenty projects were selected by an independent review committee, from the open call for applications in December 2019. LCO then extended the 2020 observing semesters, because of the impact of COVID, and our partners requested changing the GSP year to start in August as a more favorable start date for educators. In extending 2020 Cohort through July 2021, thirteen of the 2020 partners were successful in reapplying. Additionally nine new partners joined the program from a supplemental call in June 2020, bringing the total number of Global Sky Partners to 29.

The programs these partners led served a total audience of over 24,000 individuals and used over 2300 hours of observing time on the LCO educational network of 0.4-meter telescopes. Despite the global pandemic the audience of the Global Sky Partner program is over twice the size, more diverse and has a larger geographic reach than in previous years.



Pilot Partners

In 2020 we introduced the ability for people to apply to be a pilot partner. These projects are limited to 10 hours. They are for groups to try out an idea for an educational project using LCO in between proposal calls. We have found that project leaders who are inexperienced in either running educational projects, using robotic telescopes or both, require more assistance initially. Becoming a pilot partner allows them to experiment and tune their goals with a small audience without the commitment of being a full partner. The aim is for the pilot partners to gain confidence and apply to be full partners at the next proposal round. Having eliminated at least some of the logistical challenges in their program, the partner will be able to focus on the educational aspects and enjoy more success.

We received 2 applications to become pilot partners in 2020. After extensive mentoring in their pilot program, both of these partners led proposals in the 2021 call which were successfully selected for the 2021 cohort.



Impact of COVID-19 pandemic

The COVID-19 global pandemic has had a profound effect on educational projects worldwide. To assess the impact on Global Sky Partners, and find out if we can help them achieve their goals, we asked all partners to complete a short survey about the impact of the pandemic.

We found that inevitably some partners were forced to pause their activities because their project either involved extensive face-to-face contact or because of their personal circumstances. However, the majority of partners said that COVID-19 lockdowns had given them an opportunity to improve their programs.

50% of partners reported COVID-19 had negatively impacted their program

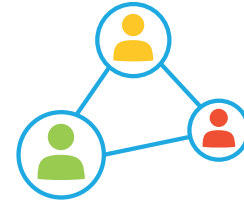
68% of partners saw an increase in demand for their LCO projects

8 out of the 29 partners had to cancel their programs*

* 1 partner left because the PI moved institutions; 1 partner left because of political instability in Haiti making their program unsustainable; the remaining 6 cited the pandemic as the main cause for their programs ending.

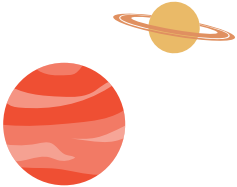
Partner Support

Each month we host a forum for all the partners to discuss their programs, ask for support and share their challenges and successes. There is an informal talk at each meeting by a partner, showcasing their program to the other partners. We regularly match experienced partners with new partners, who need advice on their educational programs. These interactions have allowed us to increase our intake of partners, and not be overwhelmed by support queries.



Exoplanet Partnership

In addition to this, there has been a collaboration between partners who are interested in exoplanets. This Exoplanet Partnership involves 5 Global Sky Partners and provides support for their own audiences to contribute to the Exoplanet Watch partner. One partner (MicroObservatory) has invested their resources in developing a web platform for sharing and analysing data from LCO's telescopes. Another partner (Our Solar Siblings) has created a web tool to streamline submitting requests for exoplanet transits to LCO (via our APIs).



Audience

Audience Survey

We ask every cohort of partners to share our audience impact survey with their audiences. In this cohort the survey showed that Global Sky Partners had an overwhelming positive impact. After being involved in a Global Sky Partner program, and particularly using LCO telescopes, data and resources:



96 % said "I can contribute to science"

91 % said "I enjoy working on science projects and would like to be involved in them in the future"

85 % said "I am confident in my ability to do science"

Reach and Demographics

The program used 2306 hours of 0.4-meter telescope time during a 20 month period, consisting of 5411 requests for observations. 83% of them were completed successfully. This is significantly higher than previous years but is unsurprising because:



The reporting period is 20 months instead of 12 (see explanation above)



Pandemic created a greater demand for online projects.



9 new partners joined in July 2020.

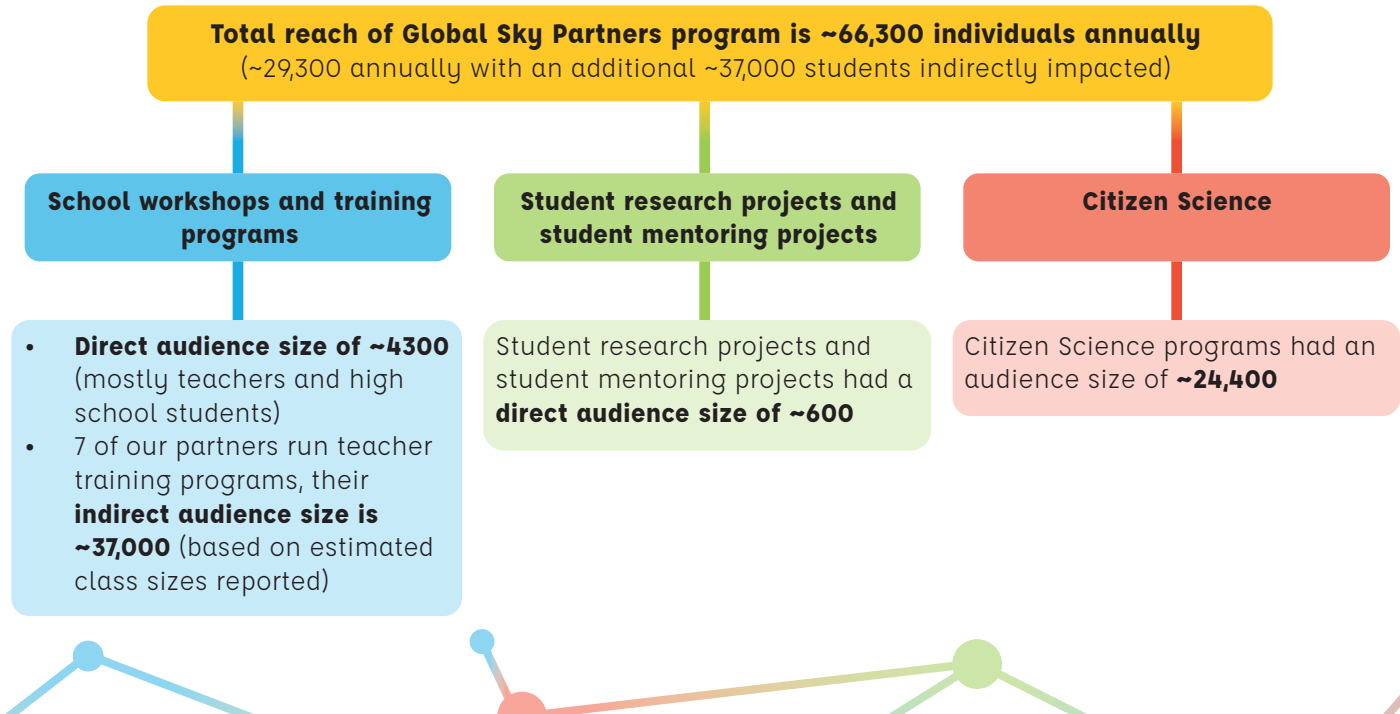


More research investigation-type projects than in previous years.

