Transients and Variable stars Science Collaboration update

Sara Bonito, INAF - Observatory of Palermo (Italy)

Rubin Observatory

Transients and Variable Stars Science Collaboration

Co-chairs:
Federica Bianco, Univ. of Delaware
Rachel Street, Las Cumbres Observatory

TVSSC

Rubin Observatory

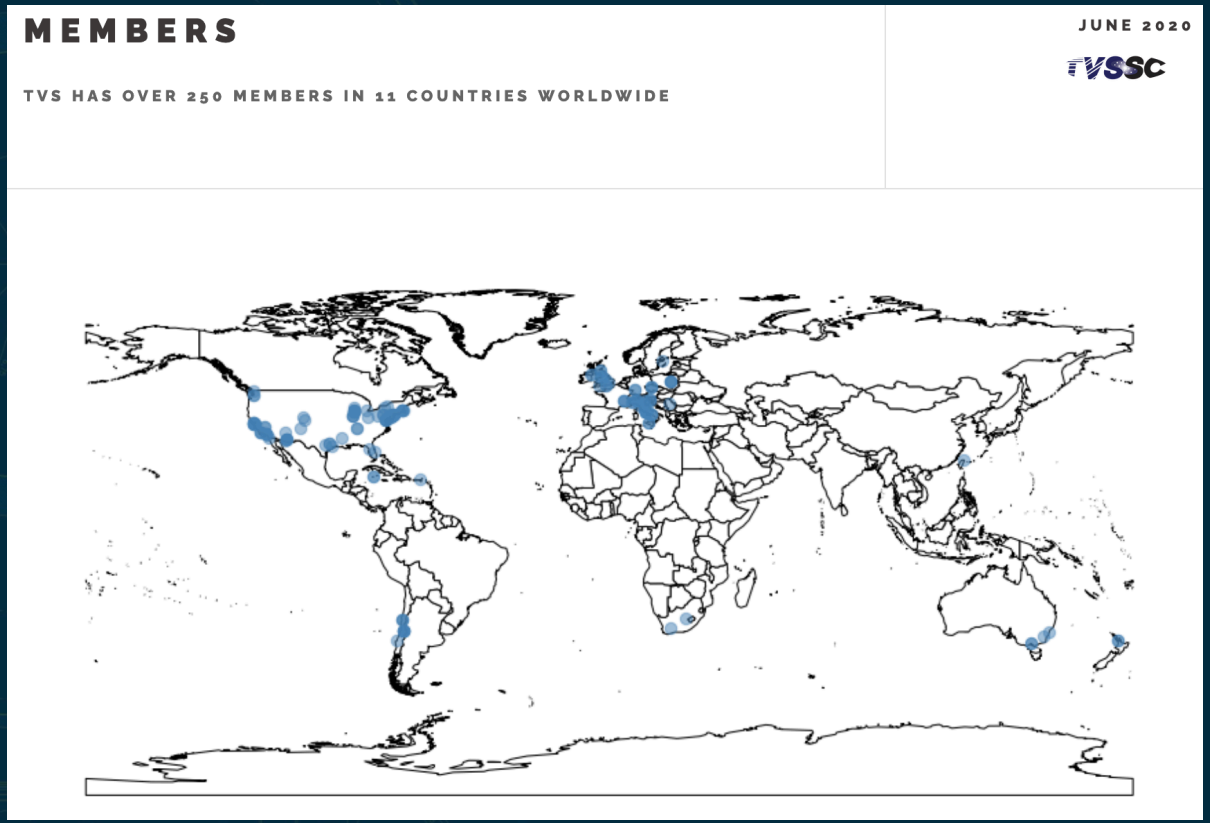
https://youtu.be/MXQQzbC5HxY

Transients and Variable Stars Science Collaboration

Co-chairs:
Federica Bianco, Univ. of Delaware
Rachel Street, Las Cumbres Observatory

TVSSC

INTERNATIONAL COLLABORATION



INTERNATIONAL COLLABORATION

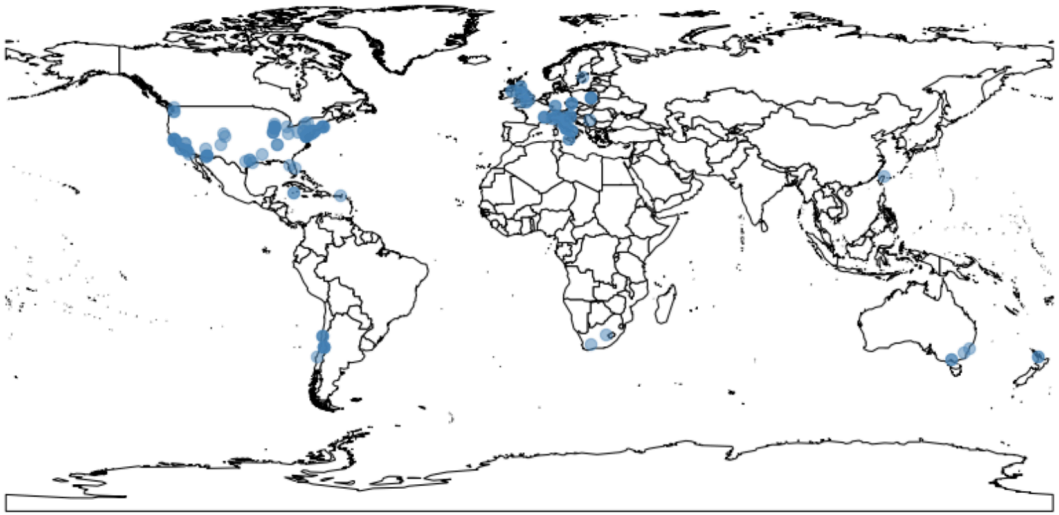
MEMBERS

JUNE 2020

TVS

TVS HAS OVER 250 MEMBERS IN 11 COUNTRIES WORLDWIDE

several in-kind contributions



STATEMENT OF VALUES

A COLLABORATIVELY WRITTEN STATEMENT OF VALUES FOR THE TVS SC

JUNE 2020

TVSSC

The goal of the LSST TVS SC is to advance our understanding of the Universe through science and to create and sustain a research environment in which all members can thrive. Supporting an equitable space free of discrimination is first and foremost a matter of social justice. We recognize that academia is embedded within, and takes advantage of, systemic racism that perpetuate white supremacy and suppresses non-white voices and voices of diverse scholars along other axes or privilege. We, as an organization, renew our commitment to be proactive in order to fix and stop this “status quo” in our corner of the Universe. The TVS SC is inherently a multinational organization with members from a wide range of cultures and this diversity strengthens our research by bringing in different perspectives and expertise. We seek to enhance our diversity of membership and to create an educational and research culture that is welcoming and supportive for all members. We encourage people to apply and be an active part of TVS, regardless of their race, color, country of origin, sex, age, national origin, religion, sexual orientation, gender identity and/or expression, disability or veteran status. We have an ongoing commitment to a range of initiatives to make our organization more equitable and justice, undertaken with the guidance of the Justice, Equity, Diversity, and Inclusion (JEDI) group of the TVS SC. More information on these activities can be found in our TVS call to action. The leadership of the TVS SC and JEDI are responsible for, and all members are empowered to, ensuring full support for these activities. Accountability metrics are explicitly included in the same document.

CONTINUE READING

SUBGROUPS

JEDI: JUSTICE, EQUITY, DIVERSITY & INCLUSION
coordinators: Sara Bonito, INAF - Osservatorio Astronomico di Palermo

ANOMALIES AND TRUE NOVELTIES
coordinator: Federica Bianco, University of Delaware

CLASSIFICATION & CHARACTERIZATION
coordinators: Nina Hernitschek, Robert Szabo,

FAST TRANSIENTS
coordinator: Maria Drout, Carnegie-Dunlap

INTERACTING BINARIES
coordinator: Andrej Prsa, Villanova Paula Szkody, UW

MAGNETICALLY ACTIVE STARS
coordinators: Ricky Egeland, High Altitude Observatory

MICROLENSING SUBGROUP
coordinator: Rachel Street, LCO

MULTIWAVELENGTH CHARACTERIZATION AND COUNTERPARTS
coordinators: Raffaella Margutti, NorthWestern

NON-DEGENERATE ERUPTIVE VARIABLES
coordinators: Sara Bonito, INAF

PULSATING VARIABLES
coordinators: Kelly Hambleton, Villanova

SUPERNOVAE
coordinators: Melissa Graham, UW

TIDAL DISRUPTION EVENTS
coordinators: Sjoert van Velzen, Leiden Observatory

TRANSITING PLANETS
coordinators: Michael Lund, JPL

DISTANCE SCALES
coordinators: Marcella Marconi, Lovro Palaversa,

OAPA

STATEMENT OF VALUES

A COLLABORATIVELY WRITTEN STATEMENT OF VALUES FOR THE TVS SC

JUNE 2020

TVSSC

The goal of the LSST TVS SC is to advance our understanding of the Universe through science and to create and sustain a research environment in which all members can thrive. Supporting an equitable space free of discrimination is first and foremost a matter of social justice. We recognize that academia is embedded within, and takes advantage of, systemic racism that perpetuate white supremacy and suppresses non-white voices and voices of diverse scholars along other axes or privilege. We, as an organization, renew our commitment to be proactive in order to fix and stop this “status quo” in our corner of the Universe. The TVS SC is inherently a multinational organization with members from a wide range of cultures and this diversity strengthens our research by bringing in different perspectives and expertise. We seek to enhance our diversity of membership and to create an educational and research culture that is welcoming and supportive for all members. We encourage people to apply and be an active part of TVS, regardless of their race, color, country of origin, sex, age, national origin, religion, sexual orientation, gender identity and/or expression, disability or veteran status. We have an ongoing commitment to a range of initiatives to make our organization more equitable and justice, undertaken with the guidance of the Justice, Equity, Diversity, and Inclusion (JEDI) group of the TVS SC. More information on these activities can be found in our TVS call to action. The leadership of the TVS SC and JEDI are responsible for, and all members are empowered to, ensuring full support for these activities. Accountability metrics are explicitly included in the same document.

