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ADLER PLANETARIUM

CITIZEN SCIENCE ALLIANCE

What to do with 500000 scientists

Chris Lintott

Adler Planetarium, Chicago

New College, University of Oxford

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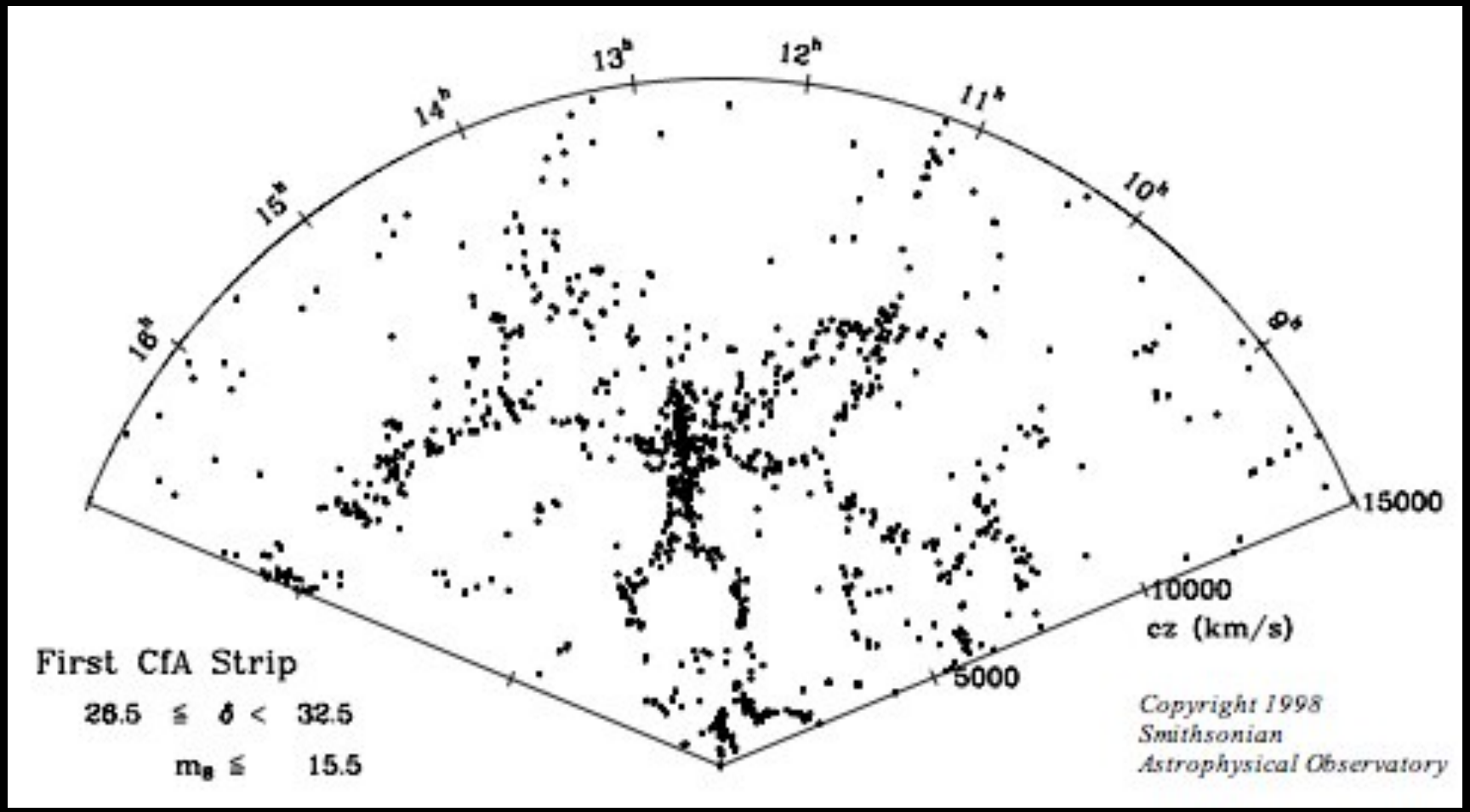

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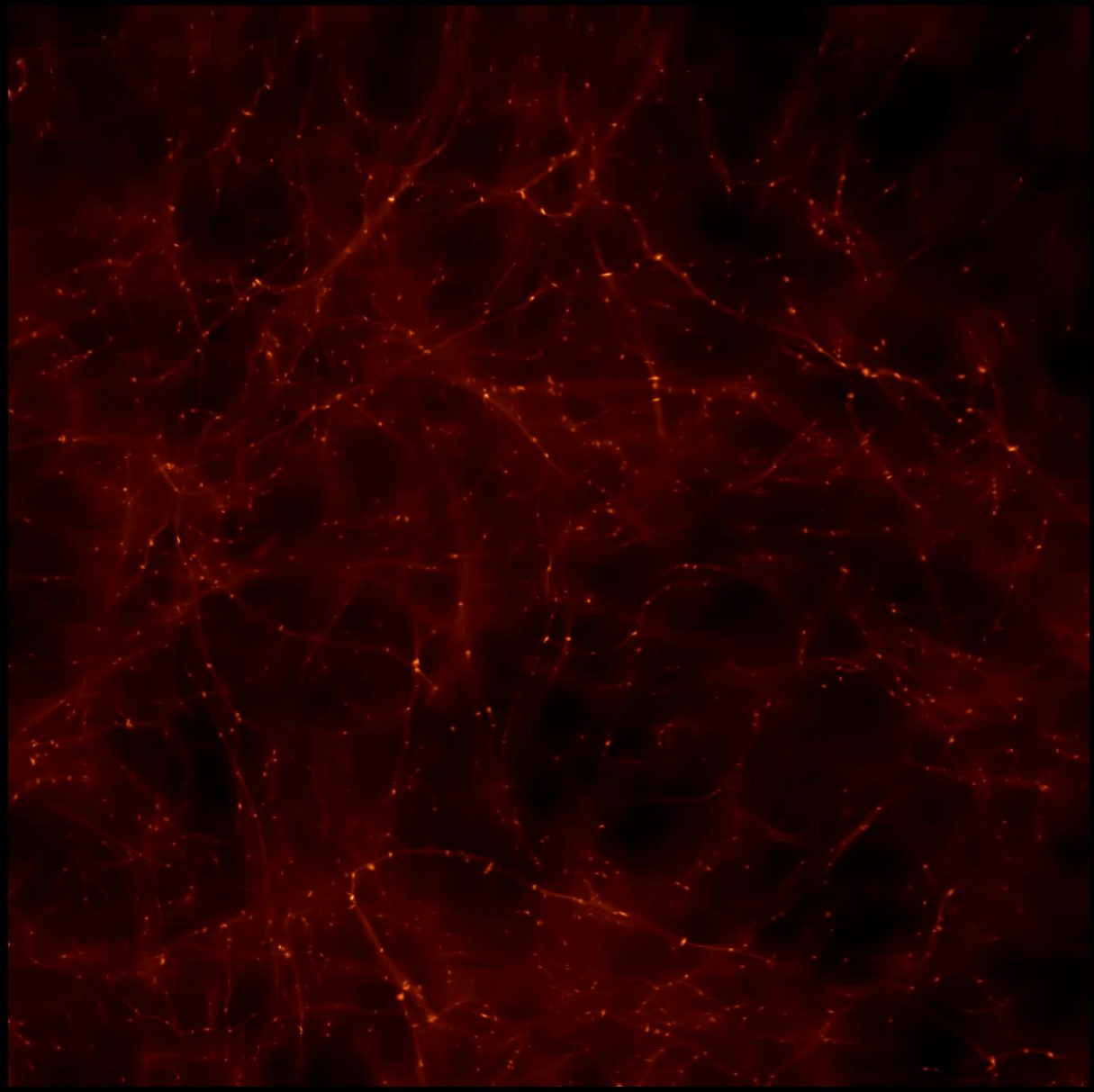

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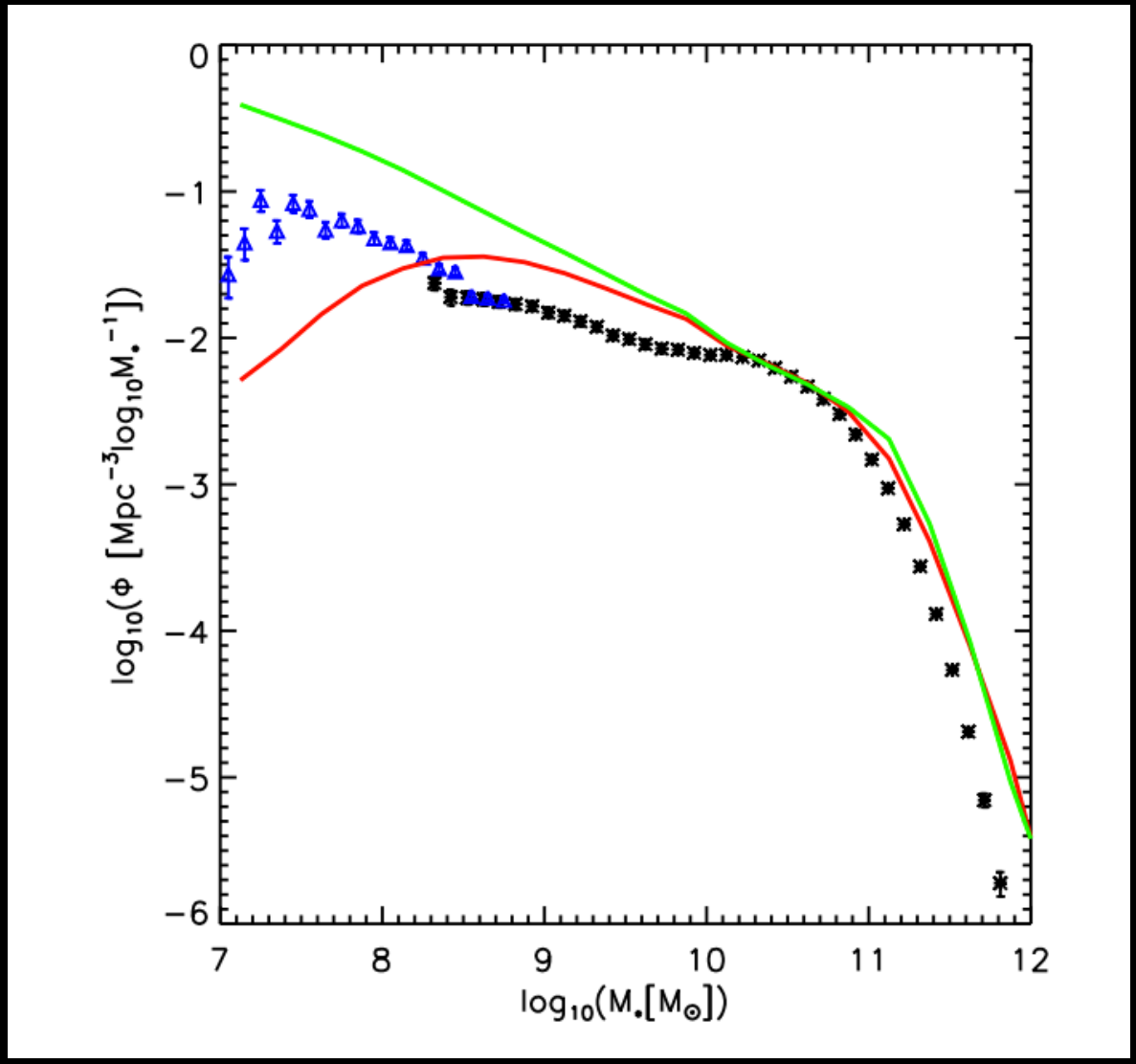

Green and red curves : predictions from Millenium simulation
Blue/Black : SDSS galaxies

Guo et al. 2011 (arXiv/1006.0106)