The partners reported that they have had more requests for research projects than full-class or teacher workshops than in previous years, due to the virtual learning emphasis of schools during the pandemic.

The programs fall into 3 broad categories, with the audience breakdown for each category shown below. The reported size of the audience for the 2020 cohort has more than doubled (2.2 times) compared with 2019.

Given that during the Covid-19 pandemic many educational programs saw a decrease in their engagement, this is a testament to the versatility of the Global Sky Partners program as a whole, and the perseverance of the individual partners. Many partners were either already running, or quickly adapted to running their programs virtually. The unique way that LCO operates is a perfect complement to this.



Audience Region

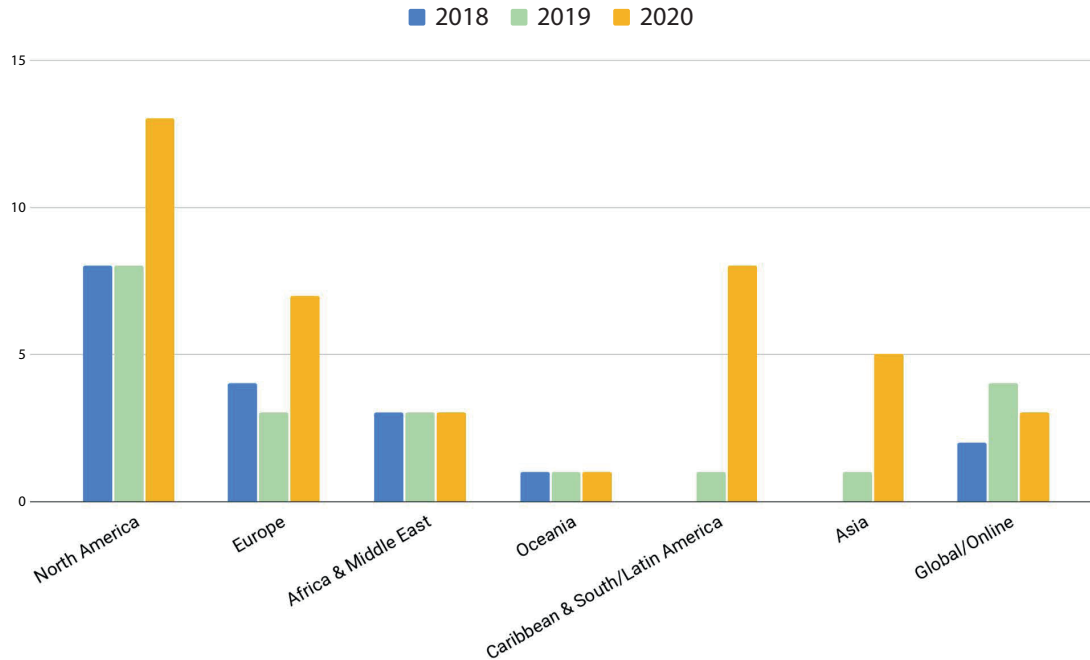


Figure 1. Geographic spread of partner audiences by region comparing Global Sky Partner programs for the 2018, 2019, and 2020 cohorts.

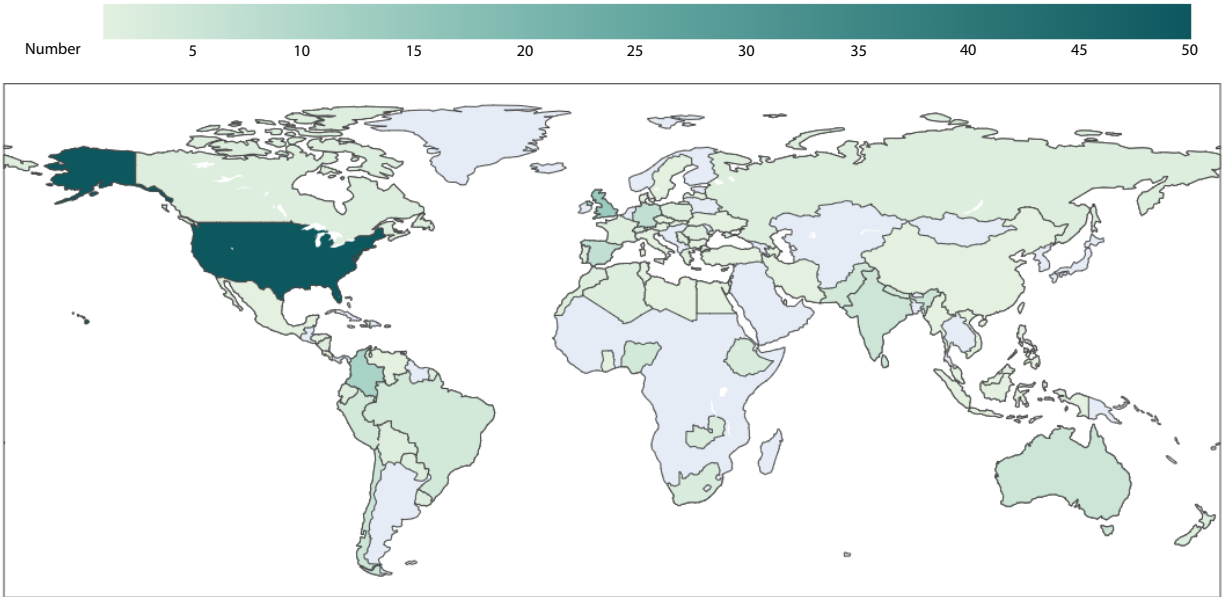


Figure 2. Geographic spread of partner audiences for 2020 cohort. Global Sky Partners had a presence in 66 countries. The color scale indicates the number of impacts partners had in each country.