CONTINUE READING

SUBGROUPS

JEDI: JUSTICE, EQUITY, DIVERSITY & INCLUSION

coordinators: Sara Bonito, INAF - Osservatorio Astronomico di Palermo

ANOMALIES AND TRUE NOVELTIES

coordinator: Federica Bianco, University of Delaware

coordinators: Nina Hernitschek, Robert Szabo,

CLASSIFICATION & CHARACTERIZATION

FAST TRANSIENTS

coordinator: Maria Drout, Carnegie-Dunlap

INTERACTING BINARIES

coordinator: Andrej Prsa, Villanova Paula Szkody, UW

MAGNETICALLY ACTIVE STARS

coordinators: Ricky Egeland, High Altitude Observatory

MICROLENSING SUBGROUP

coordinator: Rachel Street, LCO

MULTIWAVELENGTH CHARACTERIZATION AND COUNTERPARTS

coordinators: Raffaella Margutti, NorthWestern

NON-DEGENERATE ERUPTIVE VARIABLES

coordinators: Sara Bonito, INAF

PULSATING VARIABLES

coordinators: Kelly Hambleton, Villanova

SUPERNOVAE

coordinators: Melissa Graham, UW

TIDAL DISRUPTION EVENTS

coordinators: Sjoert van Velzen, Leiden Observatory

TRANSITING PLANETS

coordinators: Michael Lund, JPL

DISTANCE SCALES

coordinators: Marcella Marconi, Lovro Palaversa,

OAPA

TVS ROADMAP
(Kelly Hambleton)

Young stars and their variability (EXor/FUor)
Cataclysmic Variables
Neutron Star Binaries
Black Hole Binaries
Supernovae
Intermediate-Luminosity Optical Transients
Light Echoes of eruptions and explosions
EM counterparts of GW events
Tidal Disruption Events
Eclipsing Binary Stars

Microlensing
Pulsating Stars
Cepheids and RR Lyrae Stars
Long Period Variables
Brown Dwarfs
GRB
Blazars
Transiting Exoplanets
Alert Brokers
SETI

2018 TVS TASK FORCES

CHARACTERIZE A COMMUNITY-BROKER INTERFACE FUNCTIONALITY

Spokesperson: Markus Rabus, PUC, Chile

CROWDED FIELD PHOTOMETRY

Spokesperson: Kelly Hambleton

DEEP-DRILLING FIELDS AND MINI-SURVEYS PROPOSALS PLANNING

Spokesperson: Sara Bonito, INAF, Italy

2019-2020 TVS TASK FORCES

VERA C. RUBIN OBSERVATORY

MAF TF

Metrics (MAFs) were not generally available with the submitted TVS white papers and without them the cadences cannot be evaluated. This means the requested cadences may actually not be simulated, unless a MAF is provided or easily generated by the project members. This TF should

1 - Learn the MAF

2 - Review the TVS White Paper submissions for cadence proposals

3 - Design and code MAFs for all TVS submissions

4 - Create TVS specific (video) tutorials for MAF

SCIENCE PLATFORM EVALUATION THROUGH "STACK CLUB" INVOLVEMENT TF

Members will get involved in the LSST “stack club” and this gain access to the LSST Science Platform. This TF should:

1 - Gain familiarity with the LSST Science Platform and share it with the rest of TVS,

2 - Understand what TVS users need from the Science Platform and evaluate whether the current design will provide it.

3 - Report on Stack Club by a member of the club (possibly also member of TVS)

DEEP AND ACCURATE PSF PHOTOMETRY IN CROWDED FIELDS, AND SEARCH FOR VARIABLE STARS TF

This TF will follow the success of the deblending TF that

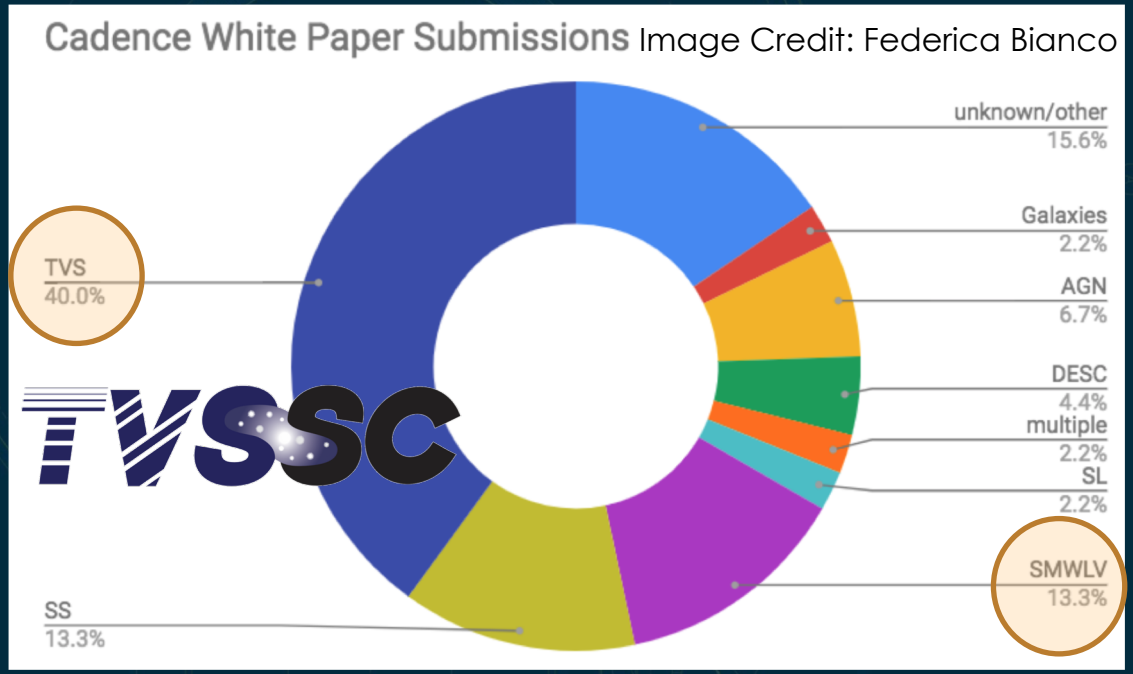
COMMISSIONING TF

The LSST commissioning is planned to start in a year and LSST Project has solicited the involvement of the SCs. This TF should:

TVS Deep-drilling fields and mini-surveys proposals planning

Task Force 2018

(Chair: Sara Bonito)



https://www.lsst.org/submitted-whitepaper-2018

Transients and Variable Stars

Stars Milky Way and Local Volume

successful

SMWLV

Rosaria (Sara) Bonito – INAF - Observatory of Palermo (Italy)

TVS/SMWLV Cadence Note Task Force 2020-2021

- Rubin LSST Observing Strategy
- Cadence Notes (deadline April 15th): > 50%

https://www.lsst.org/content/survey-cadence-notes-2021

- Simulations of the metrics
- Hackathon days (Will Clarkson – co-Chair SMWLV)

SMWLV-TVS hack days, 2021 Summer

Science Survey Strategy tvs, smwlv

willclarkson Stars, Milky Way & Local Volume Collaboration Member 2 1d

Quote

Hi all - this is to let you know that SMWLV and TVS will be re-starting the informal “hack days” throughout 2021 Summer, to provide a space for people to work on various necessary projects, including (but not limited to) ongoing cadence investigations.

These will be much more loosely themed than the cadence hack days that led up to the Apr 15th SCOC cadence notes deadline: in addition to the gathertown space itself that is maintained by the project, a sign-up sheet will usually be posted for folks to claim a “room”. Occasionally there may be informal short presentations. All are welcome to the hack sessions: to enter the meeting space, click on this Gathertown link.

The hack days will run from 10:00am-12:00 Noon EDT and 1300-1500 EDT unless otherwise stated on the following Thursdays (click here to subscribe to the hack day Google calendar 3). As always, please feel free to attend as much or as little as you find useful.

- Thurs May 13
- Thurs May 27
- Thurs Jun 10
- Thurs Jun 24
- Thurs Jul 08
- Thurs Jul 22
- Thurs Aug 05
- Thurs Aug 19
- Thurs Sep 02

Here is the plan of the meeting space:

May 11

1 / 2

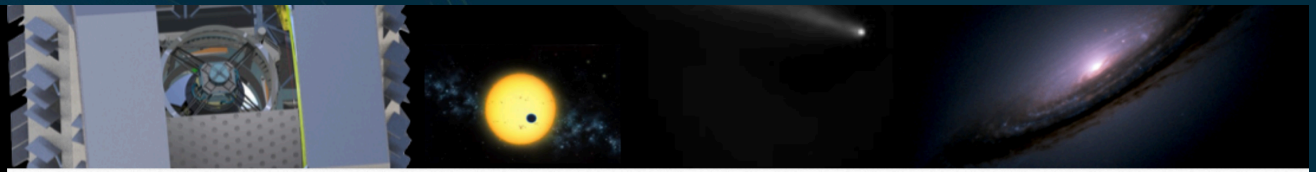
May 11

1d ago

TVS Science Platform Evaluation Task Force 2019-2020 (Chair: Sara Bonito)

Transients and Variable Stars
LSST Science Collaboration

- Intro
- Subgroups
- Members and roles
- Task Forces
- Documents
- Events
- Become a member
- Contact us



TVS Task Force

LSST Science Platform Evaluation

Work Plan

Members:

Sara Bonito	Chair, Spokesperson
Rachel Street, LCO	
Raffaella Margutti, Northwestern University	
Kelly Hambleton, Villanova University	
Melissa Graham, University of Washington/LSST	
Maryam Modjaz, New York University	

More members,
from a very diverse range of scientific interests

The LSST Science Platform - Current Snapshot

Portal Aspect

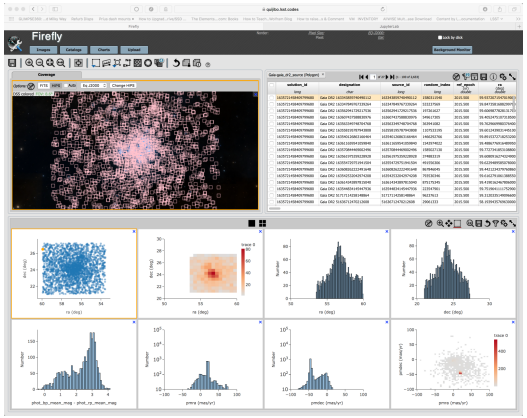
exploratory analysis and visualization of the LSST archive

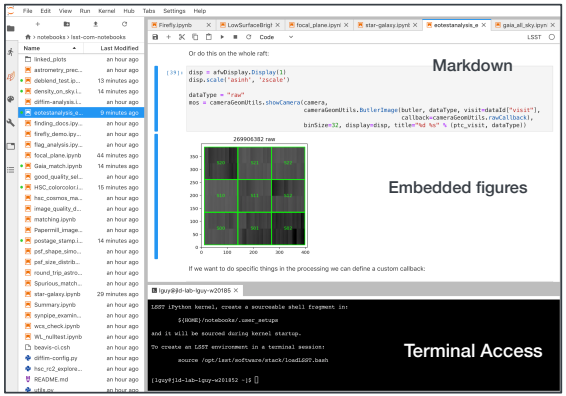
JupyterLab Notebook Aspect

in-depth 'next-to-the-data' analysis & creation of added-value data products

Web API Aspect

remote access to the LSST archive via industry-standard APIs





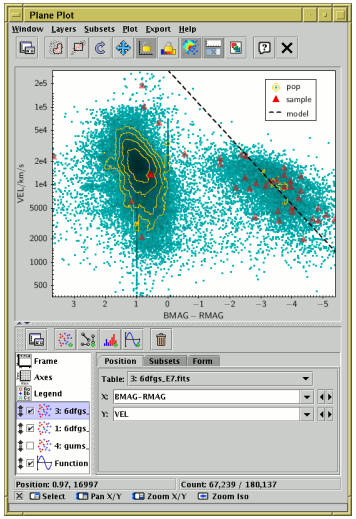


Figure credit: Mark Taylor

"*LSST Science Platform, Final Design Review*" by Leanne Guy; video and slides available at: https://www.lsst.org/content/lsst-information-scientists

Rubin Science Platform

Portal

Discover data in the browser

Learn more about the portal.