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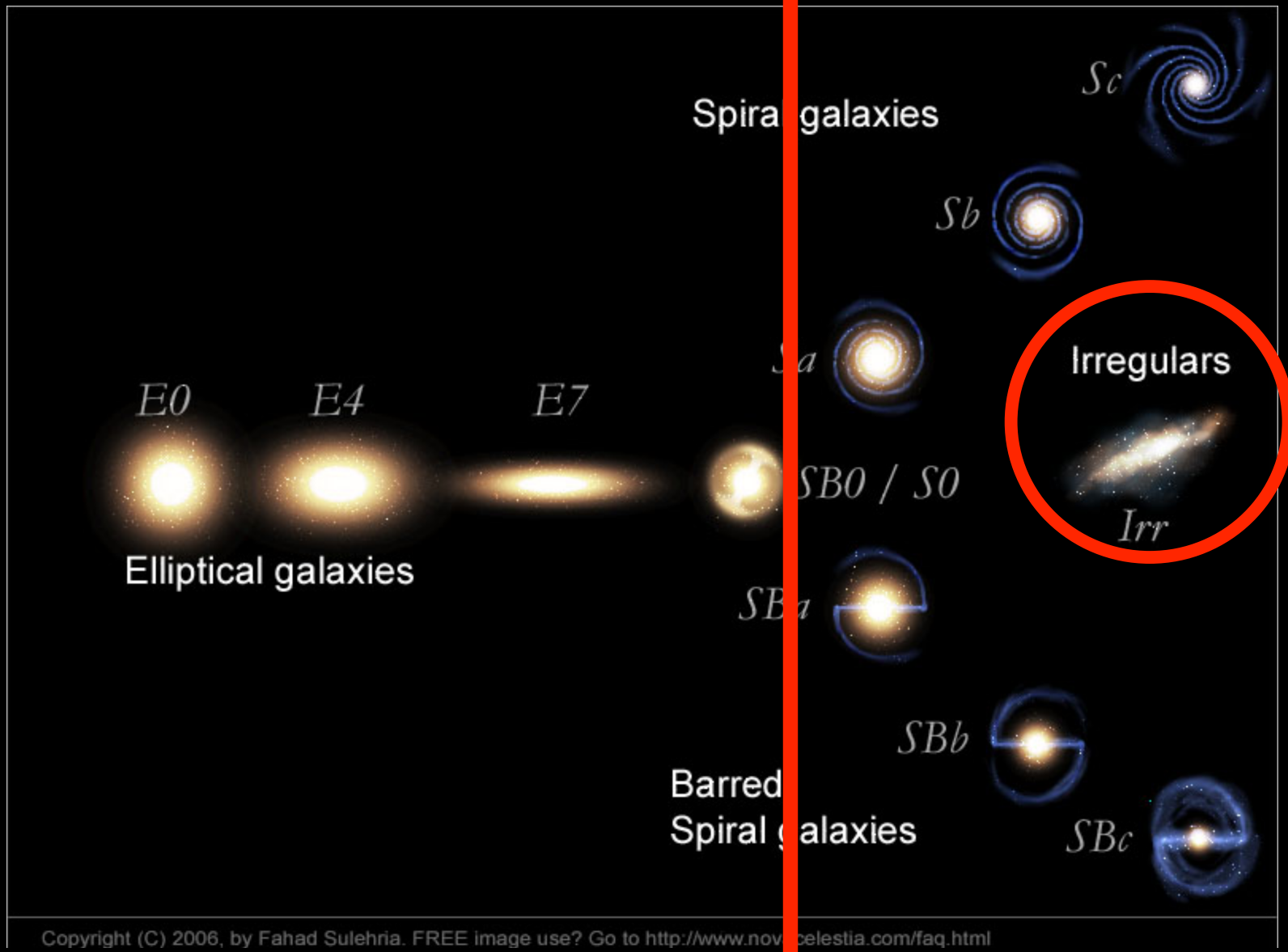

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STARDUST @ HOME

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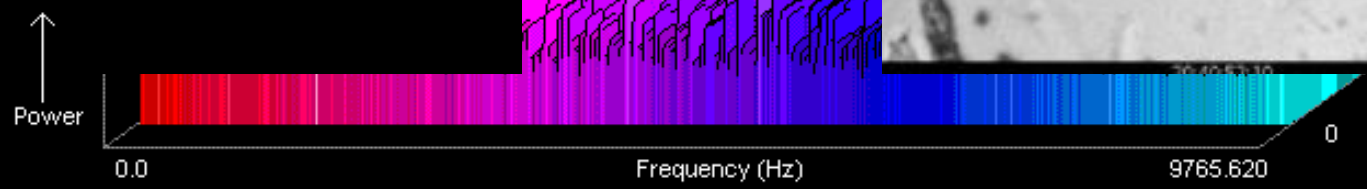
User Info

time: 8 hr 28 min 41.1 sec



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GALAXY ZOO .org
Welcome
Home
The Science
How to Take Part
Galaxy Analysis
Forum
Press & News
FAQ
Links
Contact Us
Login
Register
Galaxy Tutorial
Galaxy Analysis
Galaxy Analysis
Welcome to Galaxy Zoo's view of the Universe. If you're here you should already have seen the Tutorial, but feel free to go and remind yourself. There's no need to agonise for too long over any one image, just make your best guess in each case.
Galaxy Ref:
588010880371851294
Choose the Galaxy Profile by clicking the buttons below
CLOCK
ANTI
EDGE ON/ UNCLEAR
SPIRAL GALAXY
ELLIPTICAL GALAXY
STAR / DON'T KNOW
MERGERS
Show Grid Overlay on the next Image

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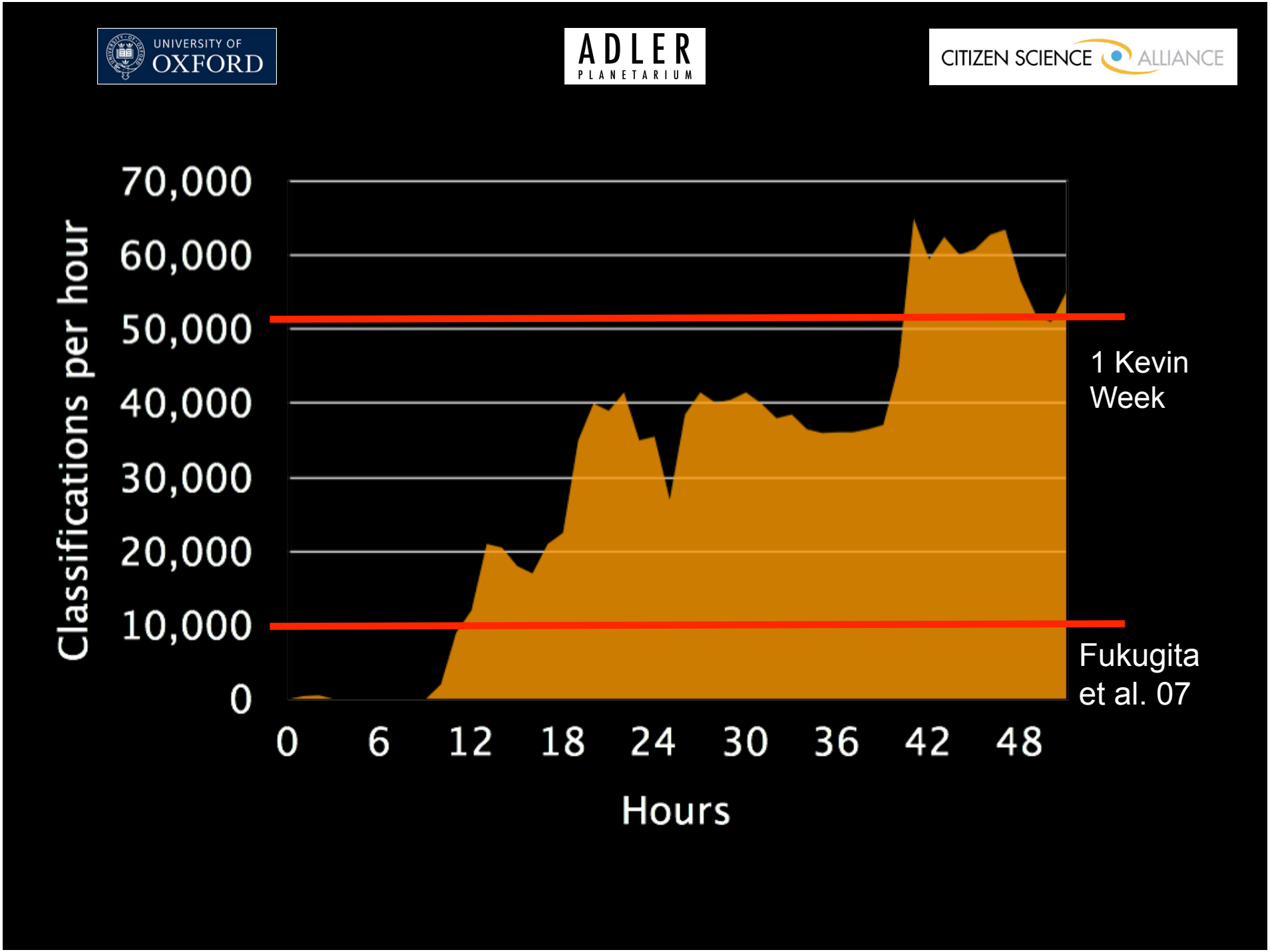
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CITIZEN SCIENCE ALLIANCE
Classifications per hour
70,000
60,000
50,000
40,000
30,000
20,000
10,000
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6
12
18
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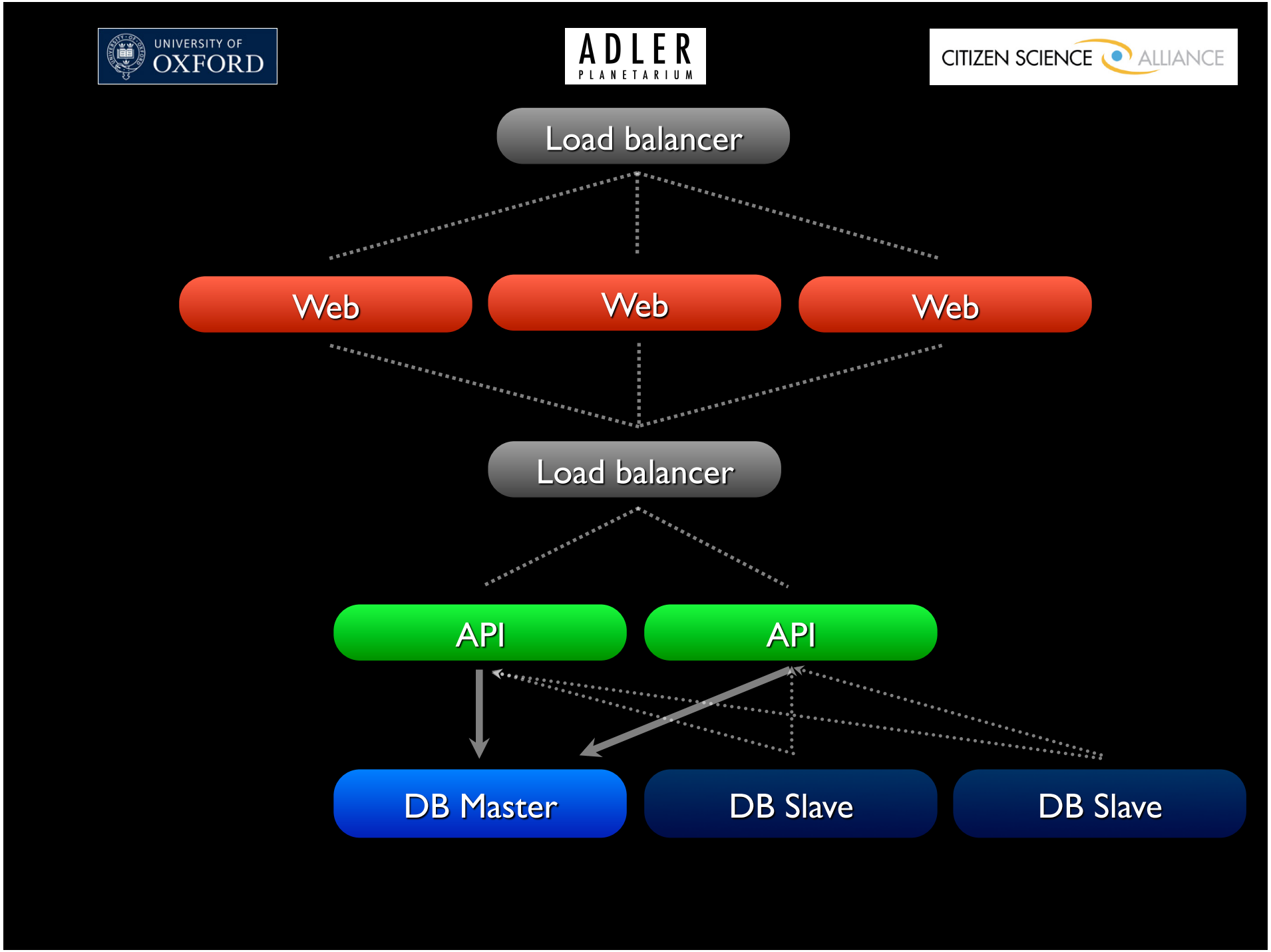
30
36
42
48
Hours
1 Kevin Week
Fukugita et al. 07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Load balancer
Web
Web
Web
Load balancer
API
API
DB Master
DB Slave
DB Slave