Audience Demographics

From partners offering mentoring, workshops and training programs, with a total audience size of ~3900 individuals:



21 % of the audience are from disadvantaged or underrepresented communities or developing world countries with a **further 31%** being from mixed representation



14 % of the audience were mentored in publication quality research projects



68 % of the audience took part in workshops and teacher training



47 % of the audience were high school students



41 % of the audience were teachers.

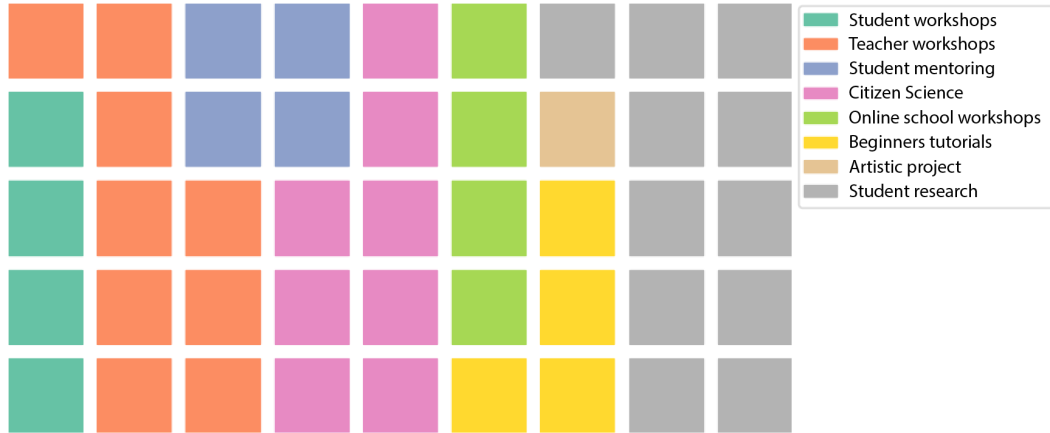


Figure 3. Activity breakdown by partner. The number of boxes indicates the number of partners involved in the labelled activity. Some partners are involved in multiple activities.

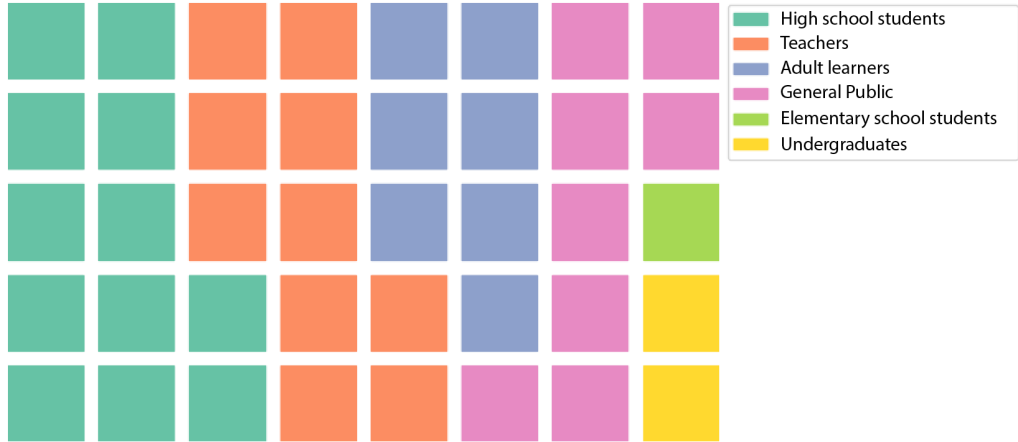


Figure 4. Audience breakdown by partner. The number of boxes indicates the number of partners targeting the labelled audience. Some partners target multiple audiences.

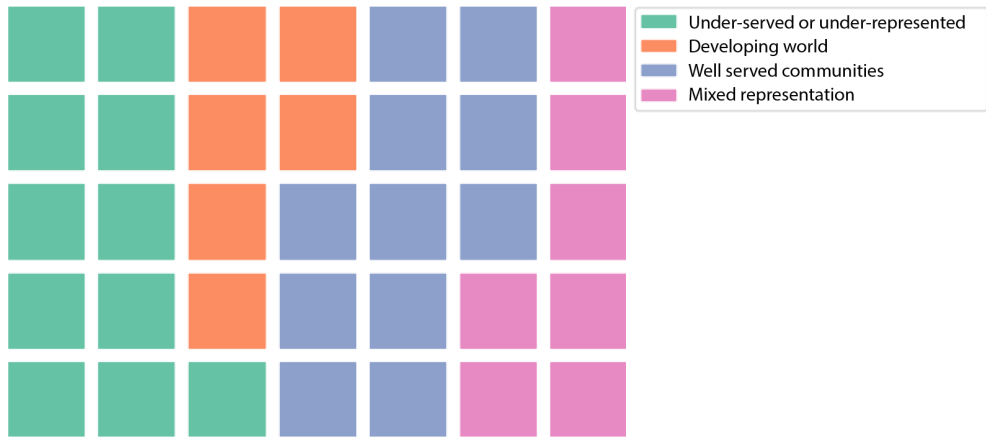


Figure 5. Audience demographic breakdown by partner. The number of boxes indicates the number of partners targeting the labelled demographic. Some partners target multiple demographics.

Achievements

The following publications are by high school students in peer-reviewed journals, as a result of investigations through Global Sky Partners in 2020:



14 papers published in **Journal of Double Star Observations**,

4 papers published in **Astronomy: Theory, Observations and Methods Journal**

2 papers published in **Research Notes of the American Astronomical Society**

1 paper published in **Monthly Notices of the Royal Astronomical Society**



7 talks were presented at the June 2020 **Society for Astronomical Sciences** conference



9 papers are in preparation for publication in **Journal of Double Star Observations**, again by high school students



1 partner used LCO images in their **press release** about the renaming of an exoplanet system to honor Haitian independence.



2020 Partner Programs



North America

Aninoquisi To'sdigo'ti'a

student workshops

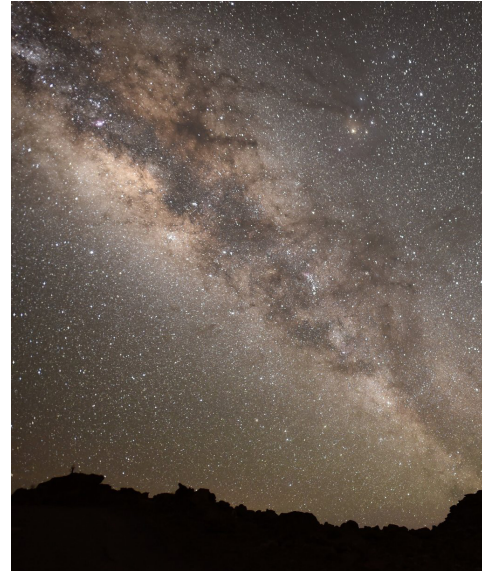
Aninoquisi To'sdigo'ti'a (We see the stars) engages middle and high school students in the Eastern Band of the Cherokee Indians in a science project to observe exoplanet transits in nearby stars. Due to the pandemic, it was not possible with the intended school so in the end they worked with a nearby charter school.