Notebooks

Process and analyze LSST data with Jupyter notebooks in the cloud

Learn more about notebooks.

APIs

Learn how to programatically access data with Virtual Observatory interfaces

Rubin Science Platform

Portal

Discover data in the browser

Learn more about the portal.

Notebooks

DP0

Process and analyze LSST data with Jupyter notebooks in the cloud

Learn more about notebooks.

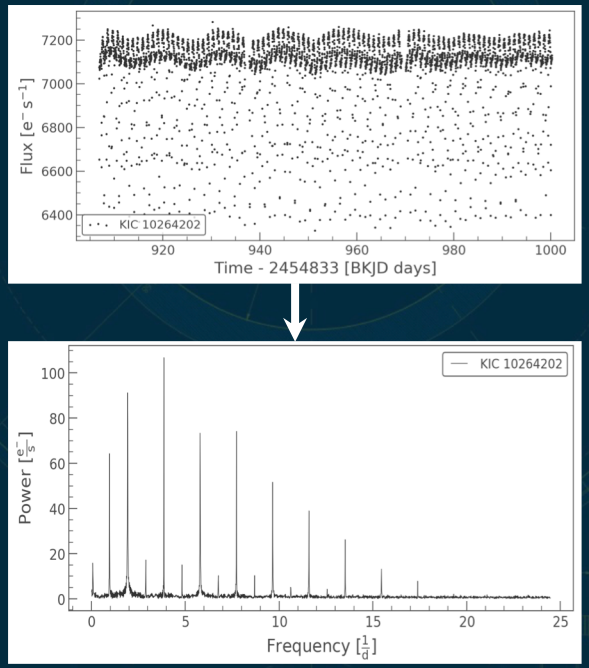
APIs

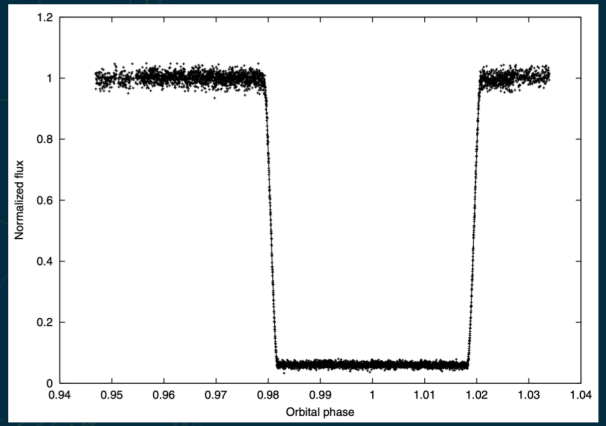
Learn how to programatically access data with Virtual Observatory interfaces

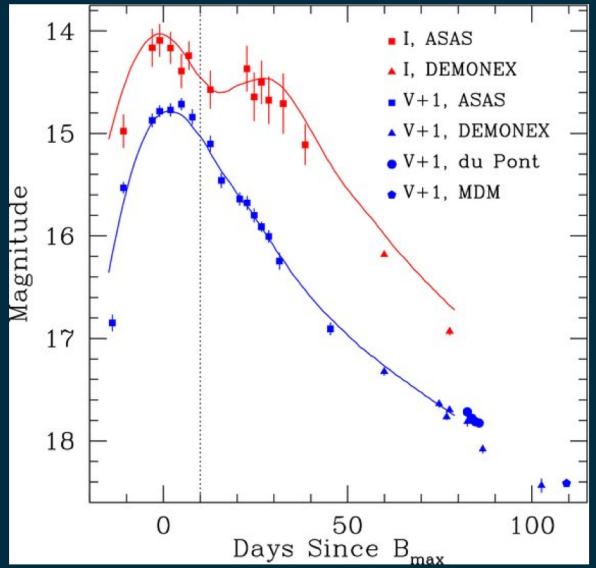
Melissa Graham's talk

Lightcurve analysis

Much of TVS science will depend on analysing and modeling lightcurves
Extensive software already exists for this purpose

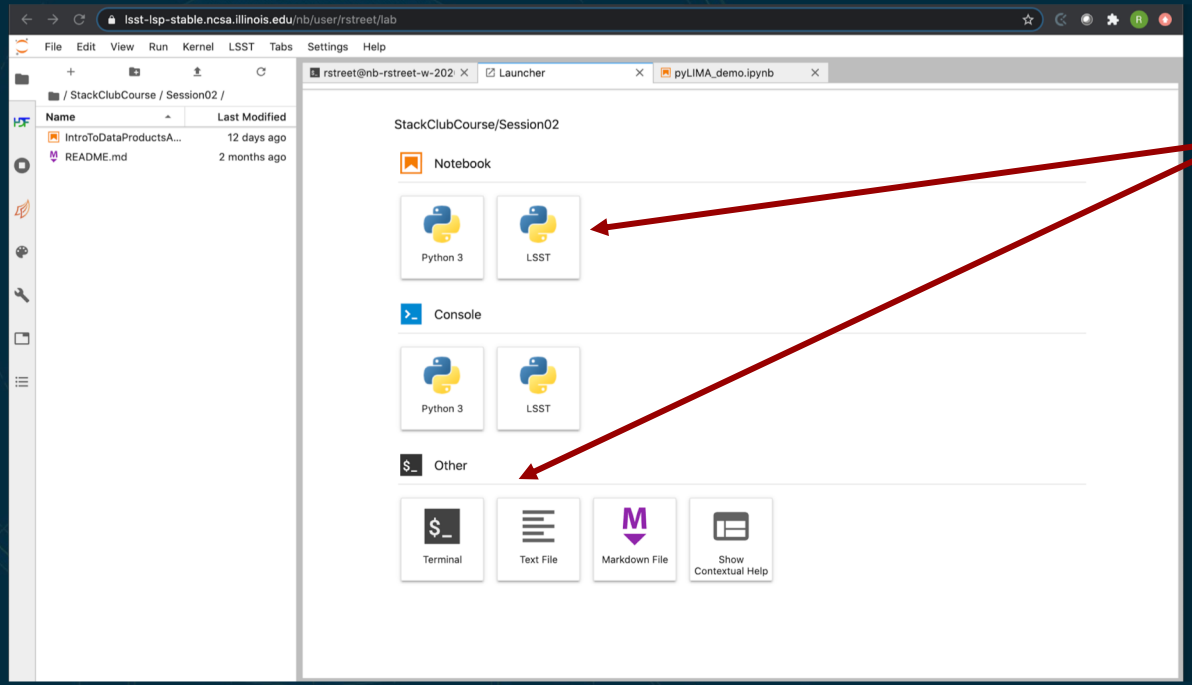






Graphics: Lightkurve.org, Maxted et al., 2004, MNRAS, 355, 1143, Khan, R. et al. (2010), ApJ, 726, 106

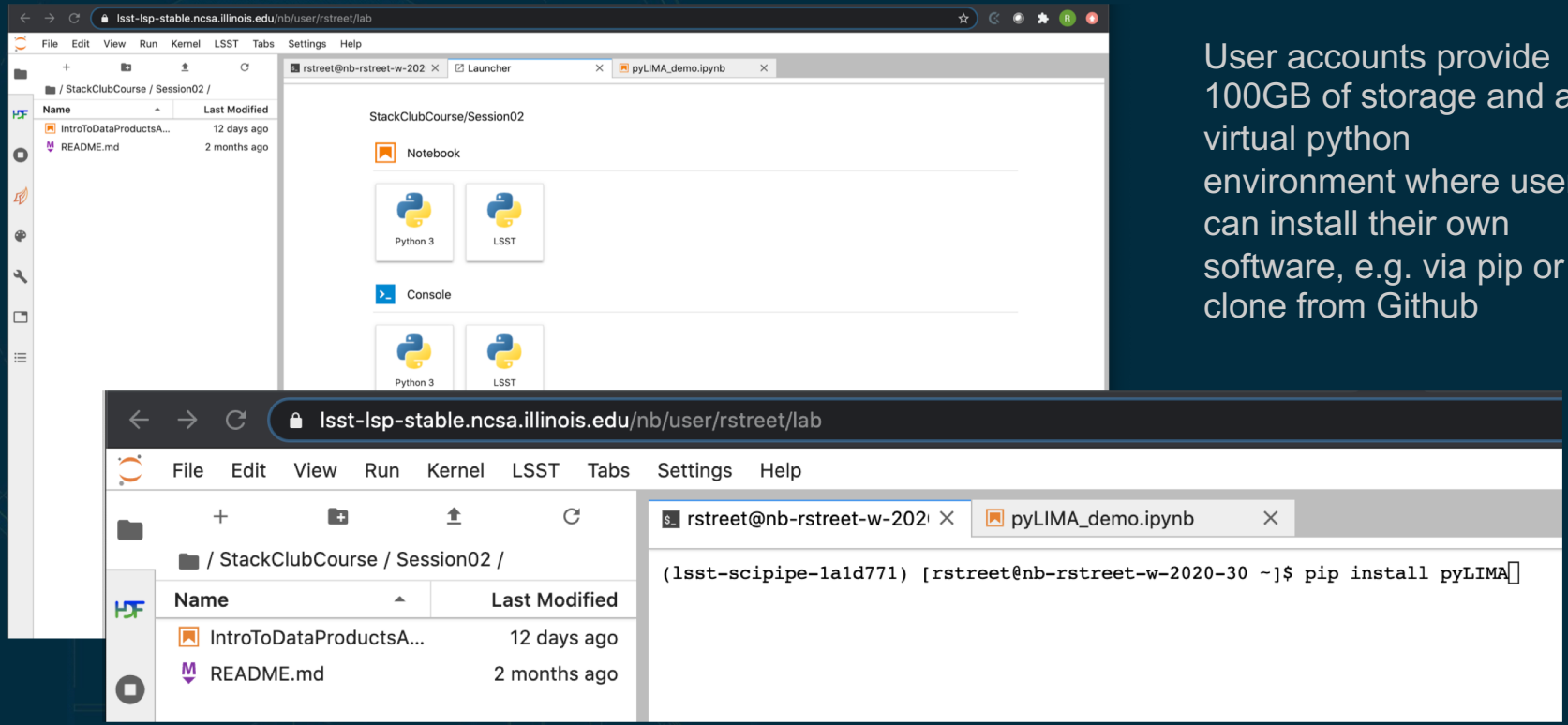
Lightcurve modeling in the RSP



Notebook aspect of RSP offers both Jupyter Notebook and a terminal

Rosaria (Sara) Bonito – courtesy of Rachel Street

Lightcurve modeling in the RSP



User accounts provide 100GB of storage and a virtual python environment where users can install their own software, e.g. via pip or clone from Github