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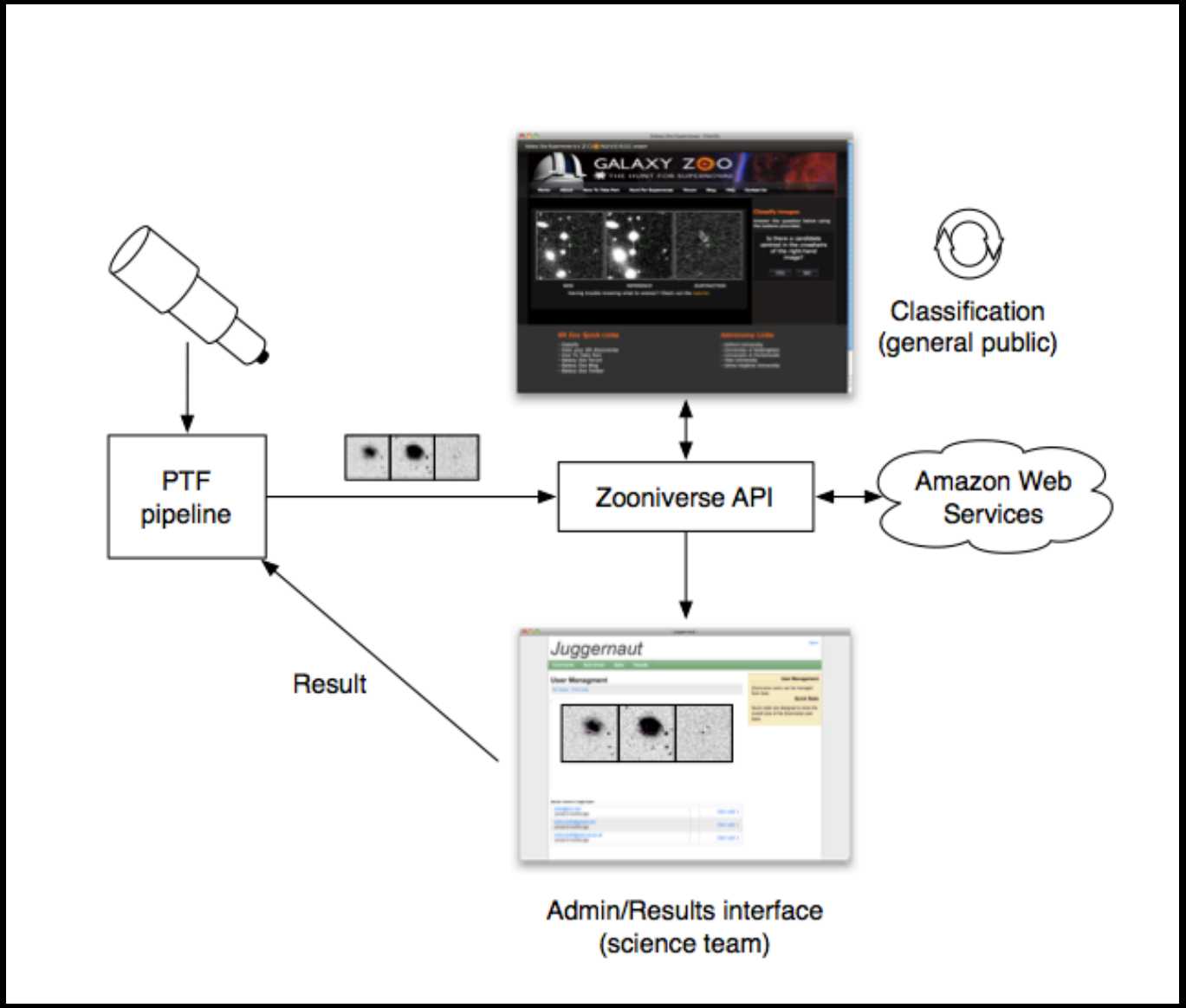

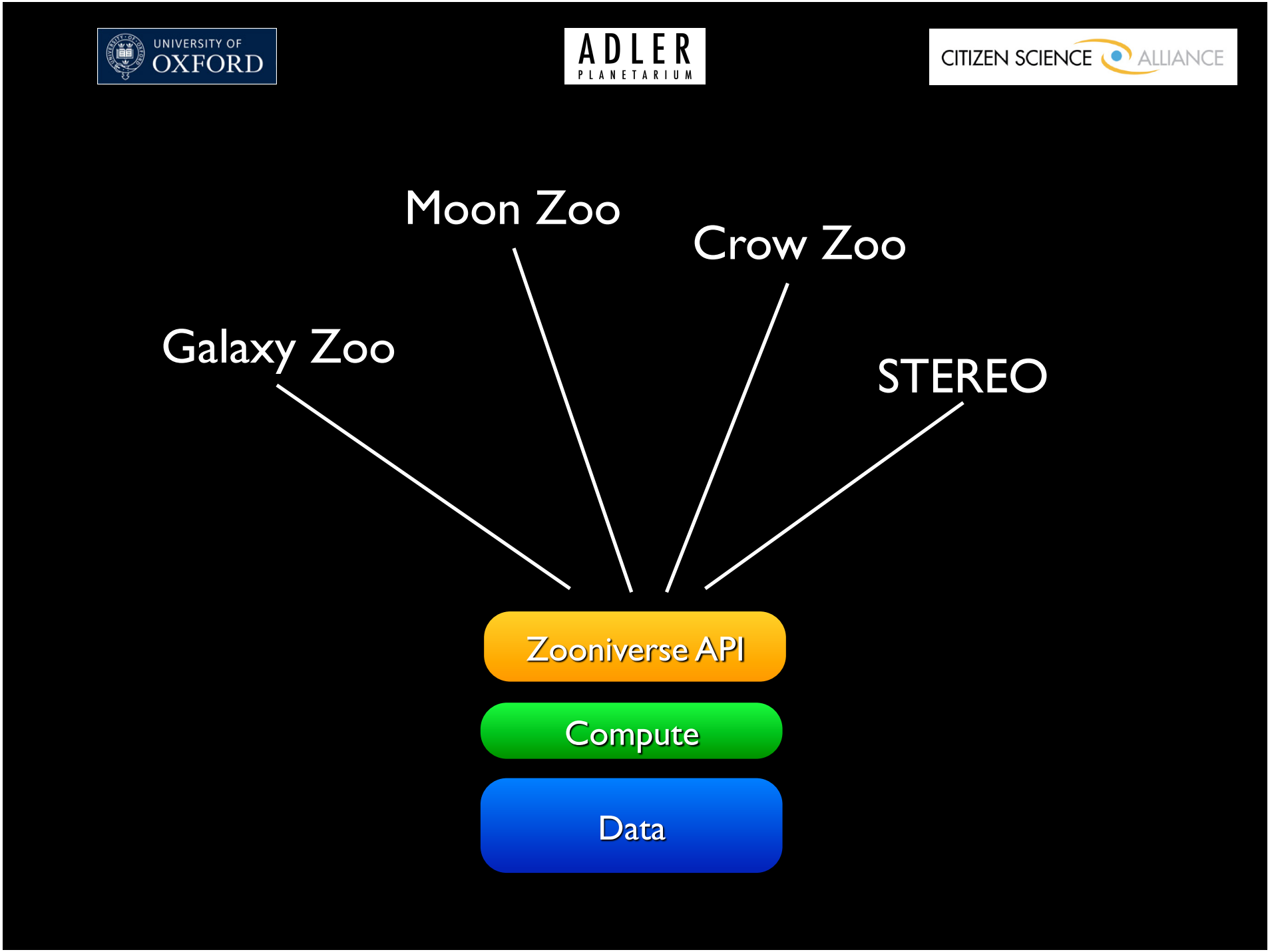
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Moon Zoo
Crow Zoo
Galaxy Zoo
STEREO
Zooniverse API
Compute
Data

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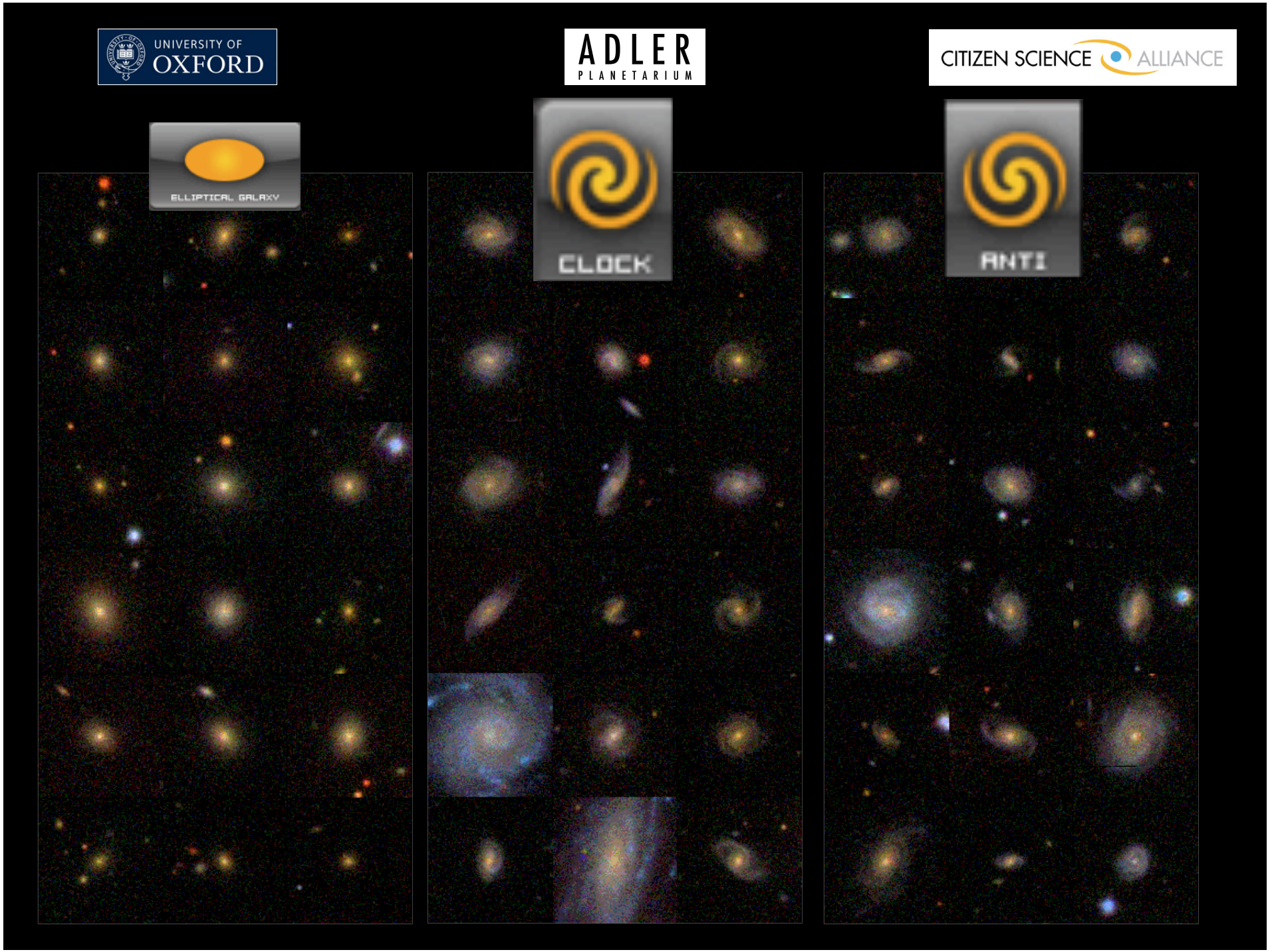
350,000+ classifications