They conducted a citizen science project to observe the transit of an exoplanet around WASP 131. The program involved 5-6th grade students from a school in southern Appalachia with a historically underserved population. Students were coached on observing with LCO and analysing their data using AstrolmageJ. They also discussed how robotic telescopes are used in astronomy and how citizen science observations such as this help identify timing variations that will help space missions like ARIEL carry out their mission.

Location North Carolina

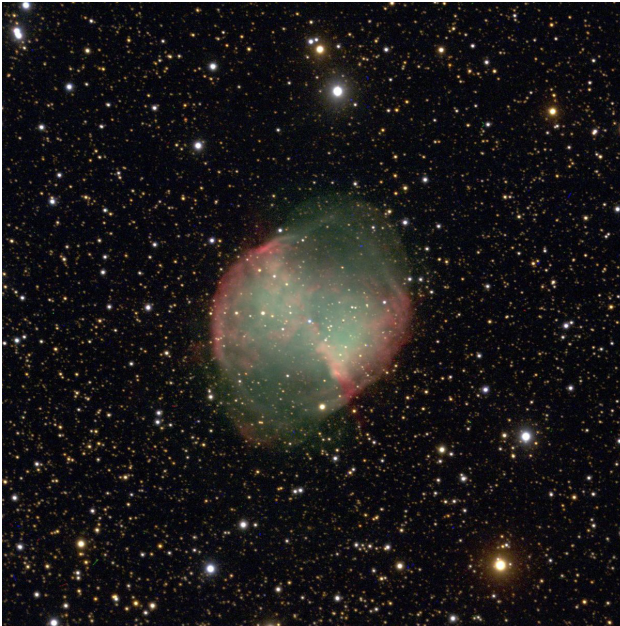
Demographic High school students from disadvantaged areas

Size 20



Cosmic Adventures by Orange County Astronomers

beginners project



[Cosmic Adventures](#) is an "inreach" program of the Orange County Astronomers, providing members with opportunities to do real astronomical research and activities of scientific value. There is a significant aspect of this program for the youth members of the group which is modeled after the program "*100 hours for 100 schools*", providing basic astronomy inspiration and awareness through robotic telescopes. The membership of the Orange County Astronomers is 800.

An exoplanet investigation by one of their junior members is being prepared for submission to a peer-reviewed journal.

Location California

Demographic Astronomical society members

Size 200

Authentic Ground-based Astronomy Research for Teens and Young Adults

student research

This program brings astronomy research opportunities to youth groups (high school age) in out-of-school and after-school settings. They are given instruction on the research process and then work in groups to conduct a project, selecting from several options, including double star astrometry, RR Lyrae photometry, exoplanet and asteroid light curves, variable star light curves and gamma ray burst follow-up optical observations. This program is based in part on the Astronomy Research Seminar, taught for the past 10 years at Cuesta Community College. Student groups propose and then carry out a study of a double star system or several systems, collecting and analyzing data and writing up their analysis in a paper for publication in the Journal of Double Star Observations, all within the time frame of a single semester. Students present their project results in either an online or in-person meeting.

They created a game to introduce the general public to the idea of light curves, called [Exoplanet Finder Game](#). It uses LCO data collected by high school students in their program.

Two of their students participated in the 2021 AAVSO (American Association of Variable Star Observers) conference, one with a poster and the other with a talk about their project using LCO. Both of these students have changed their planned career path after being involved and actively identify as "scientists".

Location Northern California

Demographic High school students from disadvantaged areas


Size 46

Glendale Community Project

student research

The Glendale Community College Astronomy Club has many students eager to engage in an honors-level science experience. This partnership merged the honors students and club members into one research cohort and engaged them in the authentic practice of experimental design and execution.

The project used LCO to study exoplanet transits and intrinsic variable stars. The LCO images supported students' research and written communication projects, which are both required components of their Honors curriculum. The classes observed and analyzed the time-series images to determine properties of the objects, then they wrote up their findings into journal-article format papers.



Studying NGC 457 'The Owl Cluster' with Glendale Community College

Brian Gleim, Prof. Victoria White
Glendale Community College

ABSTRACT

The Students of the Glendale Community College 212 decided to study Open Star Clusters the new semester. We students each chose our own cluster and all studied a different one.

We used our knowledge from the stars to observe the star cluster, we learned how to use the telescope and how to use the camera and how to use the computer to get the most accurate results.

We created graphs to calculate the magnitude, we also used telescopes located around the world to get images of the cluster which is where we draw the information from.

INTRODUCTION

In the Spring of 2019 the Honors A&T 112 Class at GOC decided to study star clusters. Specifically we chose to do Open Star Clusters. We used the Las Campanas Observatory's telescopes to get the images needed to study the clusters. Our reason for choosing open clusters was to get their real astronomy and make the discovery for ourselves.

With the images taken in the telescopes, we used several different programs to identify the age of the cluster and how far away it is. We first looked down all the stars magnitudes in all the filters. We then compiled this into to determine their mass and luminosity. With that we could calculate the distance. We measured the color of the stars and where they fell on the Main Sequence diagram. This allowed us to determine the age of the stars and overall cluster.

We were unable to see our actual cluster in our own town. However, we did get experience with how the telescopes at a different level in the semester.

METHODS AND MATERIALS

We used the Las Campanas Observatory's telescopes to take images of the cluster. We used their location of our object and the exposure time. We used in three different filters to see how to best when time worked best. More

RESULTS

The first image below is an image the Las Campanas Observatory created to show the Owl Cluster in color. This color requires green light to be used in the program imaging. In reality the Owl Cluster has blue and red stars.

The Owl Cluster has a wide variety of stars, it has both blue and red giants as well as white dwarfs. I came to this conclusion by looking at the color diagram shown below. According to my study the Owl Cluster is a few billion years old. I found this out by looking at the highest mass main sequence star. This star turned out to be a B star, it also burned out it is 631 parsecs away.

However, there is a 2.02 average of instability modeling. This means the stars appear redder and/or farther from their actual age.