Building lightcurves

```
mjds = []
mags = []
merrs = []
for visit in visit_list:
    data_id = {'visit':visit, 'ccdnum':9}

    exposure = butler.get('deepDiff_differenceExp', data_id)
    exposure_filter = exposure.getFilter().getName()
    exp_src_cat = butler.get('deepDiff_diaSrc', data_id)

    detected_source_positions = SkyCoord(exp_src_cat['coord_ra']*u.deg,
                                         exp_src_cat['coord_dec']*u.deg)
    (idx, sep2d, sep3d) = bright_star.match_to_catalog_sky(detected_source_positions)

    if sep2d.arcsec > 1.0:
        print('No match for visit '+str(visit))

    else:
        ts = calc_visit_mjd(exposure)

        flux = exp_src_cat.getPsfInstFlux()[idx]
        ferr = exp_src_cat.getPsfInstFluxErr()[idx]
        ra = detected_source_positions[idx].ra
        dec = detected_source_positions[idx].dec

        photCalib = exposure.getPhotoCalib()

        phot = photCalib.instFluxToMagnitude(flux, ferr)

        if not np.isnan(phot.value):
            mjds.append(ts)
            mags.append(phot.value)
            merrs.append(phot.error)
            print(mjds[-1], mags[-1], merrs[-1], ra, dec)
        else:
            print('No valid photometry for visit '+str(visit))

lc_data = np.zeros([len(mjds),3])
lc_data[:,0] = mjds
lc_data[:,1] = mags
lc_data[:,2] = merrs
```

Data served by data Butler system

Rubin LSST data products are organized on a per-image basis

Lightcurves must be built by extracting flux data for each object from the source catalog from each image of a set

Rosaria (Sara) Bonito – courtesy of Rachel Street

Modeling lightcurves

Perform a fit to this lightcurve using the pyLIMA software package

```
candEvent = event.Event()
candEvent.name = 'LSST '+str(idx)
candEvent.ra = bright_star.ra.deg
candEvent.dec = bright_star.dec.deg
```

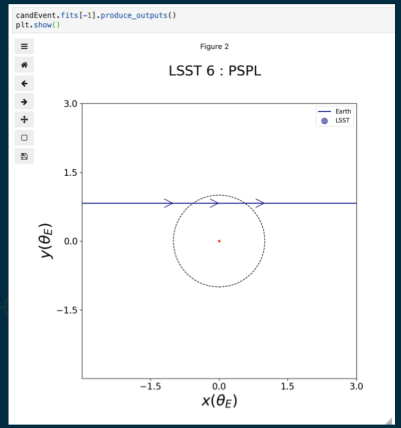
```
tel = telescopes.Telescope(name='LSST', camera_filter=exposure_filter, light_curve_magnitude=lc_data)
```

```
candEvent.telescopes.append(tel)
candEvent.find_survey('LSST')
candEvent.check_event()
```

```
check_event  : Everything looks fine, this event can be fitted
```

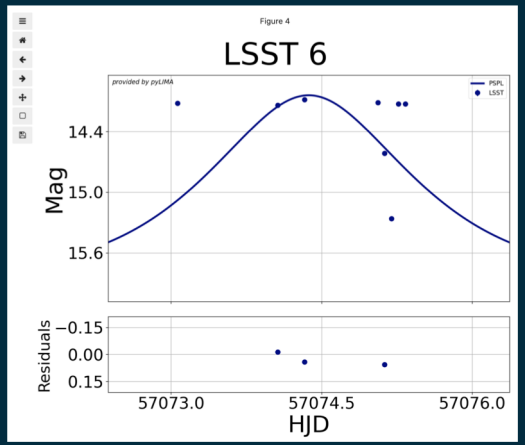
```
model = microlmodels.create_model('PSPL', candEvent)
candEvent.fit(model,'LM')
```

```
Start fit on LSST 6, with model PSPL and method LM
check_event  : Everything looks fine, this event can be fitted
initial_guess  : Initial parameters guess SUCCESS
lmarquardt  : Levenberg_marquardt fit SUCCESS
[57074.37182223308, 0.8243296550731875, 1.000000213749654, 357557.1592597104, -0.886646832413759, 12190961.721315151]
```



LSST 6 : PSPL

	Parameters	Errors
to	57074.37182	0.40224
uo	0.82433	6.54603
tE	1.0	4.8444
fs_LSST	357557.15926	5295025.68251
g_LSST	-0.88665	1.65546
Chi^2	12190961.72132	0.0



Example of a lightcurve modeling procedure and products, using the pyLIMA software within the RSP Notebook aspect