Thousands of new users

Android app coming...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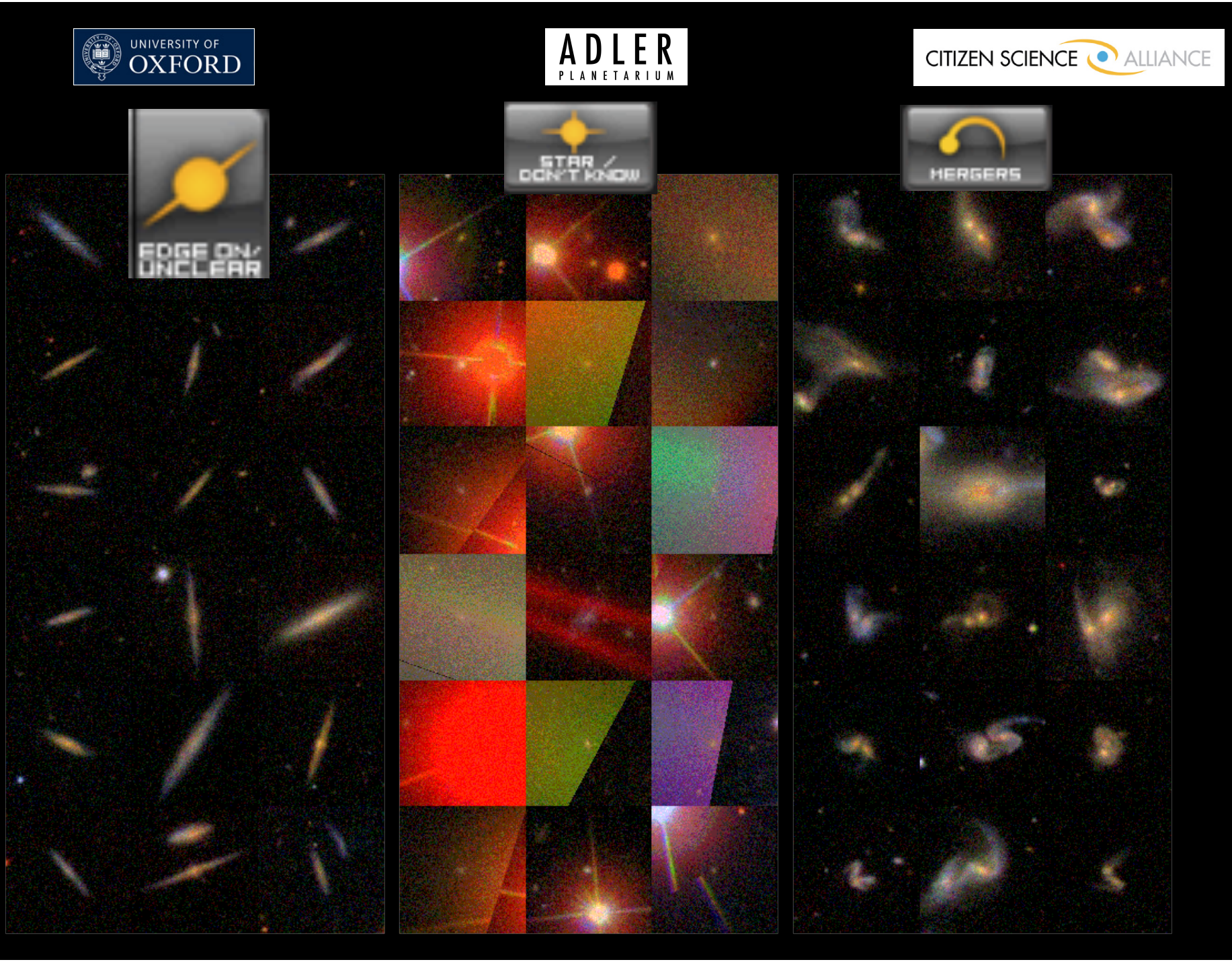
OXFORD
ADLER
PLANETARIUM
CITIZEN SCIENCE ALLIANCE
ELLIPTICAL GALAXY
CLOCK
ANTI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CITIZEN SCIENCE ALLIANCE
EDGE ON/
UNCLEAR
STAR /
DON'T KNOW
MERGERS

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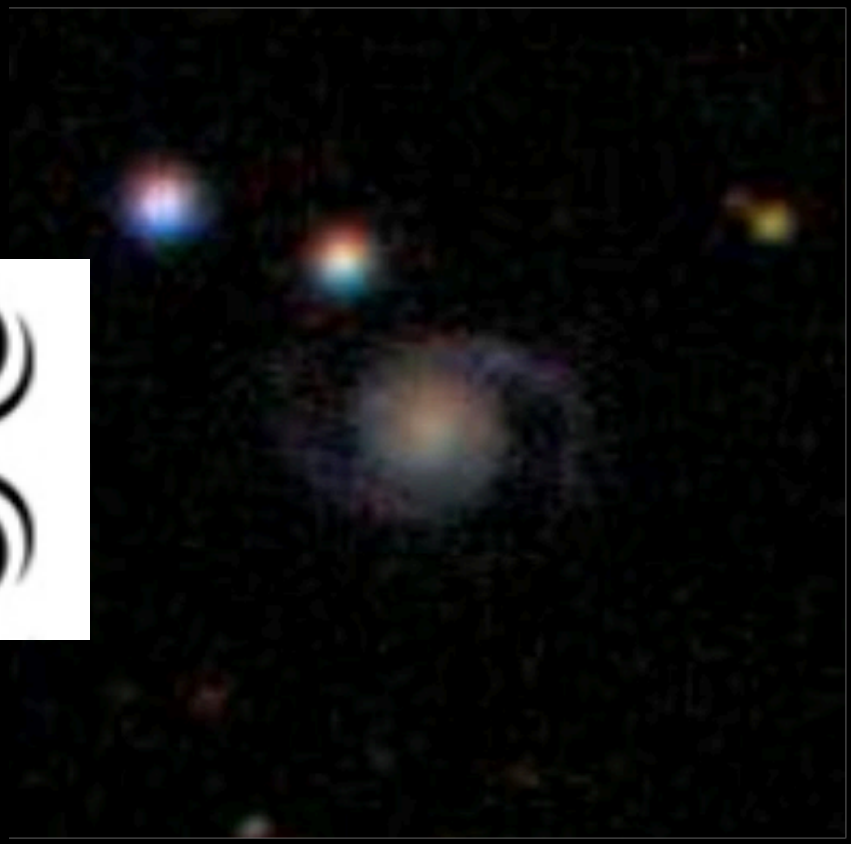
Longo (astro-ph/0707.3793) finds an excess of anticlockwise spirals



So do we...

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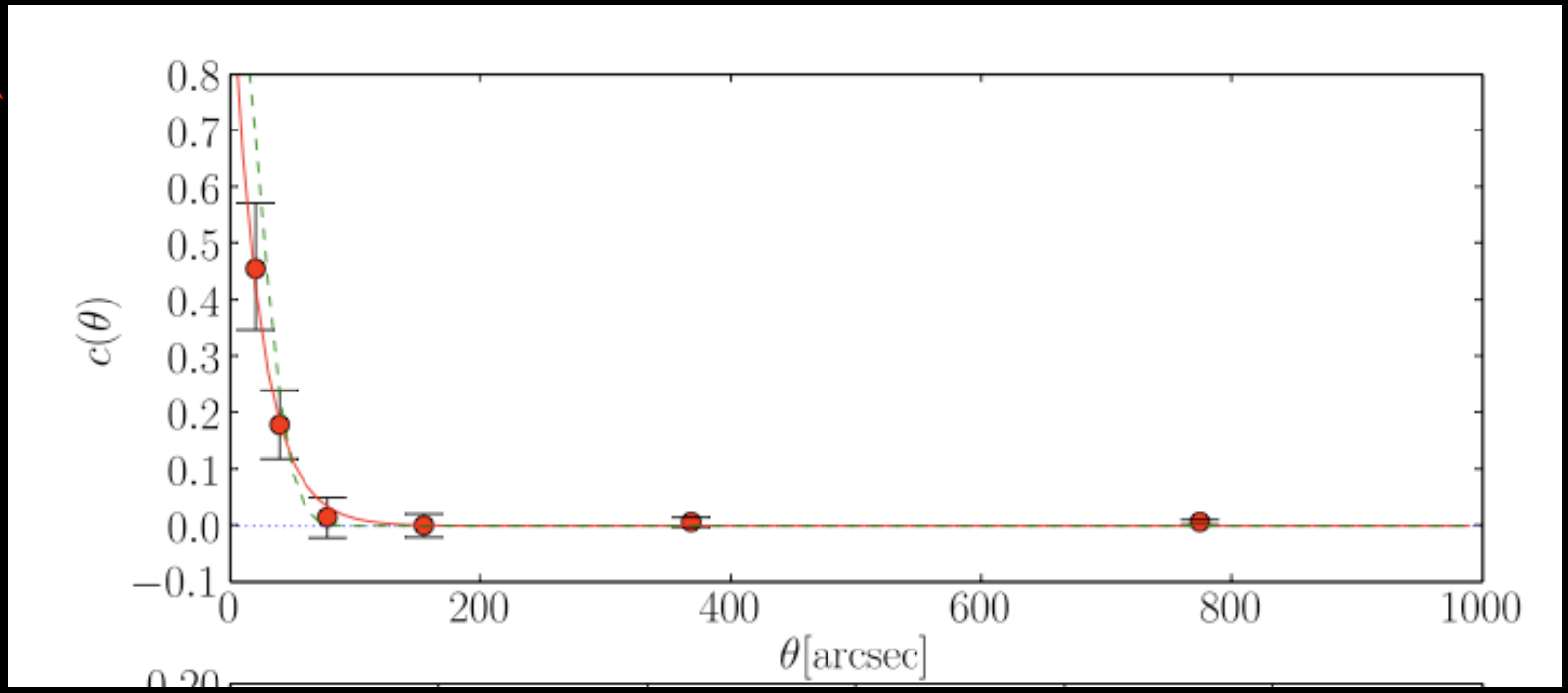
Odds of two galaxies having the same spin



Separation (in 1/3600 of a degree)

Slosar et al.