DISCUSSION


The B4 is the second highest mass star on the chart I was using. That means this star is huge and extremely bright, it's also very close.

Other studies have shown that the owl cluster is 21 million years old. My observations were slightly off but pretty close.

However, for a college project not being helped by NASA or anything it went pretty well. Inconclusives may be in my observations and my answer. I was able to learn a lot on how astronomers use tools to find out information about the universe.

The main goal of this experiment was to learn how astronomers study the universe. It was also about picking an open star cluster and using tools to determine age, distance, and instability.

If I had more time and was getting together with more astronomers I could probably get an exact result. However over the course of a few weeks this was a pretty neat job.



Location Arizona

Demographic Non-science major community college students and high school students

Size 14

Observe with Einstein

student workshops

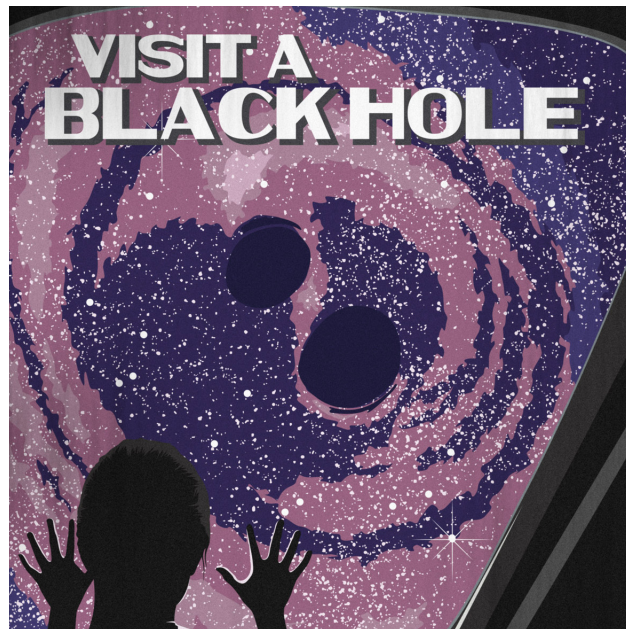
Activity cut short due to COVID

Participants in this program have the opportunity to communicate and work with other participating schools around the world. Together, they discuss gravity's effect in astronomy and discuss creative project ideas. These discussions about the nature of gravity, black holes and other compact objects, the detection of gravitational waves, and whether light can be affected by gravity are an important part of the program. From these discussions, they form a research plan and then use LCO telescopes to explore further.

Location Arizona

Demographic High school teachers

Size 24



Astronomy Research Seminars for High School and Undergraduate Instructors and Students

teacher workshops

student research

Astronomy Research Seminars are organized by the [Institute for Student Astronomical Research](#) (InStAR). Their mission is to develop, conduct, and promote the adoption of the Astronomy Research Seminar, which is an immersive, student team-based astronomical research experience for high school students. InStAR also serves as a central coordination site and resource for student research teams predominantly in the US to obtain resources, talk with other research groups, and to be a part of a growing community of practice.

The US audience comes from 6 high schools in 4 different states and the instructors come from colleges and universities in 8 different states in the US. A third of the student audience comes from high schools which have an enrollment from minority groups which is higher than the state average. High School students participate in the Astronomy Research Seminars alongside college students and instructors and high school teachers. Everyone participates in the process on equal footing, as research colleagues. Many of the high school students come from underserved communities and have been given scholarships by local grant sources or by the Institute for Student Astronomical Research.

Their audience is high school students and instructors around the US, Chile and Australia and college students and instructors around the US. 28 high school and college students and 19 instructors published 11 papers in the [Journal of Double Star Observations](#) between April 1, 2020-Jan 1, 2021. Also, 30 instructors attended their workshops about bringing astronomy research to their students using LCO.

Location

Across USA, Chile, Australia

Demographic

High school teachers and students

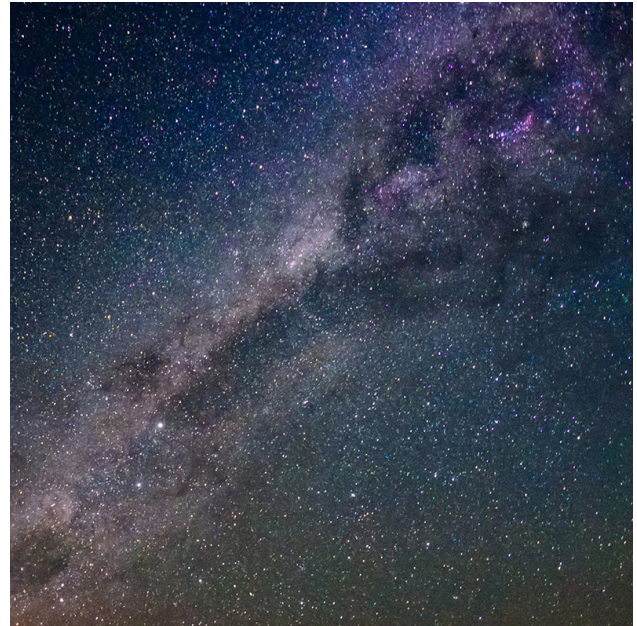
Size

125

Scintillating Citizens by Canada Aviation and Space Museum

citizen science

The Canada Aviation and Space Museum, in partnership with LCO, began a Citizen Science project to collect data on variable stars, called [Astrophysics at Home](#). Visitors to the museum website are taught what a variable star is, why they are important to study, and they then help monitor a specific star. Participants request data through the museum's website, which is then translated into an observation request and sent to LCO. LCO obtains the observations, processes the images, and sends analyzed data back to the citizen observer. Multiple observations were made over time, resulting in full light-curves, ready for analysis by astrophysics students at Carleton University.



Location Canada

Demographic General audience

Size 400

STEM through Astronomical Research

student workshops

student research



The [Boyce Research Initiatives and Education Foundation](#) (BRIEF) provides research opportunities to students to enhance their educational experience and introduce them to the scientific and technical communities. BRIEF provides, as its primary education mission, hands-on astronomy research experiences using LCO for high school students that result in published peer-reviewed papers.

BRIEF has developed three complimentary curricula using LCO, leading students through the essentials of requesting observations, making observations, analysing data, and writing publications for peer-review. Students investigate double stars and contribute exoplanet observations to the NASA TESS mission.

Their students have published 12 peer-reviewed papers in JDSO¹ and 1 in ATOM² journals. Their students also presented their work at 3 different professional conferences (RTSRE³, AAVSO⁴ and AAS⁵).