Rosaria (Sara) Bonito – courtesy of Rachel Street

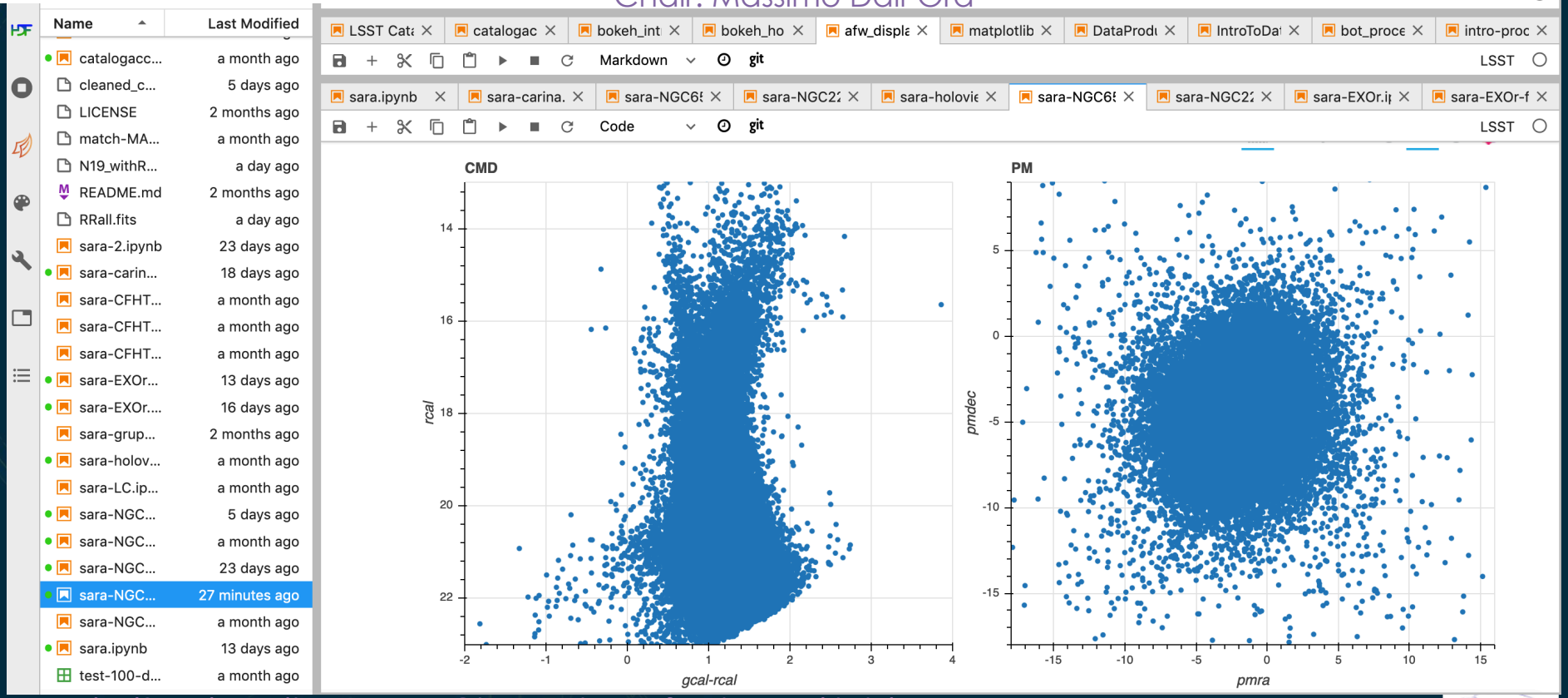
x

DEEP AND ACCURATE PSF PHOTOMETRY IN CROWDED FIELDS, AND SEARCH FOR VARIABLE STARS TF

RUBIN OBSERVATORY LSST

TVSSC

Chair: Massimo Dall'Ora

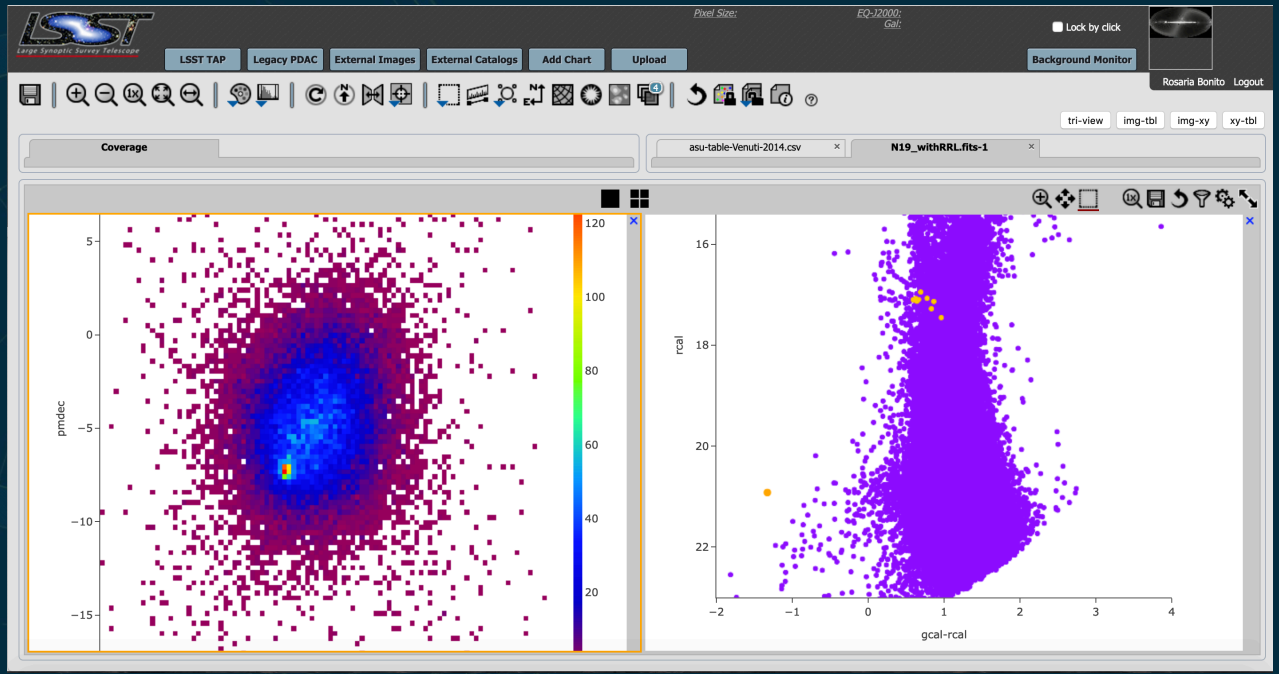


Rosaria (Sara) Bonito – INAF - Observatory of Palermo (Italy)

OAPA

RUBIN OBSERVATORY

NGC 6569 – RR LYRAE



Dall'Ora et al. in preparation

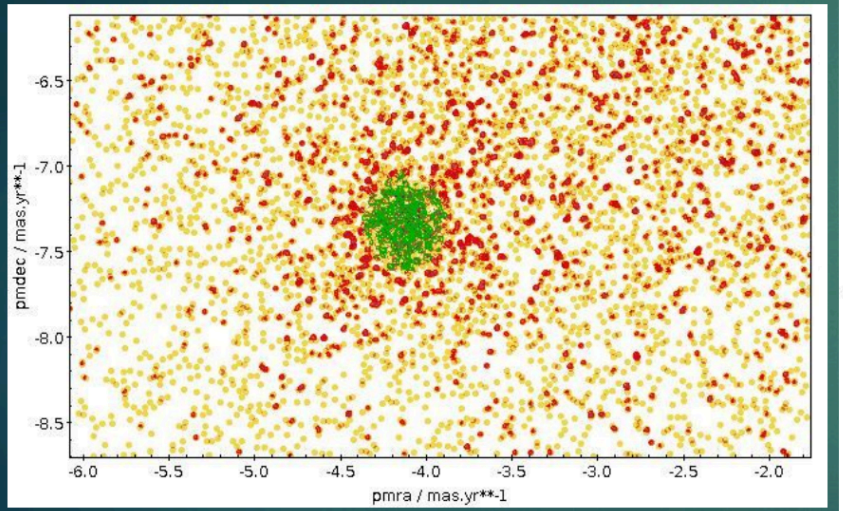
Rosaria (Sara) Bonito – INAF - Observatory of Palermo (Italy)

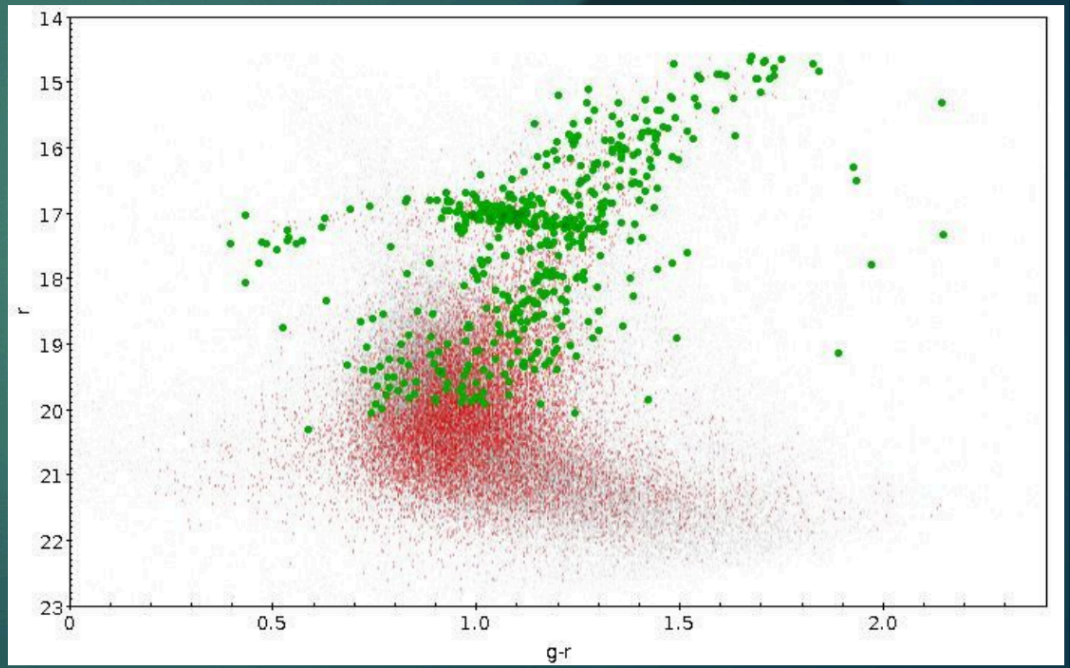
Membership

NGC 6569

RUBIN OBSERVATORY

Dall'Ora et al. in preparation





PM_RA = -4.12 +- 0.11
PM_DEC = -7.33 +- 0.12

Rosaria (Sara) Bonito – courtesy of Massimo Dall'Ora

TVSSC

File Edit View Run Kernel LSST Tabs Settings Help

/ notebooks / StackClubCourse /

Name	Last Modified
catalogacc...	a month ago
cleaned_c...	5 days ago
LICENSE	2 months ago
match-MA...	a month ago
N19_withR...	a day ago
README.md	2 months ago
RRall.fits	a day ago
sara-2.ipynb	23 days ago
sara-carin...	18 days ago
sara-CFHT...	a month ago
sara-CFHT...	a month ago
sara-CFHT...	a month ago
sara-EXOr...	13 days ago
sara-EXOr....	16 days ago
sara-grup...	2 months ago
sara-holov...	a month ago
sara-LC.ip...	a month ago
sara-NGC...	5 days ago
sara-NGC...	a month ago
sara-NGC...	23 days ago
sara-NGC...	26 minutes ago
sara-NGC...	a month ago
sara.ipynb	13 days ago
test-100-d...	a month ago

sara-LC.ipynb

cluster.ipynb | DataInventory.ipynb | Exploring_A_Data_Repo.ipy | sara-exploring-data-repo-

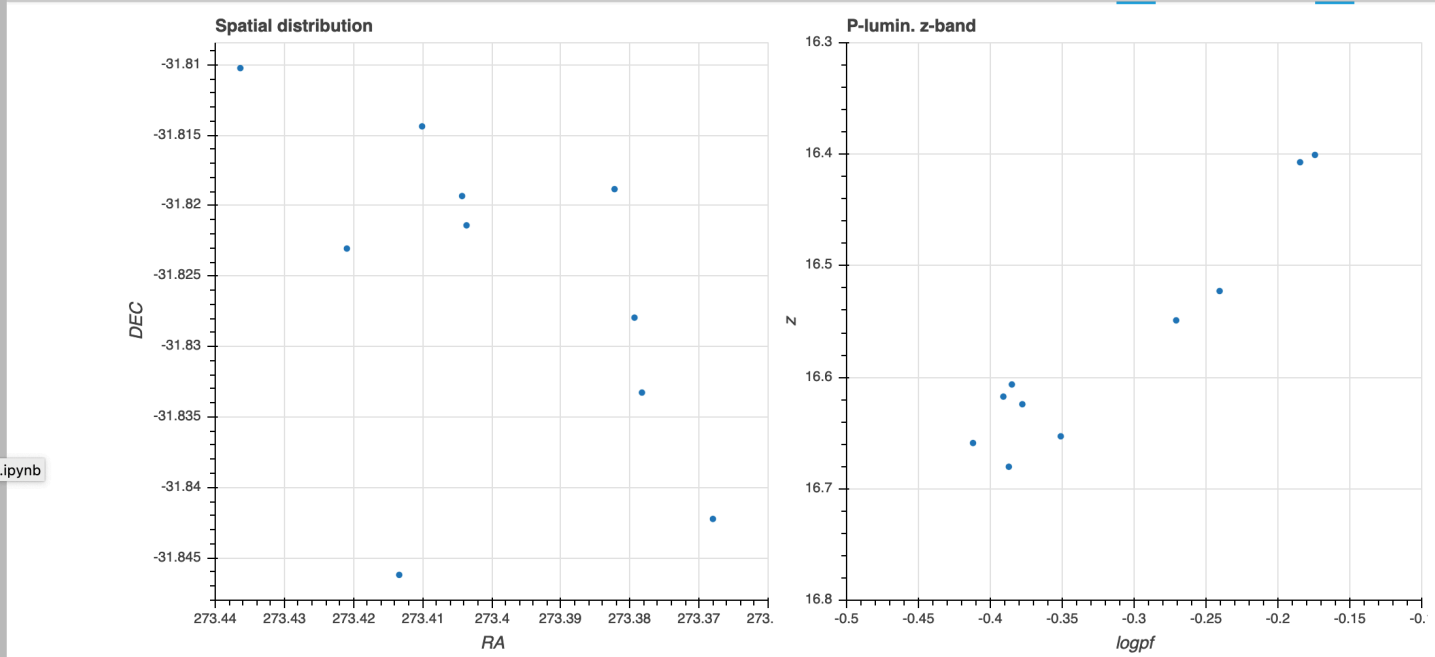
Markdown git LSST

LSST Cata | catalogac | bokeh_int | bokeh_ho | afw_displa | matplotlib | DataProdu | IntroToDat | bot_proce | intro-proc