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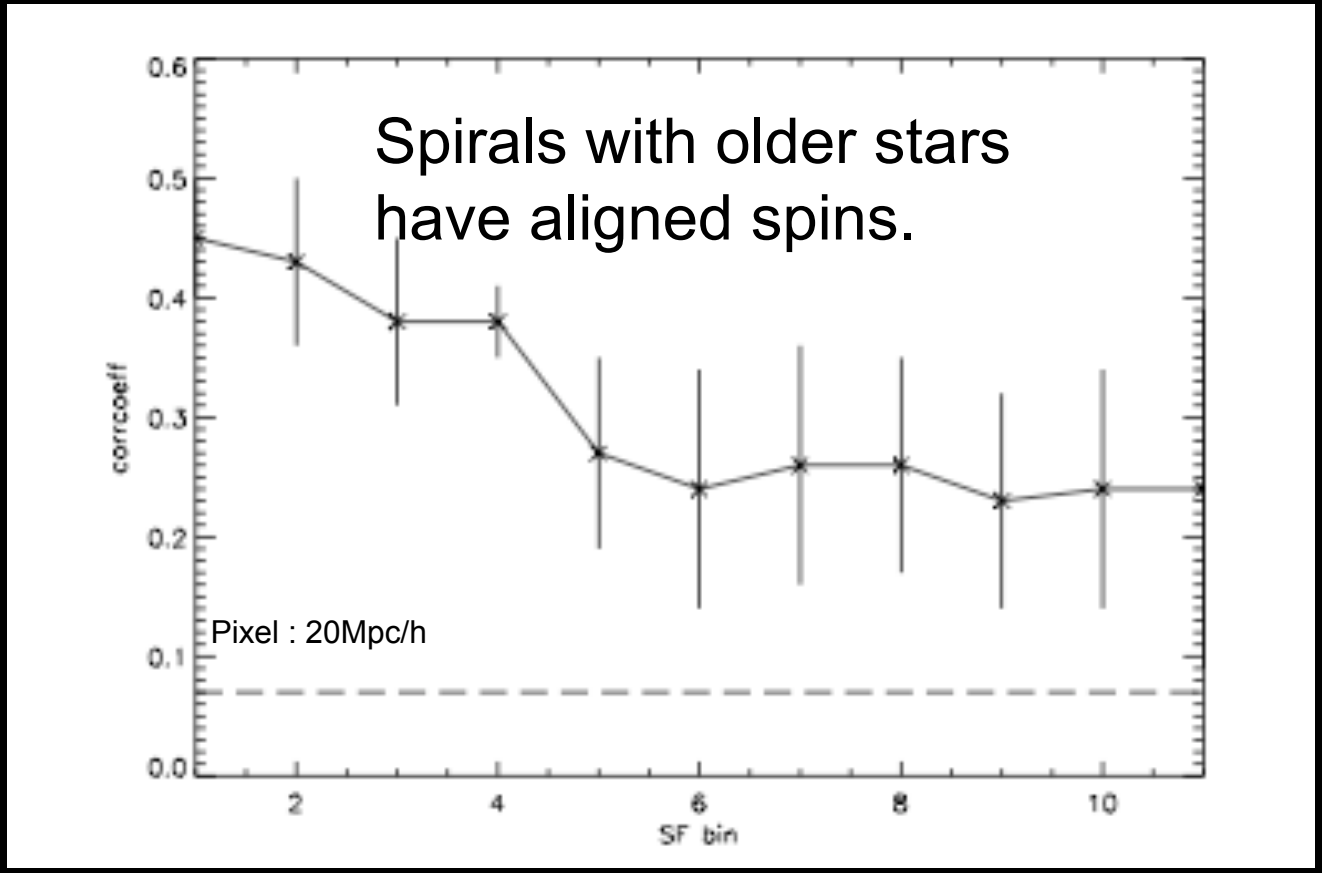

SF Bin	1	2	3	4	5	6	7	8	9	10	11
<age>	12.1	8.5	4.7	2.3	1.1	0.5	0.3	0.1	0.06	0.03	0.01

Jiminez et al. 2010

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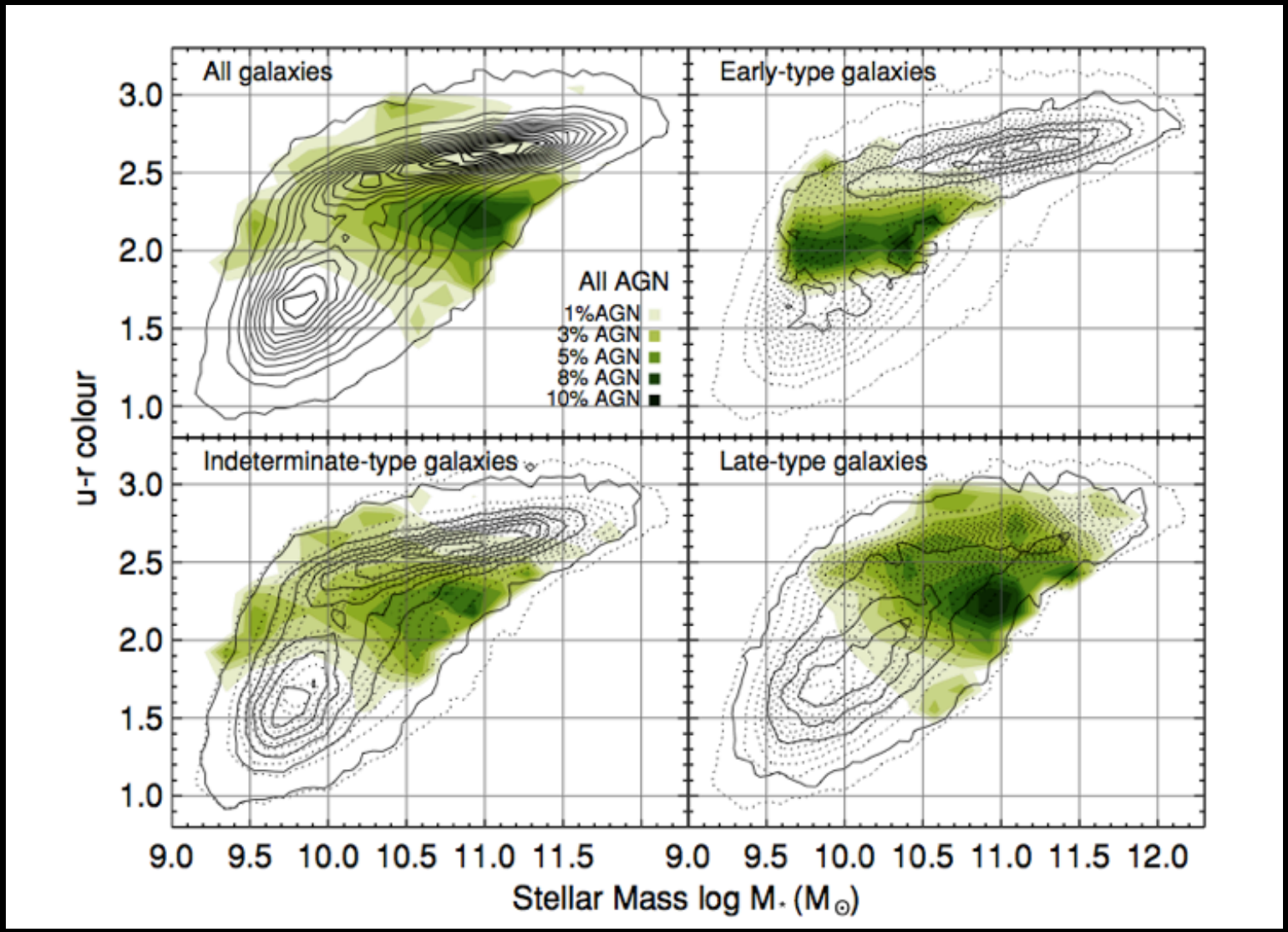

Schawinski, Lintott et al. 2010, arXiv : 1002.1488

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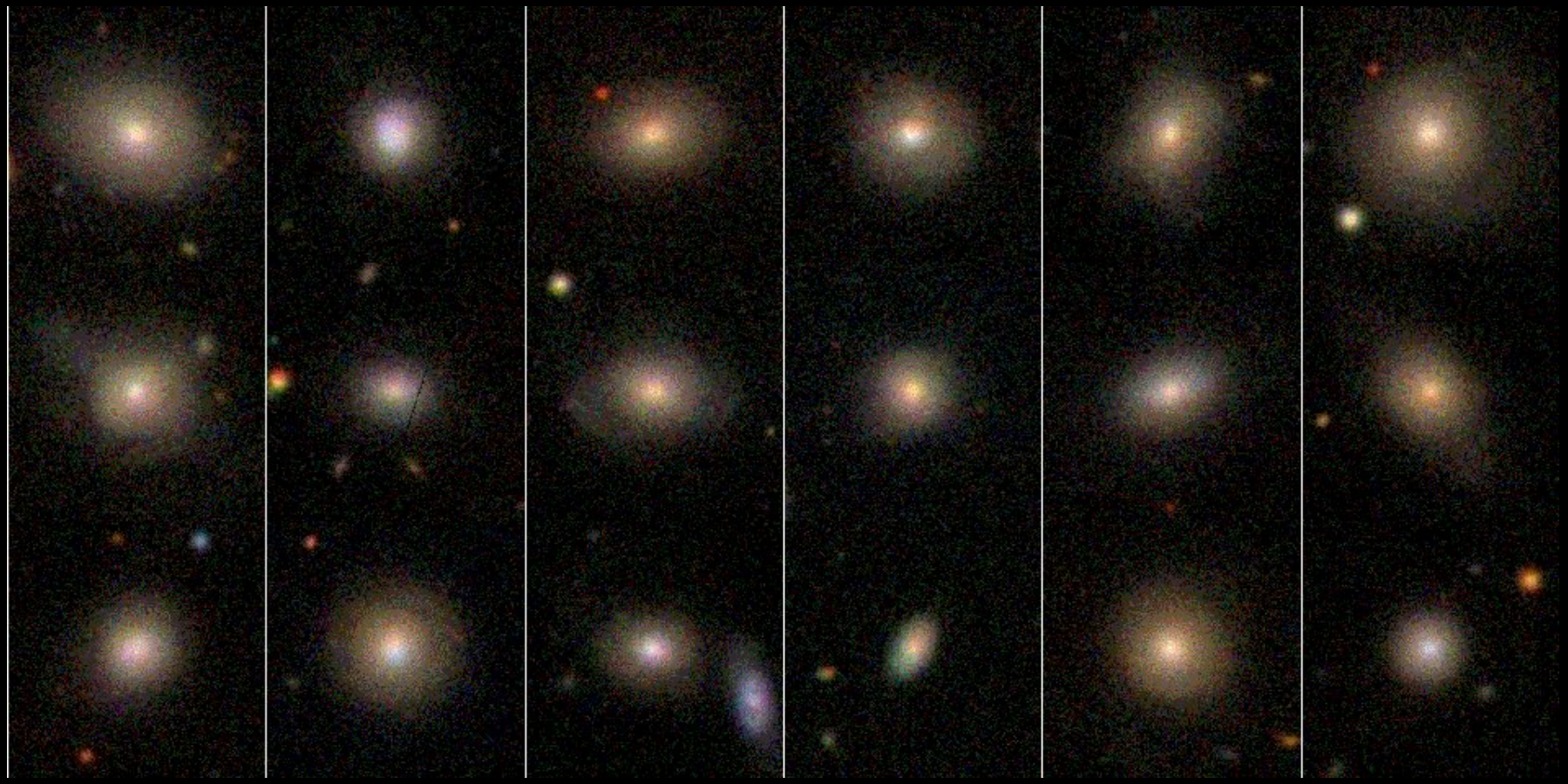
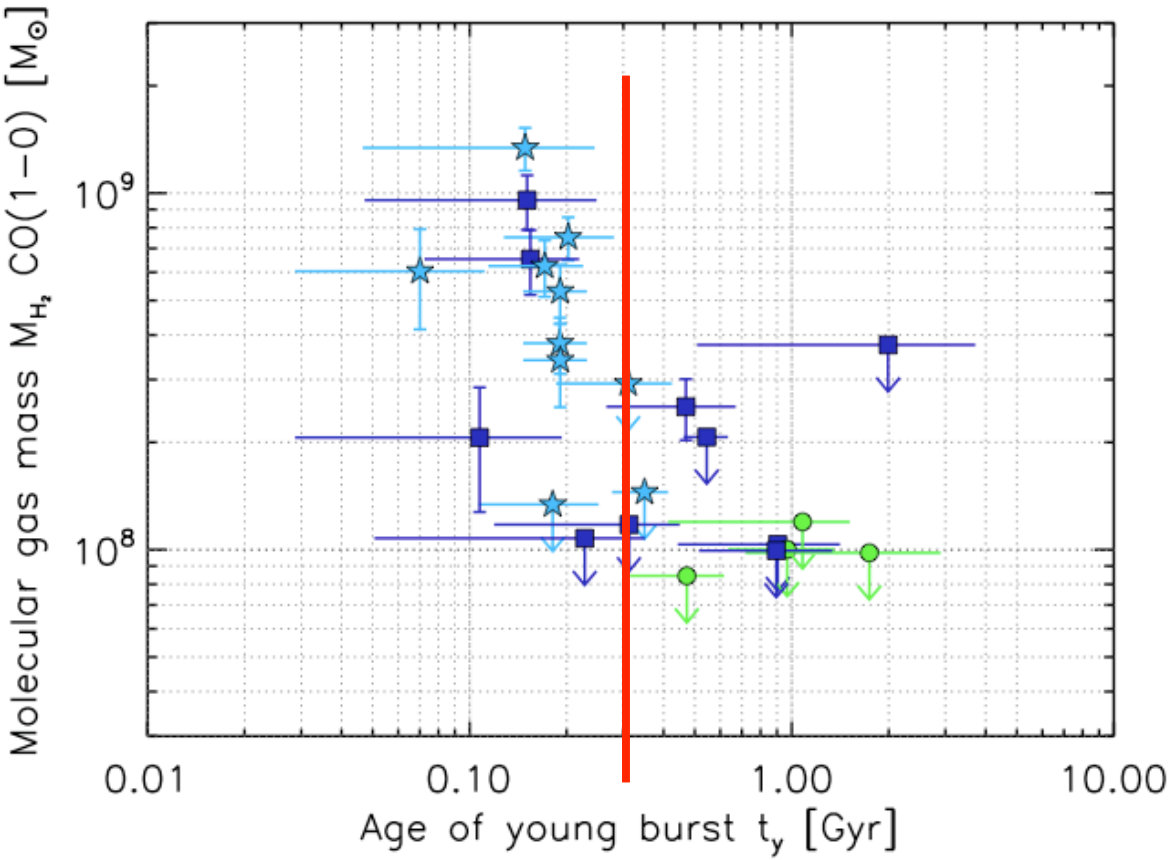
Blue ellipticals : ~250 local galaxies