¹Journal of Double Star Observations

²Astronomy: Theory, Observations and Methods

³Robotic Telescopes, Student Research and Education

⁴American Association of Variable Star Observers

⁵American Astronomical Society

Location San Diego area

Demographic High school students and teachers

Size 400

Central and Southern America

Astwonomi Lakay

student workshops

Activity cut short due to COVID

Astwonomi Lakay is establishing an astronomy course in State University of Haiti via the National School of Geology and Science Faculty. A special astronomy curriculum is being developed using images from LCO's robotic telescopes, where students can prepare and present their research. Additionally they provide workshops for school and community groups, hosted around Haiti.

During 2020 Haiti was impacted not only by the global pandemic but also political unrest. The partner's efforts focus on providing workshops for high school students and undergraduates. Early in 2020 they used LCO to provide the press images for an international astronomy competition to [rename the exoplanetary system HD1502 as Independence - Citadelle](#), run by the International Astronomical Union.

Location Haiti

Demographic High school and undergraduate students, and general public

Size 80



Búsqueda y seguimiento de estrellas variables

Activity cut short due to COVID

undergraduate projects



The Astronomical Observatory of the Universidad Nacional Autónoma de Nicaragua in Managua does not have a telescope usable for student astronomy research projects. This project provides access to world class observing resources that support research projects for the undergraduate astronomy students. This partnership aimed to train astronomers and physicists of the future in Nicaragua.

Location Nicaragua

Demographic Undergraduate students

Size 4

Hiparcpia

teacher workshops

student workshops

Hiparcpia is a community group of secondary school teachers, high school students and science outreach practitioners who created this program. It provides training in astrometric and photometric follow-up of main belt asteroids and near earth objects for teachers in Paraguay.

During the pandemic the group has focussed their efforts on developing tools to observe, identify asteroids and analyze asteroids. Additionally they are developing a machine learning algorithm to help identify the type and family of their asteroids. This approach is different from a traditional asteroid approach which takes orbital parameters and processes them to find which family or group an asteroid fits into.

Location Paraguay

Demographic High school teachers

Size 40



Inclusive Astronomy

Activity cut short due to COVID

student workshops



The Inclusive Astronomy project is based at the El Minuto de Dios Ciudad Verde school in Colombia. They implement new technologies and methodologies to create gender-balanced astronomy workshops. These are targeted at students from vulnerable communities and those with special educational needs.

Location Colombia

Demographic High school students

Size 25

HELIOS Galileo Teacher Training Program

teacher workshops

student workshops

research projects

[HELIOS GTTP](#) is a Colombian heliophysics work and study group focused on outreach activities and teacher training on the sun and star variability. This group is made up of Galileo Teacher Training Program and Hands On Universe members, Medellín's Planetarium staff, teachers and astronomy enthusiasts. During 2020 they invested heavily in converting their in-person workshops to virtual.

They ran a successful series of 5 workshops for teachers observing and analysing variable stars using LCO. The participants were mostly from Colombia but also included teachers from Chile and Spain. The audiences now have regular observing campaigns to provide long term monitoring and analysis on 10 variable stars. Their results are being prepared for publication currently.

They also disseminated their practices at several international (and online) conferences during 2020.

Location Colombia

Demographic High school teachers and amateur astronomers

Size 200



Europe

ORBYTS

teacher workshops

student workshops

research projects

[ORBYTS \(Original Research by Young Twinkle Students\)](#) is an educational program in which secondary school pupils (16-17 y/o) work on scientific research linked to the [Twinkle Space Mission](#) with mentoring from PhD students and other early career scientists.

The goal of every partnership is that students will contribute towards publishable research. They get hands-on experience of working closely with scientists and doing scientific research. The program also addresses diversity challenges by dispelling harmful stereotypes and challenging any preconceptions about who can become a scientist.



Their sessions were moved onto Zoom during the pandemic. While this made some technical aspects more difficult, the project was still successful, with each year group becoming co-authors on a publication about their investigation.

Location UK

Demographic High school students

Size 70

PETeR

teacher workshops

student workshops

research projects

[Proyecto Educativo con Telescopios Robóticos](#) (PETeR) - An Educational Project with Robotic Telescopes. PETeR is an enquiry-based online lab which aims to familiarize the Spanish educational community with the scientific method and practice, while contributing to the diffusion of astronomy and astrophysics knowledge. This is achieved by dedicating observation time with robotic telescopes to educational activities and e-science projects aimed at students and amateur astronomy associations.

In 2020 and 2021 PETeR carried out virtual training courses for Spanish teachers on "Introduction to Astronomy" and "PETeR: Discover the Universe with robotic telescopes" for teachers from the Canary Islands, in collaboration with the Department of Education of the Canary Islands Government.

PETeR has also mentored the development of several high school student research projects including confirming asteroid and comet orbits, finding and characterizing variable stars, [confirming and characterizing transiting exoplanets](#), and [studies of star clusters](#).

Location Spain (mainland and Canary Islands)

Demographic Elementary and high school students, and teachers

Size 730



Africa

AstroLab

postgraduate workshops

research projects

Astrolab is a tutorial, based on telescopic observations, where participants learn how to do science and discover that science can be challenging, interesting and manageable. This tutorial has been developed primarily for undergraduate science students in order to emphasize the nature of science with the interdisciplinary nature of astronomy, and its natural links with technology and instrumentation. Astrolab is a learning-by-doing laboratory to acquire research competencies and to understand the complexity of practical work. Astrolab works with students from universities in sub-Saharan African countries.

Due to the Covid-19 pandemic travel and physical meetings were not possible up to August 2021. Consequently, in 2021, Astrolab refresher courses (for previous course attendees) and one-to-one training, took place, via video-conference for lecturers in Ethiopia, Nigeria, South Africa, and Zambia.



For the first time in their 10+ year history, AstroLab expanded their program beyond Africa to Nepal and South America. A large part of this was due to the high quality and high availability of the LCO network, and the students being more prepared to be taught remotely.

- Location** Ethiopia, Nigeria, South Africa, Zambia, Nepal and Peru
- Demographic** Postgraduate students and faculty
- Size** 45

Astronomy & Astrophysics Awareness in Nigeria

teacher workshops

student workshops

Partner withdrew due to COVID

The program used LCO telescopes as an integral part of their science engagement program in Nigeria aimed at primary school children. The project begins with a demonstration telescope then moves participants to using LCO telescopes for deep sky object observations.