Markdown git LSST

sara.ipynb | sara-carina. | sara-NGC6[illegible] | sara-NGC2[illegible] | sara-holovie | sara-NGC6[illegible] | sara-NGC2[illegible] | sara-EXOr.ip | sara-EXOr-f

Code git LSST



OAPA

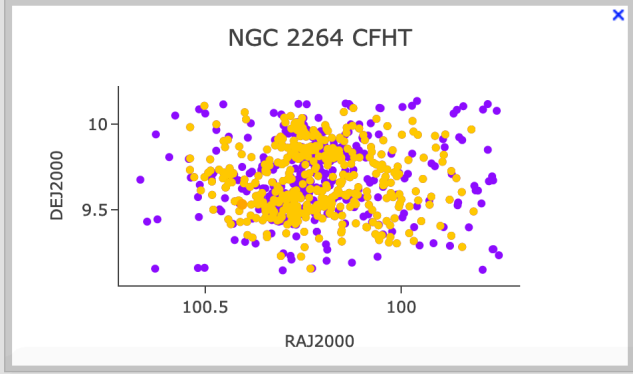
LSST TAP | Legacy PDAC | External Images | External Catalogs | Add Chart | Upload | Background Monitor

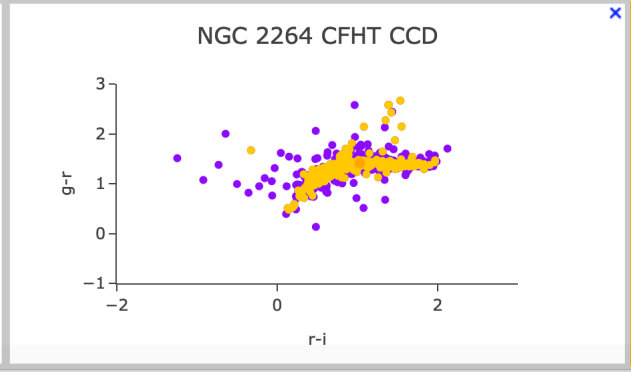
Rosaria Bonito Logout

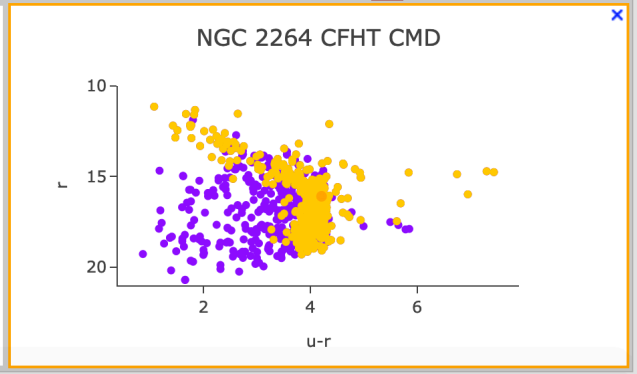
asu-table-Venuti-2014.csv

1 of 8 (1 - 100 of 757)

recno	Mon	A	RAJ2000	DEJ2000	umag	gmag	rmag	imag	St	SpT	r_SpT	Av	Lbol	Mass	Rad	logAge
3.7900000000e+02	⌂{		100.40547000000000	9.53274	20.30	17.500	16.088	15.060	w	M2.5	p	3.0000000000e-01	0.43	0.33	1.87	
5.8100000000e+02	⌂{		100.14793999999999	9.70781	22.30	19.786	18.416	16.696	w	M4.5	p	1.0000000000e-01	0.16	0.21	1.32	6.43
3.2000000000e+02	⌂{		100.27139999999999	9.81543	19.73	17.054	15.775	15.332	w	K5.5	s	6.0000000000e-01	0.47	1.00	1.24	
5.8200000000e+02	⌂{		100.07696999999999	9.86836	22.15	19.962	18.602	16.935	w	M4	p	1.0000000000e-01	0.12	0.22	1.13	6.53
5.8400000000e+02	⌂{		100.07508999999999	9.83946	21.70	19.083	17.721	16.283	w	M2	s	2.0000000000e-01	0.22	0.35	1.27	6.48
3.1700000000e+02	⌂{		100.23958999999999	9.82246	21.47	18.806	17.394	15.929	w	M3.5	p	3.0000000000e-01	0.29	0.27	1.65	
3.1600000000e+02	⌂{		100.27494999999999	9.59758	16.44	14.612	14.101	13.971	w	G2	p	3.0000000000e-01	1.99	1.20	1.42	7.34
5.8600000000e+02	⌂{		100.16257999999999	9.60000	19.85	17.200	15.875	15.213	w	M0	s	9.0000000000e-01	0.60	0.63	1.69	6.37
5.8700000000e+02	⌂{		99.89477999999998	9.78169	20.63	18.195	16.897	16.196	w	M0	p	0.0000000000e+00	0.16	0.66	0.87	7.27
5.8800000000e+02	⌂{		100.15287000000000	9.36812	19.28	16.572	15.103	14.318	w	K7:M0	p	8.0000000000e-01	1.37	0.65	2.50	6.00
5.8900000000e+02	⌂{		100.14537999999999	9.90198	21.81	19.045	17.640	16.043	w	M4	s	3.0000000000e-01	0.27	0.25	1.68	6.31







Venuti et al. 2014

NGC 2264 YOUNG CLUSTER

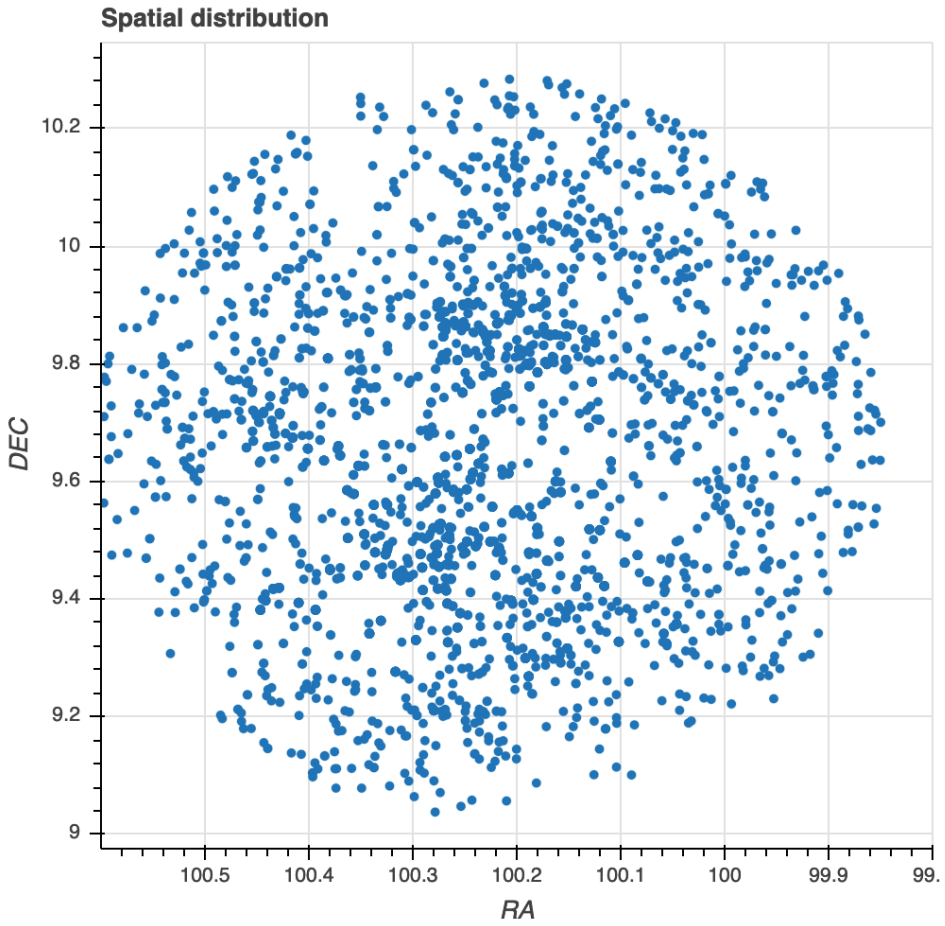
The Gaia-ESO Survey: A new diagnostic for accretion and outflow activity in the young cluster NGC 2264*

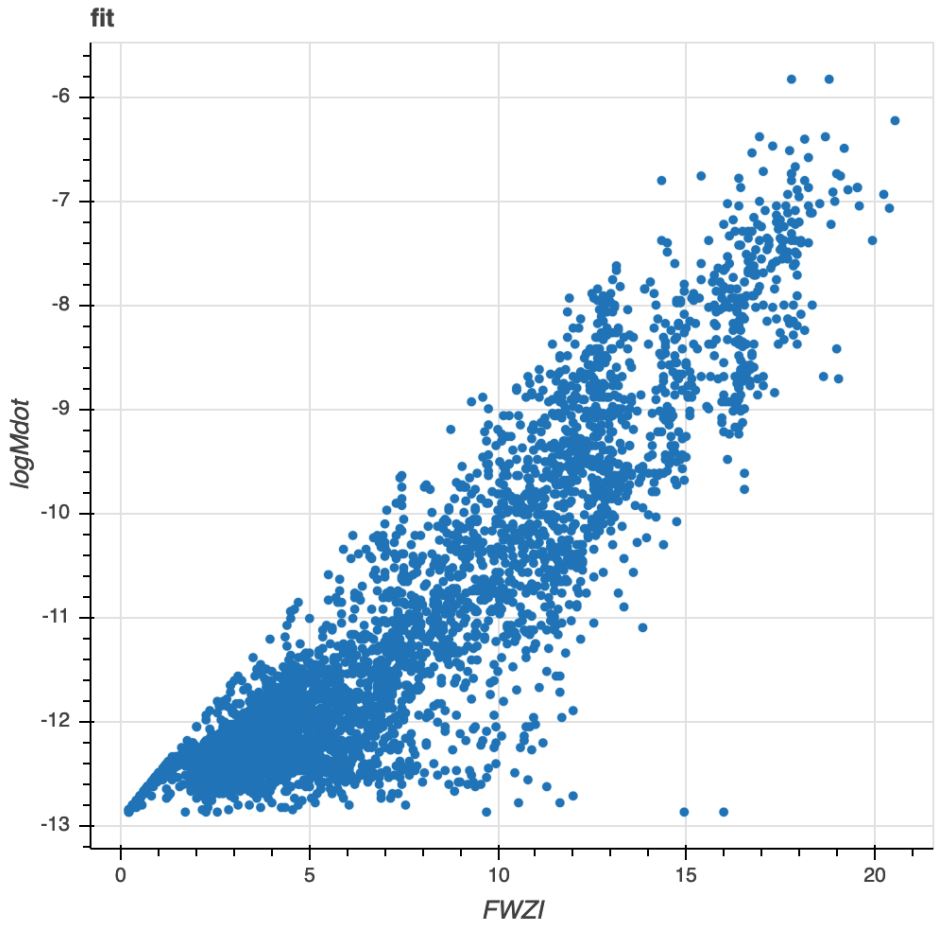
Bonito R.[1], Prisinzano L.[1], Venuti L.[2,1], Damiani F.[1], Micela G.[1], Sacco G.[3], Traven G.[4], Biazzo K.[5], Sbordone L.[6], Masseron T.[7,8], Zwitter T.[9], Gonneau A.[10], Bayo A.[11,12], Roccatagliata V.[13,3,14], Randich S.[3], Vink J.S.[15], Jofre P.[16], Flaccomio E.[1], Magrini L.[3], Carraro G.[17], Morbidelli L.[3], Frasca A.[5], Monaco L.[18], Rigliaco E.[19], Worley C.[10], Hourihane A.[10], Gilmore G.[10], Franciosini E.[3], Lewis J.[10***], and Koposov S.[10]