Star Formation Rate between 0.5 and 50 (!) solar masses per year

Milky Way ~ 1 solar masses per year



BPT diagram classification

Star Formation

Transition Region

AGN

Schawinski, Lintott et al. 08, ApJ

Galaxy Zoo : SDSS

STAGES : Hubble Space Telescope

Wolf et al : astro-ph/0811.3873

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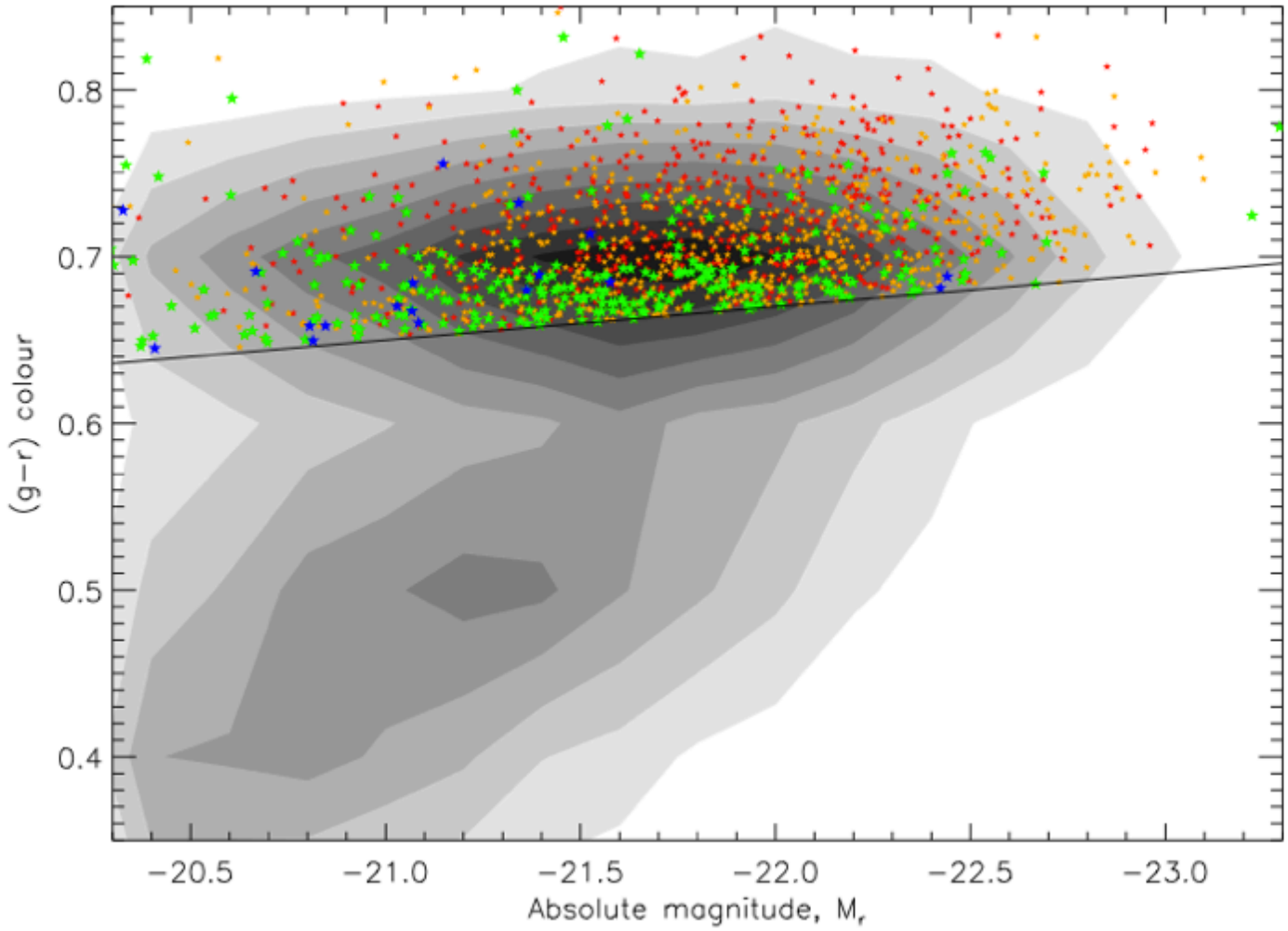

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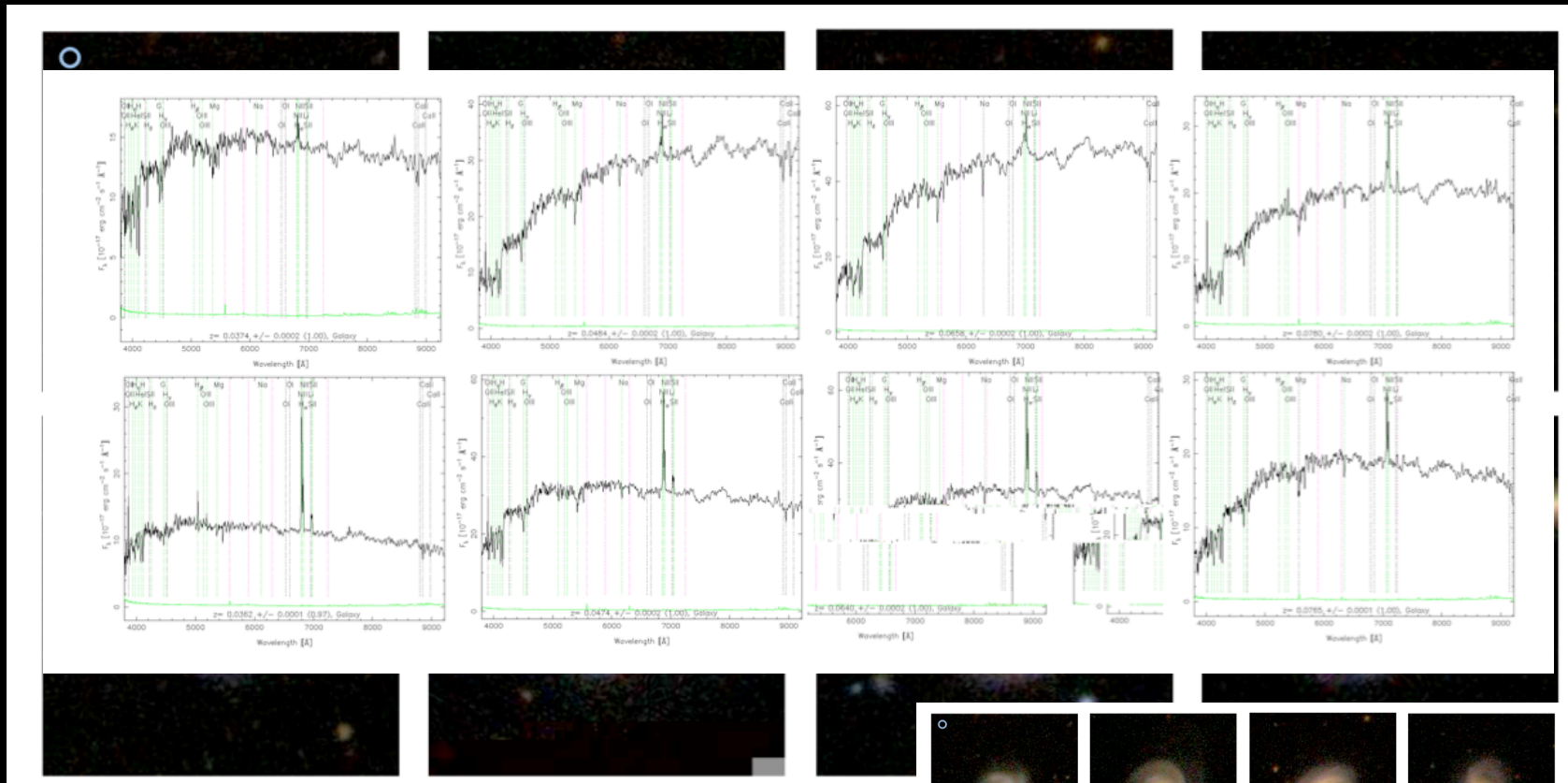