Location Nigeria

Demographic Primary schools

One Home, One Sky

Partner withdrew due to COVID

teacher workshops

student workshops



One Home, One Sky aimed to help the children and their families to do scientific activities to reduce the stress and anxiety caused by the war in Libya. It is aimed particularly at girls and children with additional needs. The initiative is named "one home, one sky" as an aspiration to use astronomy to unite the people of Libya, by offering workshops to primary schools in remote areas of the country.

Location Libya

Demographic Primary schools

Middle East and Asia

Qatar National Library Astronomy Club

teacher workshops

student workshops

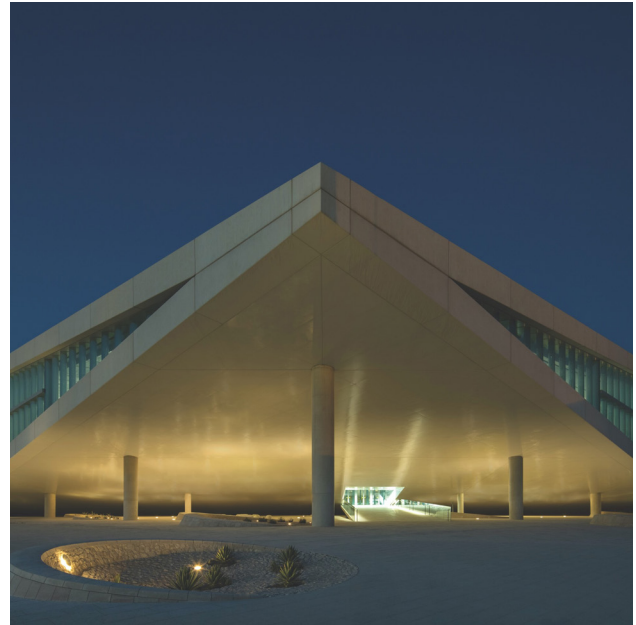
The program is an astronomy club for schools in Qatar hosted by Qatar National Library. The program aims to empower, inspire and increase science awareness and curiosity of all learners from a young age. The audience works with library staff and are mentored by an expert astronomer in scientific investigations on variable stars and exoplanets.

These students studied several exoplanet systems, in particular [WASP-98b](#), [WASP-29 b](#), [WASP-122b](#) and [Wasp 49b](#).

Location Qatar

Demographic High school students and teachers

Size 30



Variable Stars Israel

student workshops



This is an outreach program for 9th grade gifted children, collecting data on double stars and analyzing the data to characterize the stars. Astronomy leaders learn how to guide groups of young students and teach the students how to analyse the spectra of stars.

Location Israel

Demographic High school students and teachers

Size 20

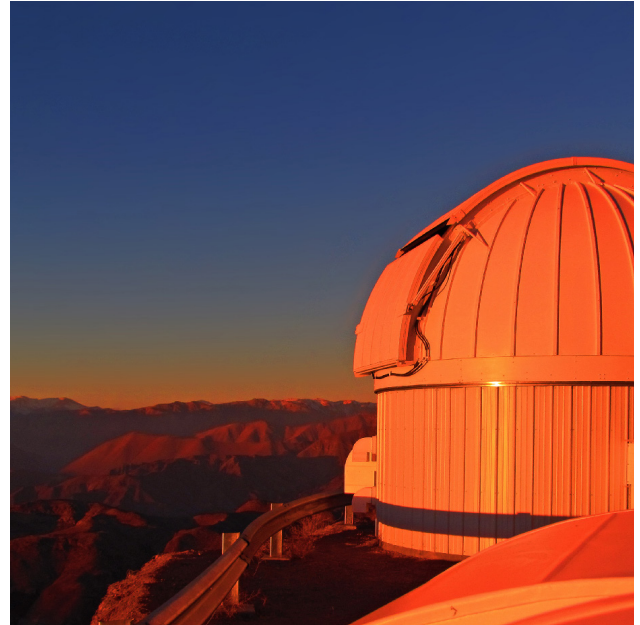
Youth Astronomy Teachers' Link

student workshops

student research

Partner withdrew due to COVID

The Youth Astronomy Teachers' Link (YATL) provides high-quality astronomy and planetary science education resources to young people in China. The YATL Astronomy Research Project for High School began in 2016 and more than 15 schools compete annually to participate in the YATL research opportunities. The goal is to start students on a research career.



Location China

Demographic High school students

Australia

Our Solar Siblings (school workshops)

teacher workshops

student workshops

research projects

[Our Solar Siblings](#) provides an established teacher training program to enrich the science curriculum with astronomy content. It provides an evidence based, curriculum based, project for high school level astronomy. OSS provides teaching and learning support for the participants. The science focus covers the entire life cycle of stars. LCO is used to provide inspirational color images to the teachers and their students. Global reach programs provided through Our Solar Siblings are discussed in the Global and Online sections below.



While the pandemic hampered expansion, new course aspects have been developed including; bi-monthly training for a cohort of 10 teachers in New South Wales, an introductory course in exoplanets complete with a web application to submit exoplanet observations to LCO (see Exoplanet Partnership), and a research project in star clusters. Their introductory astronomy workshops continued virtually with students presenting "Depth Study"s of their chosen objects, using LCO data.

Location Australia

Demographic High school teachers

Size 250

Global programs

(where instructors and students communicate remotely)

Exoplanet Watch

citizen science

student research

[Exoplanet Watch](#) is a citizen science project to observe transiting exoplanets – planets outside our solar system – with small telescopes. Being able to access Las Cumbres Observatory telescopes enables people who don't have their own telescopes or who live in light polluted cities or in cloudy regions to be able to actively participate in exoplanet observations. Using LCO to follow up helps to better constrain each planet's period which allows for better mass measurements. Exoplanet Watch helps increase the efficiency of exoplanet studies made by large telescopes to characterize exoplanet atmospheres by reducing uncertainty about the predicted timing of transit events.

Campaigns to observe 6 different exoplanet systems, using LCO data, were successful. Exoplanet Watch was in beta testing until June 2021, and they anticipate spending 2021 and 2022 making the project more user-friendly for novices who don't already have a background in astronomy. They anticipate use of LCO and audience size will increase.

Location

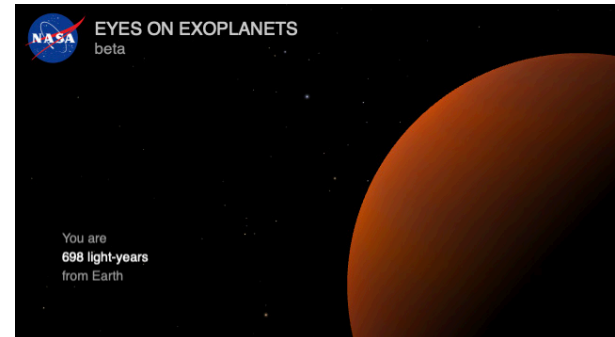
USA, Germany, France, Peru, Australia, Chile, Greece, New Zealand, UK

Demographic

General audience, amateur astronomers

Size

780



Our Solar Siblings (student mentoring)

student research



This aspect of Our Solar Siblings provides educational and scientific mentoring to middle school and high school students to undertake research investigations using LCO telescopes.