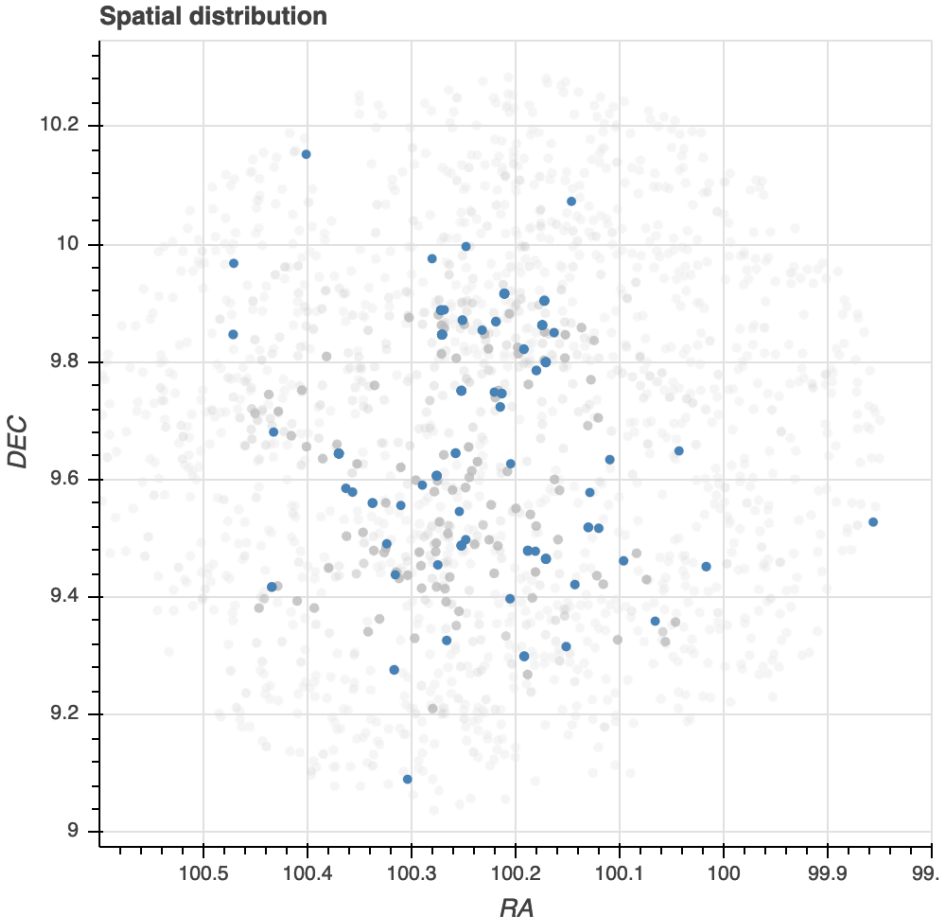
Bonito et al. 2020, A&A

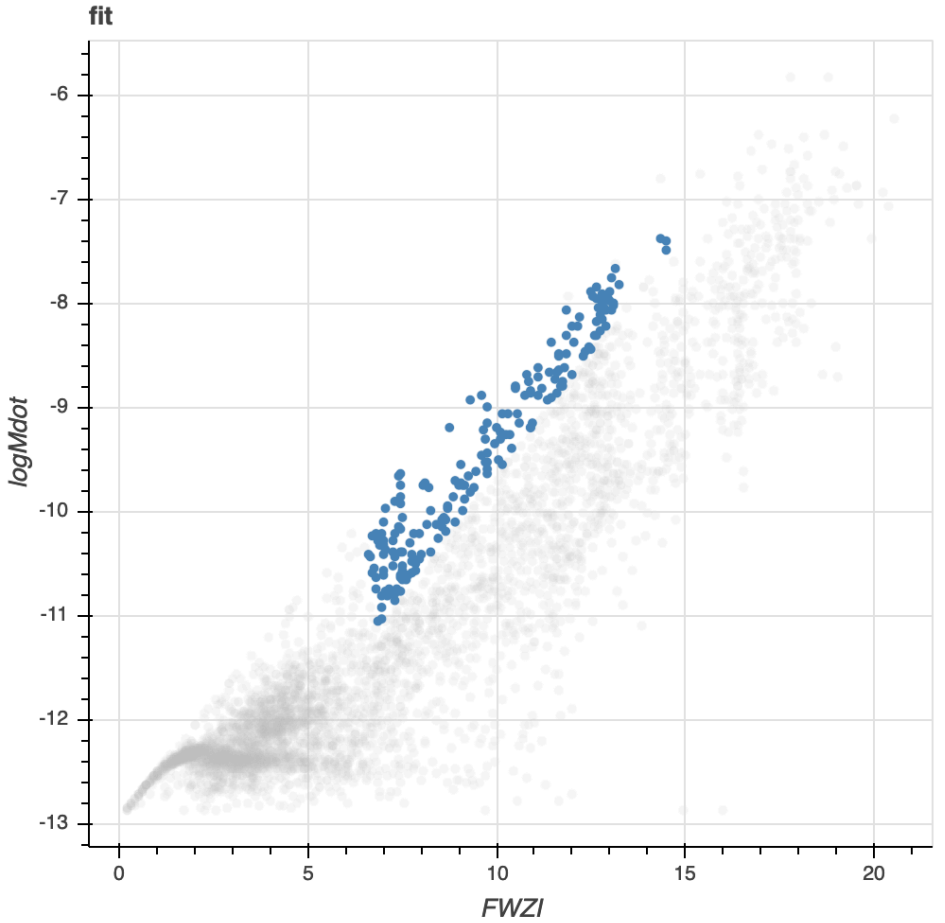
Bonito & Hartigan et al. 2018 (WP for Rubin LSST Cadence Optimization)

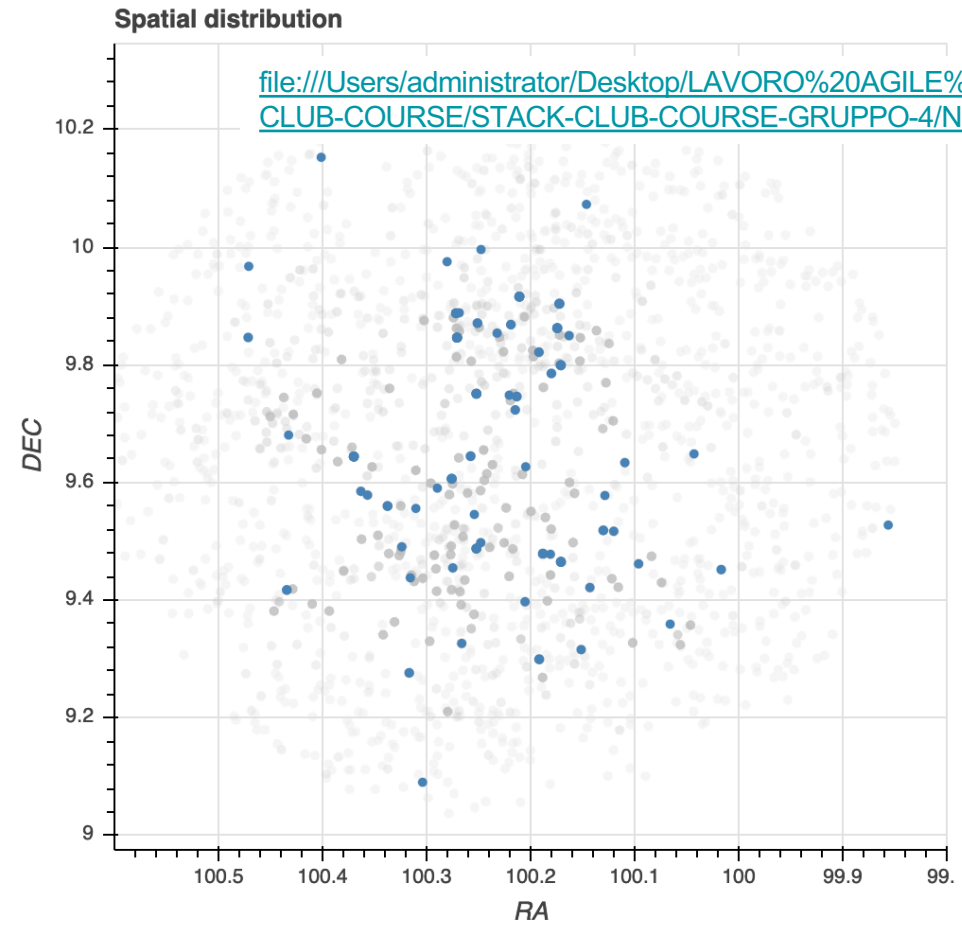
Bonito & Venuti et al. 2021 (Cadence Note)


Spatial distribution
DEC
RA
10.2
10
9.8
9.6
9.4
9.2
9
100.5
100.4
100.3
100.2
100.1
100
99.9
99.

