



BRIEF

Boyce Research Initiatives and Education Foundation BRIEF

AAS Albuquerque

Small Ground and Space Telescopes in the New Era of Big Telescope Surveys

June 2-3, 2023

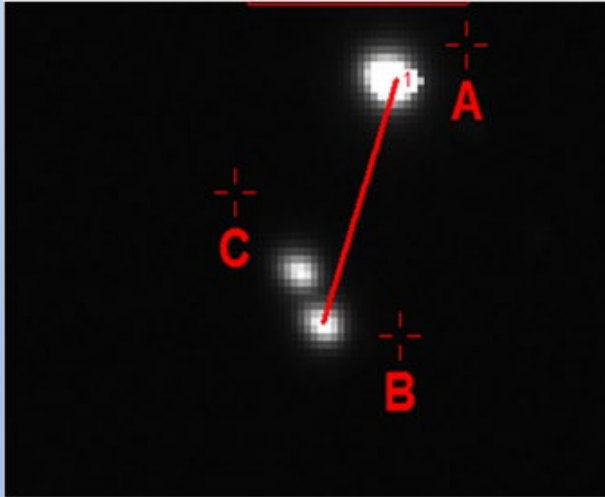




BRIEF – 501 (c) Non-Profit founded in 2013

Our Mission:

...to provide scientific and technical research opportunities **to enhance** the educational experience of students and to introduce them to the scientific and technical communities...





The BRIEF Community

VOLUNTEERS for science, engineering, instruction

Grady Boyce	Observatory operations
Scott Dixon	Exoplanets and Speckle
Mark Harris	Speckle Programs
Chandru Narayan	Data Science + Bush School
John Downing	Observatory engineering
Brian Delgado	Outreach
Andrew Lerario	Outreach



Collaborations with

- Las Cumbres Observatory - Global Sky Partner since 2018
- Michael Fitzgerald - Our Solar Siblings
- InStAR
- Astrometry Working Group - host

Sponsorships

- AAVSO Webinars
- RTSRE

Faculty partners at

- San Diego State University
- Miramar College
- Mesa College
- Grossmont College



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 Visit: Boyce Astro @ <http://www.boyce-astro.org>



First- We get our students up to speed





BRIEF (aka Boyce – Astro)

Programs and Offerings

Online
Asynchronous

Online Seminars
Each 2 x / year

Independent Study
& Activities

Tutorials
at our website

IntroSTARS™
beginning astrophysics

Star Parties and
Astrophotography
For Outreach
**Blue Dot
Bush School**

DoubleSTARS™
Astrometry & **write a
scientific paper**

Explorers™
Photometry & **exoplanet
transit report to NASA**

Intro to Python
for astronomy – **build an
HRD from Gaia data**

Speckle Interferometry

Mentoring

Internship
projects

Exoplanet Watch
TESS
Eclipsing Binaries

Telescope
Operations

Partner Programs
OSS
InStAR
Bush School



BRIEF Students, Researchers, and Education Resources

Over 500 students to date:

Demographics: 50/50 high school and college

At any one time:

typically 15 to 20 in a seminar

typically 15 to 30 post seminar students participating in research

Educational Methods Used

Online Asynchronos Tutorials

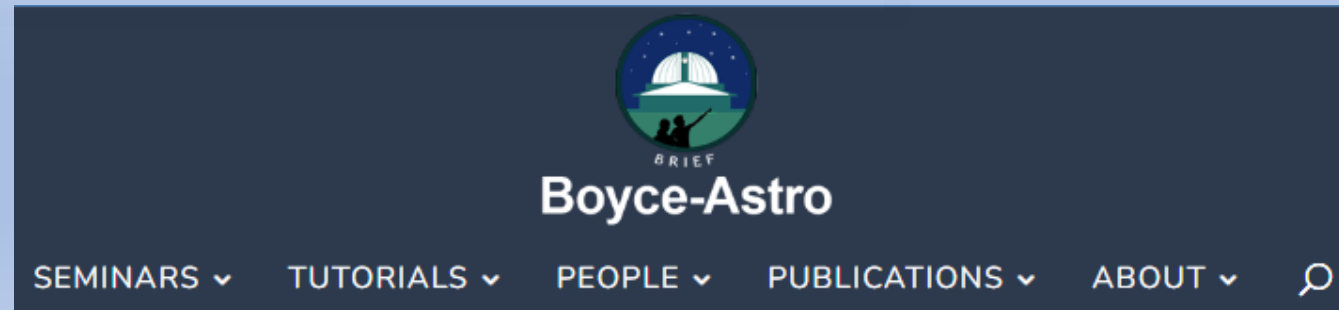
Seminars Synchronous

Use Zoom and full YouTube library

Server with extensive set of tools for student use

Dozen citizen scientists and college faculty

Website





We like to do discovery ... or at least confirmation





Our Products – Papers or Programs

Papers - students author published papers from their research

Journal of Double Star Observers

~ 50 student papers published

~ 10 currently in process

~ 10 papers with staff co-authors

Supported ~10 papers in other journals

Programs - students support research with observations and data reduction

TESS - Subgroup 1

Exoplanet Watch

Circumbinary Exoplanets

Known Binary Sky Surveys

Post-doc research projects

SDSU / NSF Exoplanet training for teachers



BRIEF has Two Robotic Observatories in California + LCO 0.4m scopes worldwide

BARO



BARON



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BRIEF (“BOYCE-ASTRO”) OBSERVING SYSTEMS