Location

Canada, USA and Australia

Demographic

Middle and high school students

Size

10

Hunting Outbursting Young Stars (HOYS)

citizen science

[HOYS is a citizen science project](#) working together with amateur astronomers to provide observational data for research in star and planet formation. LCO provides telescope resources to amateur astronomers without access to a telescope equipped with a camera. They provided daily monitoring of all the stars in the Cocoon Nebula.

The group of participants, as a community, builds up their own set of light curves of young stars during the project. HOYS provided 6 online introductory workshops and guidance to participants to conduct their own small research projects with the data they obtain as well as using the wealth of other publicly available HOYS data.



Location UK, India, Switzerland, Brazil, USA, Pakistan, Germany

Demographic Amateur astronomers and general public

Size 250

100 hours for 100 schools

beginners project



100 hours for 100 schools is a collaboration between several organizations involved in providing high quality and well supported astronomy education programs. 100 schools were selected from the 1,300 schools that already actively participate in [International Astronomical Search Collaboration](#) in 10 countries. The teachers were invited to choose and develop a project with their students, from a selection of suggested projects, ranging from basic to advanced. Training is offered through [Galileo Teacher Training Program](#) and [Global Hands on Universe](#).

The teachers communicated together via the use of [Padlets](#), where they shared their images, descriptions and comments.

Location

Algeria, Australia, Bolivia, Brazil, Chile, Colombia, Cyprus, Egypt, Germany, India, Iran, Morocco, Nepal, New Zealand, Poland, Portugal, Romania, Russia, Serbia, Spain, Sri Lanka, Taiwan, Turkey, USA, Venezuela

Demographic

Elementary and high school teachers

Size

470

Stanford Online High School

student research

[Stanford Online High School \(SOHS\)](#) is an accredited, independent school for intellectually passionate students in grades 7 - 12. The SOHS Astronomy Research Club involves students across the world in astronomy research education and projects using data from LCO telescopes. These students have published 13 posters at professional conferences and 5 peer-reviewed papers on their research with LCO. The research projects were on a variety of subjects including studying variable stars, double stars and exoplanets.

Location USA, UK, Russia, Czech Republic, France, Germany, Switzerland, China

Demographic High school students of well- and under-represented communities

Size 280



Online programs

(where the audience communicate with each other via online platforms)

Our Solar Siblings (self-taught course)

teacher workshops



Our Solar Siblings provides a self-guided basic astronomy course in a virtual learning environment. At the end of the course the participants engage in a research investigation using LCO. Although the aim is to pursue an investigation and not necessarily publishable research, there were 12 papers submitted to peer-review journals by these teachers.

Demographic High school teachers

Size 1000

Where's the Flux

citizen science

"Where's the Flux?" is focused on observations of an unusual astrophysical source, KIC8462852, also known as Tabby's Star. Community observations of secular dimming in this enigmatic dipper are handled by members of the [sub-Reddit social discussion site, r/KIC8462852](#), for this object, including all of the imaging and analysis. This provides an excellent way to disseminate the latest news, alerts and discoveries about this fascinating object, as well as mentoring people in data analysis. All of the communication and education is in the public domain and can be viewed by anyone.

Audience members have made predictions on when dipping events will reoccur, some publishing papers on their findings. These predicted events are to occur in the Fall of 2021, and they will be using LCO data to test their hypotheses.

Demographic Public (via Reddit)

Size ~7000

KIC 8462852 [Join](#)

r/KIC8462852

Posts Wiki FAQ

Hot New Top ...

PINNED BY MODERATORS

8 Posted by u/Crimfants 1 year ago

Spring 2020 Photometry post - what is this star up to?

46 Comments Share Save ...

16 Posted by u/Crimfants 6 months ago

Fall 2020 Photometry Thread

18 Comments Share Save ...

20 Posted by u/mrbighats 6 days ago

Question Will the James Webb Telescope shed any new info that can verify or deny current theories on Tabby?

5 Comments Share Save ...

MicroObservatory Exoplanet Partnership

teacher workshops

research projects



MicroObservatory operates a network of small aperture telescopes and a suite of extensive educational labs. Through this partnership with LCO, MicroObservatory enhances their audience's learning experience. MicroObservatory has developed tools to allow time-series analysis entirely in a web browser, complete with extensive training tools. The inclusion of LCO data allows their audience to go much deeper with their studies of exoplanets, in their [DIY Planet Search](#) project.

The MicroObservatory development team implemented tools for using LCO APIs to integrate LCO data into their DIY photometry tool, and generated "Finder Charts" for LCO data for all the DIY Planet Search targets. As a member of the Exoplanet Partnership they share their curriculum resources with all Global Sky Partners, and assist with Exoplanet Watch observing campaigns.

Demographic Public (but mostly teachers)

Size ~16000

Quotes from Global Sky Partner audiences

Thanks for making this opportunity available to us. We will be working with many people who are interested in astronomy but who don't have their own telescopes (or who live in places that are cloudy most of the time) so this project is fantastic!



I love LCO, I love Science

It is very interesting to have access to remote telescopes, which would be inaccessible in other circumstances. It is very interesting to be able to learn collaboratively with people from other parts of the world.

Thank you so much for making telescope time available to student groups! The telescope time you provided enabled me, alongside many other students, to complete astronomy research in high school - an experience from which I have learned a lot and for which I am incredibly grateful.

I had thought of scientific research as relatively inaccessible, and that one would need more advanced skills and technology to do it. This project showed me the accessibility of scientific research, and that one doesn't necessarily need to know everything to do scientific research. I also came to view scientific research as a more collaborative, gradual process, rather than as defined by major breakthroughs and advancements from individual researchers.

The knock on effect of being involved in Global Sky Partners is more members of our school are now interested in astronomy, even ones who weren't involved in the project.

So fantastic taking part in real cutting edge research as an amateur astronomer.

I originally thought that [using robotic telescopes] would be very intimidating. However, I now realize that if I work one action item at a time, my project becomes much simpler. Also I found scientific research much more exciting than I expected because writing up your research is VERY satisfying!!





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