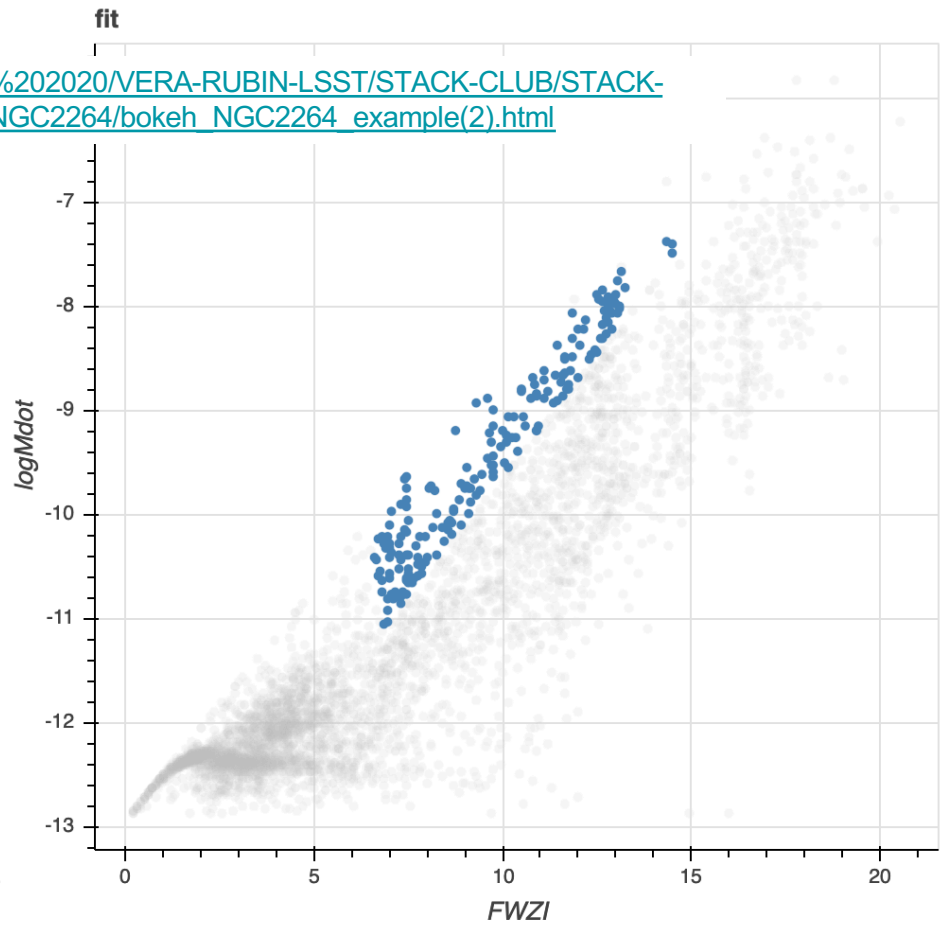

fit
logMdot
FWZI
-6
-7
-8
-9
-10
-11
-12
-13
0
5
10
15
20


Spatial distribution
10.2
10
9.8
9.6
9.4
9.2
9
DEC
100.5
100.4
100.3
100.2
100.1
100
99.9
99.
RA

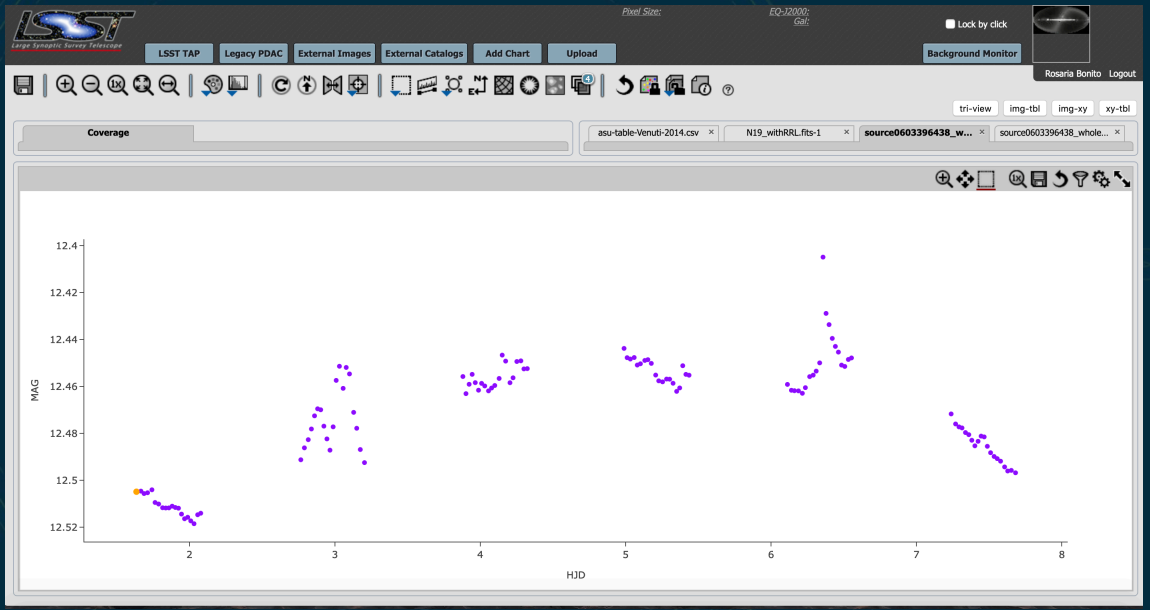

fit
-6
-7
-8
-9
-10
-11
-12
-13
logMdot
0
5
10
15
20
FWZI

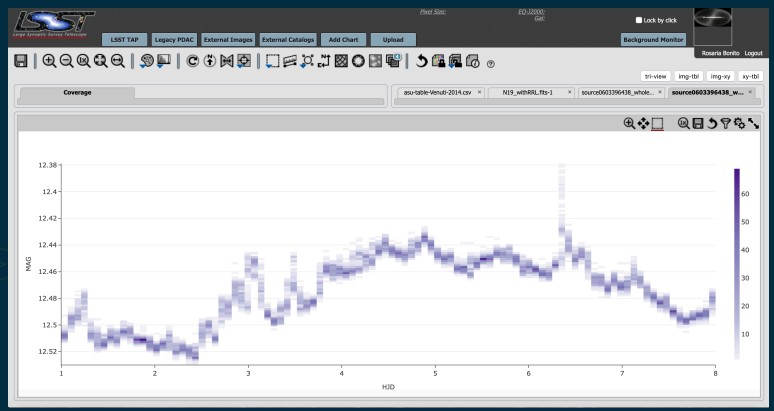


file:///Users/administrator/Desktop/LAVORO%20AGILE%202020/VERA-RUBIN-LSST/STACK-CLUB/STACK-CLUB-COURSE/STACK-CLUB-COURSE-GRUPPO-4/NGC2264/bokeh_NGC2264_example(2).html



NGC 2264 YOUNG CLUSTER





Bonito & Hartigan et al. 2018 (WP for Rubin LSST Cadence Optimization)

Rosaria (Sara) Bonito – INAF - Observatory of Palermo (Italy)

VERA C. RUBIN OBSERVATORY

File Edit View Run Kernel LSST Tabs Settings Help

/ notebooks / StackClubCourse /

Name	Last Modified
Session01	2 months ago
Session02	a month ago
Session03	17 days ago
Session04	2 months ago
Session05	2 months ago
Session06	17 days ago
testdata_cfht	Jul 27, 2020 8:07 PM
bokeh_NGC2264_CF...	9 days ago
bokeh_NGC2264_exa...	a month ago
bokeh_NGC6569_all_...	5 days ago
bokeh_NGC6569_exa...	a month ago
bokeh_NGC6569_exa...	22 days ago
bokeh_NGC6569_RRL...	5 days ago
bokeh_V1118Ori_exam...	17 days ago
bokeh_V1118Ori_exam...	20 days ago
butlertutorial.ipynb	2 months ago
catalogaccess.ipynb	a month ago
cleaned_ccd23_779.fits	9 days ago
LICENSE	2 months ago
match-MANYSPEC-C...	a month ago
N19_withRRL.fits	5 days ago
README.md	2 months ago
RRall.fits	5 days ago
sara-2.ipynb	a month ago
sara-carina.ipynb	22 days ago

cluster.ipynb | DataInventory.ipynb | Exploring_A_Data_Repo.ipy | sara-exploring-data-repo-

Markdown git LSST

LSST Ca | cataloga | bokeh_ir | bokeh_h | afw_disp | matplotli | DataProc | IntroToD | bot_proc | intro-prc

Markdown git LSST

Stack Club Course Session 6: Data Products To Science

Owner(s): **Bryce Kalmbach** (@jbkalmbach)

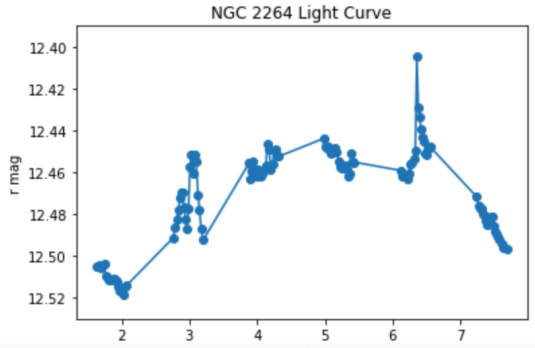
Last Verified to Run: **2020-06-11**

sara.ipyr | sara-car | sara-NG | sara-NG | sara-NG | sara-hol | sara-NG | sara-NG | sara-EX(| sara-EX(

Code git LSST

```
plt.plot(HJD, r, marker='o')
plt.ylim(12.53,12.39)
plt.xlabel('HJD')
plt.ylabel('r mag')
plt.title('NGC 2264 Light Curve')
```

[10]: `Text(0.5, 1.0, 'NGC 2264 Light Curve')`



Bonito & Hartigan et al. 2018 (WP for Rubin LSST Cadence Optimization)

Discussed during PCW2020 Metrics Hackathon

0 25 LSST | Idle Mode: Command Ln 1, Col 1 DataProductsToScience.ipynb

TASK FORCE INFO

Join a TVS Task Force and subgroup (see also information on the new **Justice, Equity, Diversity, and Inclusion** group):
https://lsst-tvssc.github.io/

Get in the conversation on Slack:
#tvs
#tvs-science_platform

E-mail: **rosaria.bonito@inaf.it**