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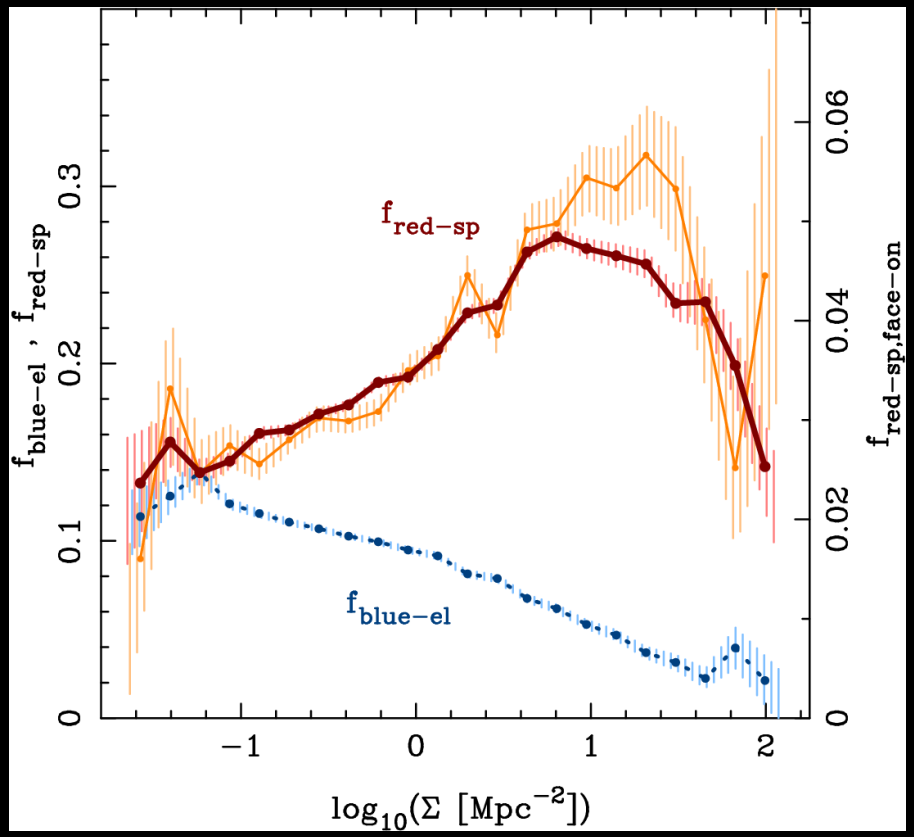
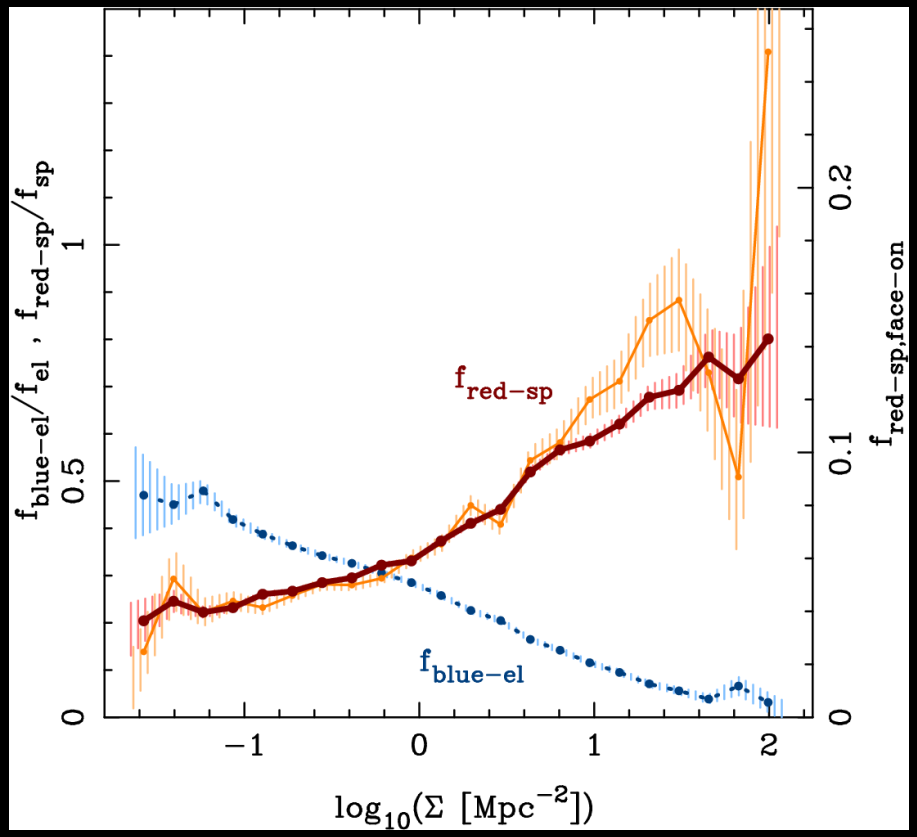
fraction of all galaxies



fraction of morphological type



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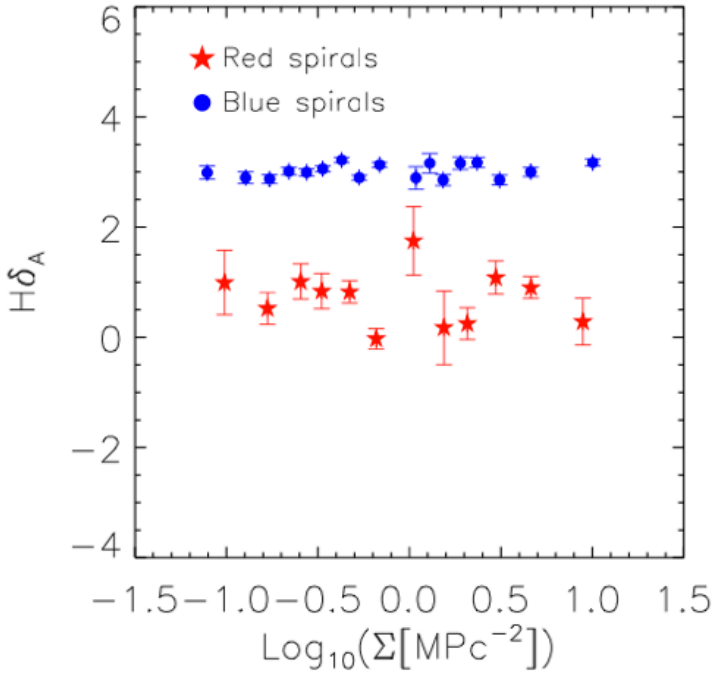

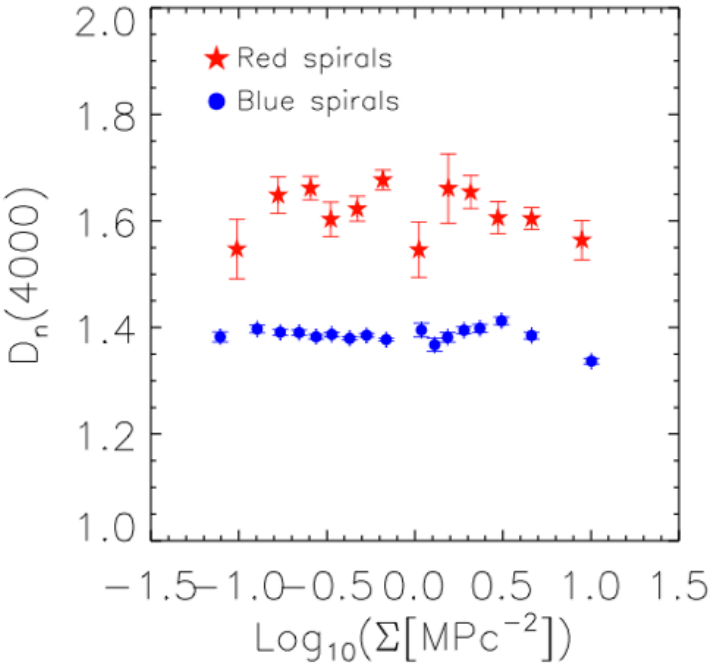

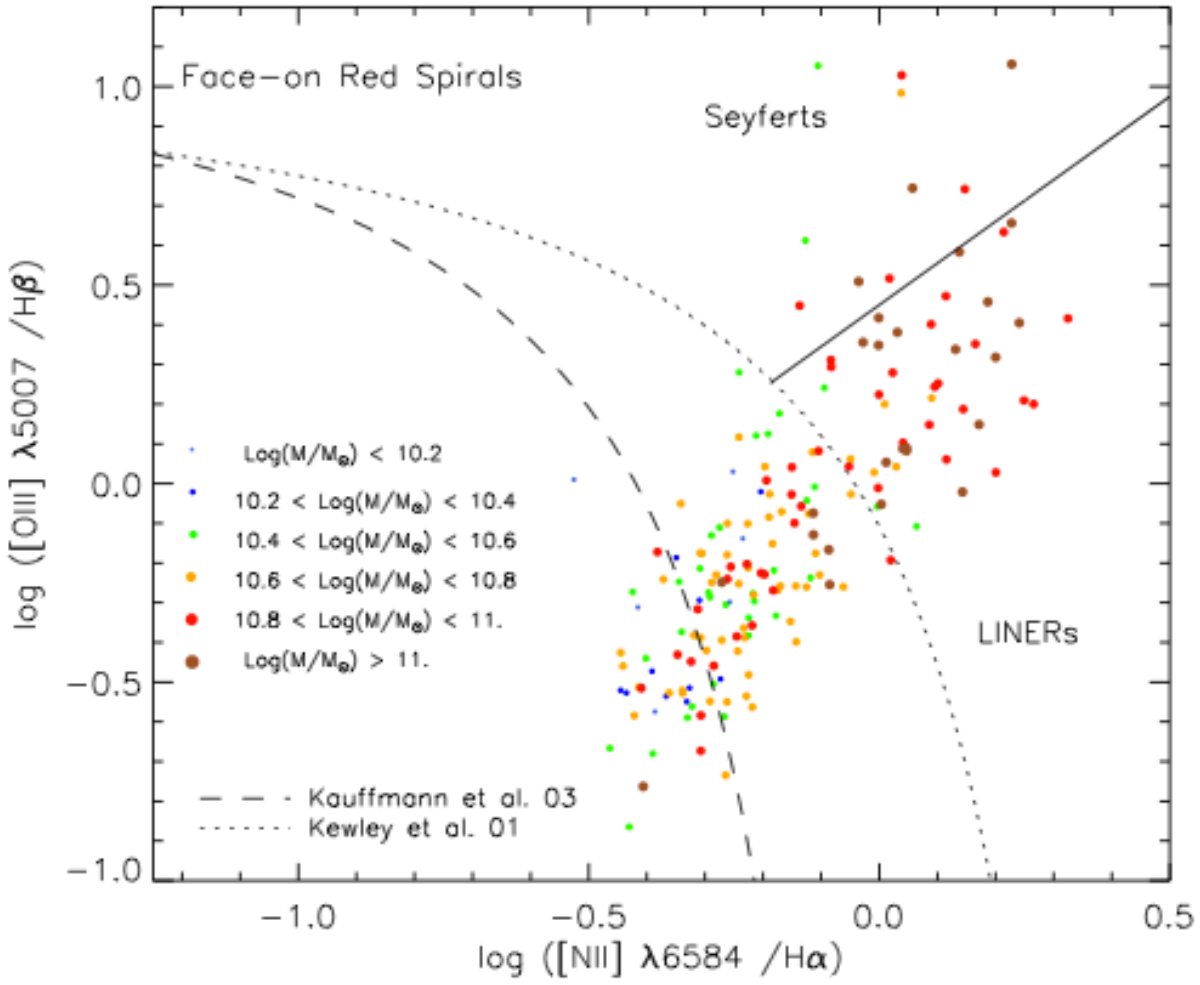

Face−on Red Spirals
Seyferts
LINERs
Log(M/M⊙) < 10.2
10.2 < Log(M/M⊙) < 10.4
10.4 < Log(M/M⊙) < 10.6
10.6 < Log(M/M⊙) < 10.8
10.8 < Log(M/M⊙) < 11.
Log(M/M⊙) > 11.
Kauffmann et al. 03
Kewley et al. 01
log ([OIII] λ5007 /Hβ)
log ([NII] λ6584 /Hα)
1.0
0.5
0.0
−0.5
−1.0
−1.0
−0.5
0.0
0.5

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GALAXY ZOO 2

Home | How to Take Part | My Galaxies | Contact Us | Register | Log In

Classify Galaxies

Answer the question below using the buttons provided.

Is the galaxy simply smooth and rounded, with no sign of a disk?