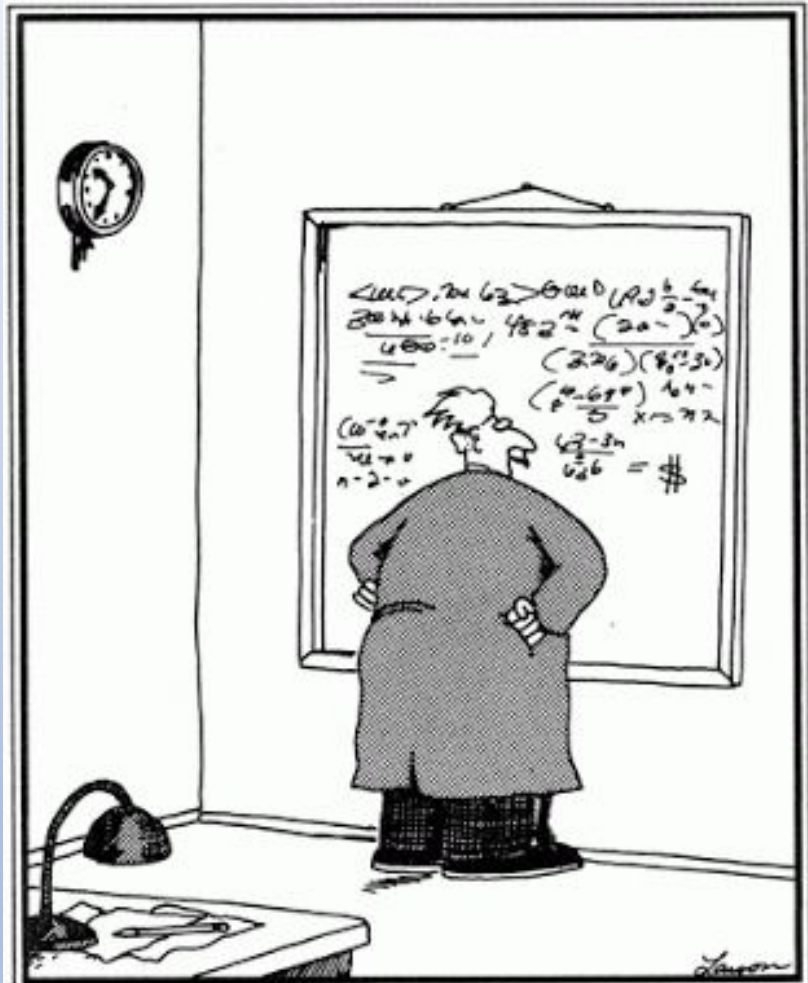
LCO: 0.4m telescopes at 6 sites	0.4m	LCO Scheduling Control		Primary use
	<u>Resolution</u>	<u>FOV</u>	<u>Filters</u>	<u>Education</u>
SBIG 6303	0.57"/pix	29' x 19'	Sloan: u, g, r, i, z; B, V; Pan STARRS w, z	photometry
QHY600 CMOS (on Delta Rho 350)	0.78"/pix	1.9° x 1.2°	Sloan: u, g, r, i, z; SII, Ha, OIII; B, V; Pan STARRS w, z; Exoplanet	photometry & photography

BRIEF: 2 Planewave CDK17s on L500 Mounts	0.43m	Control: ACP, NINA, SGP, Maxim		Primary use
BARO (75 miles east of San Diego)	<u>Resolution</u>	<u>FOV</u>	<u>Filters</u>	<u>Research</u>
3 cameras on instrument rotator				
FLI 4710 backlight CCD	0.91"/pix	16' X 16'	JC: UV, B, V, I; Sloan: g, r, i, z	photometry
ZWO 1600 CMOS (+2.5X Barlow)	0.11"/pix	8' X 6'	Sloan: g, r, i, z; Cousins: R, I; Proplanet	speckle
QSI 683 CCD	0.38"/pix	21' X 16'	Ic, Rc, B, V, SII, Ha, OIII, Luminance	photography
BARON at SRO (Sierra Remote Observatory)				
QHY 600 CMOS (+2X Barlow)	0.13"/pix	21' X 14'	Sloan: u, g, r, i, z, y; JC: B,V; Clear	speckle
Note: BARO also has a Takahashi 130 refractor with QHY128 color CMOS for wide field color imaging aligned with the other cameras on the L500.				photography

Time series differential photometry			Speckle Interferometry - 0.5"+ separation		
	Brightest	Faintest		Brightest	Faintest
Magnitude	0	18	Magnitude	6	12
Target exposure	~ 0.1 sec	~ 5 min	Target exposure	~5 msec+	~30 msec+
Comp stars in FOV of similar magnitude/color					



BRIEF (Boyce-Astro) Is Cost-Effective



Einstein discovers that time is actually money.

Questions