Smooth

Features or Disk

Star or Artifact

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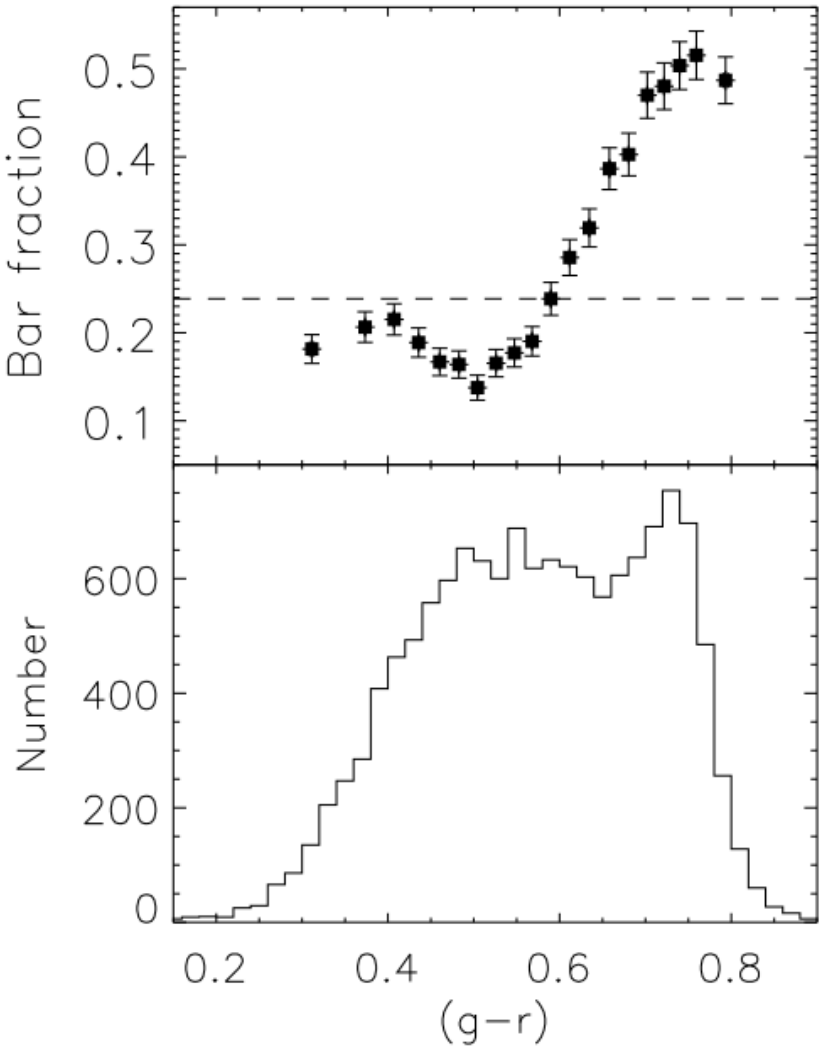

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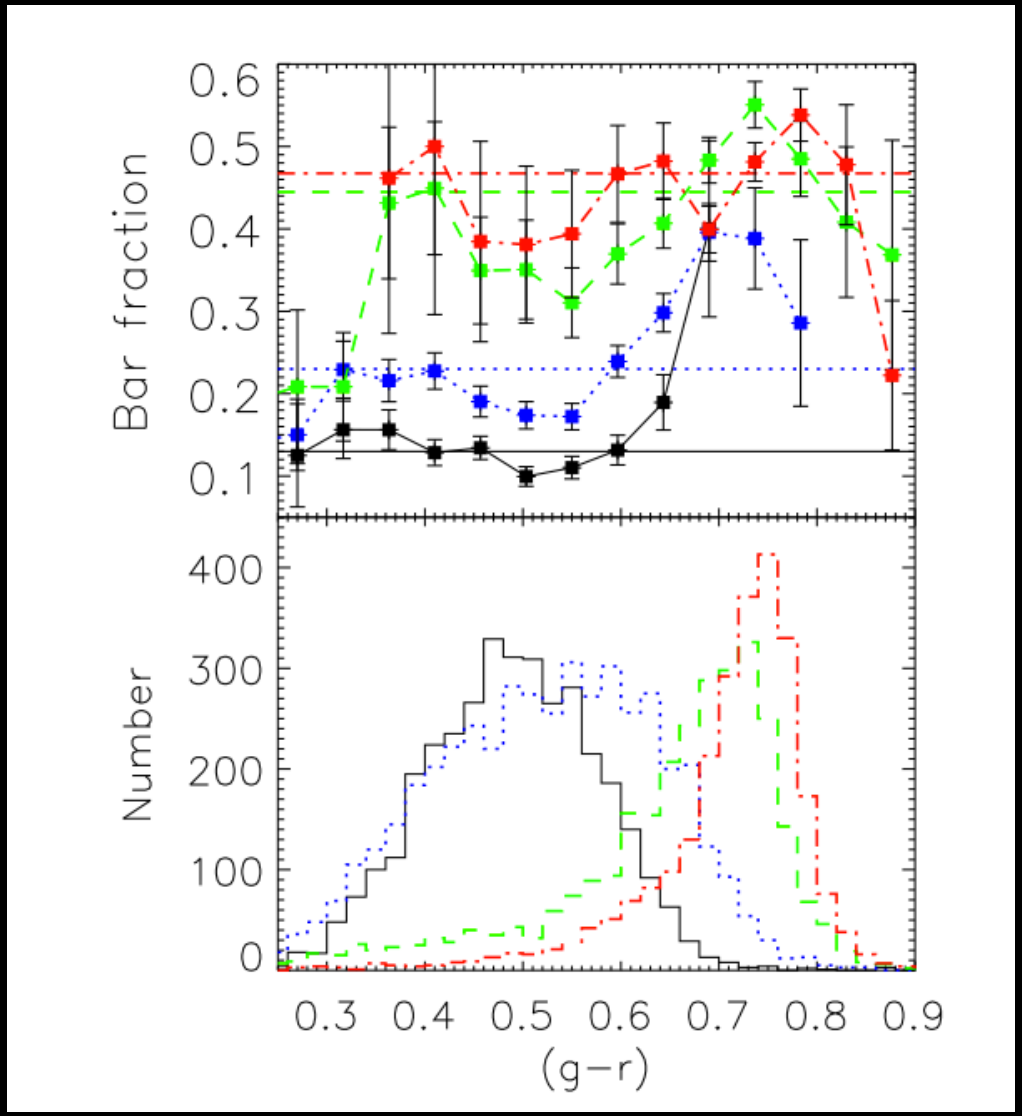

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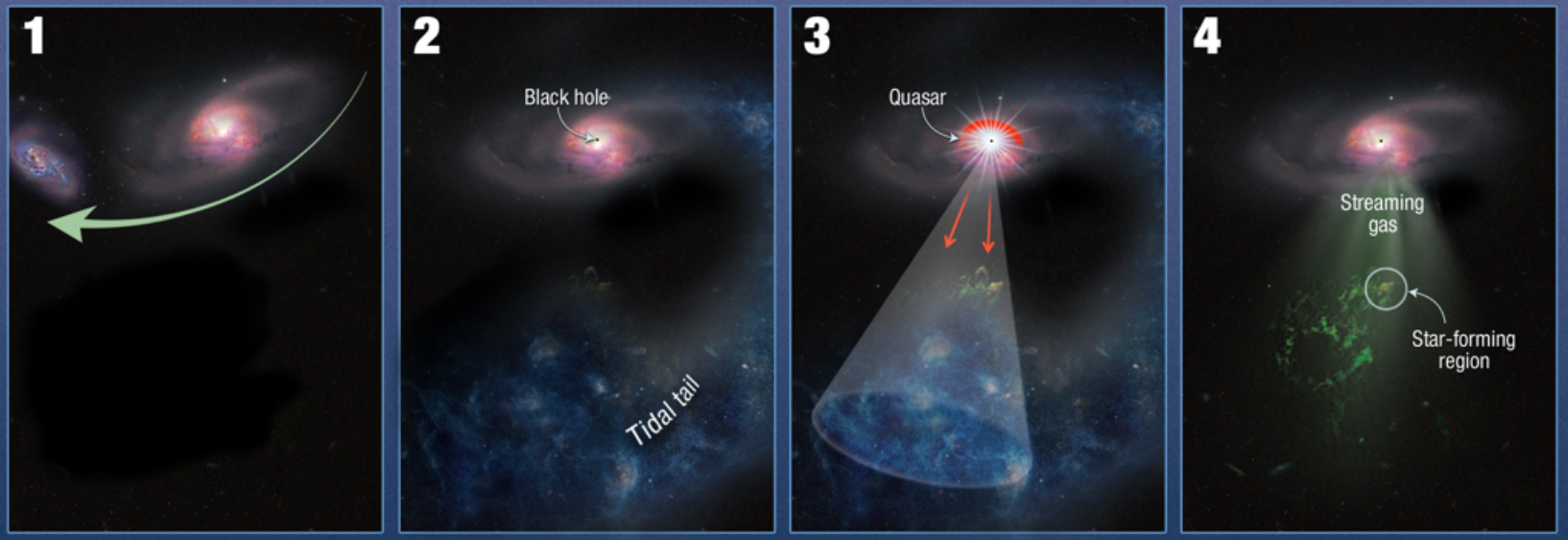
Hanny's Voorwerp
HST ACS/WFC, WFC3/UVIS/IR
WIYN

Hanny's Voorwerp* — A Space Oddity



Spiral galaxy IC 2497 gravitationally interacts with a bypassing galaxy.

A large tidal tail of gas is pulled out of the spiral galaxy.

Engorged with gas, a black hole at the center of IC 2497 "turns on" as a quasar and emits a powerful cone of light, which ionizes a portion of the tidal tail, creating Hanny's Voorwerp.

Gas streaming out from the galaxy's center impacts the tidal tail and triggers star formation.

*Hanny's Object

WFC3/IR F160W *H*
WFC3/UVIS F814W *I*
ACS/WFC FR716N Hα
ACS/WFC FR505N [O III]
WIYN *B*

50,000 light-years
15,300 parsecs 30″

N
E

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SDSS J122008.14+374101.5

GALAXY ra=185.03393832, dec=37.68375238, ObjId = 587738952292696129

Column names link to glossary entries. Move mouse over a column name to get its units.

mode	PRIMARY
status	TARGET PRIMARY OK_STRIPE OK_SCANLINE FIRST_FIELD PSEGMENT RESOLVED OK_RUN GOOD SET
flags	STATIONARY BINNED1 INTERP MANYPETRO PEAKCENTER CHILD
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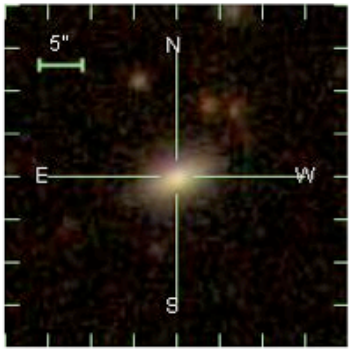
SecTarget	



u	g	r	i	z
19.39	17.64	16.85	16.47	16.20

err_u	err_g	err_r	err_i	err_z
0.04	0.01	0.00	0.00	0.01

run	rerun	camcol	field	obj	rowc	colc
4470	40	4	17	65	214.3	1723.5

fiberMag_r	petroMag_r	devMag_r	expMag_r	psfMag_r	modelMag_r
17.76	16.91	16.85	17.03	17.79	16.85

extinction_r	petroRad_r	parentId	nChild
0.05	2.941	587738952292696128	0

SpecObjID = 563461179293302784

plate	mjd	fiberId	z	zErr	zConf	specClass	ra	dec	fiberMag_r	objId
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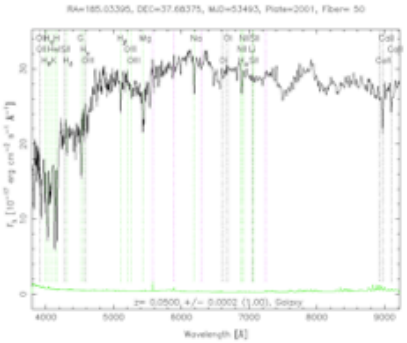

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emConf	0.228206
xcZ	0.050
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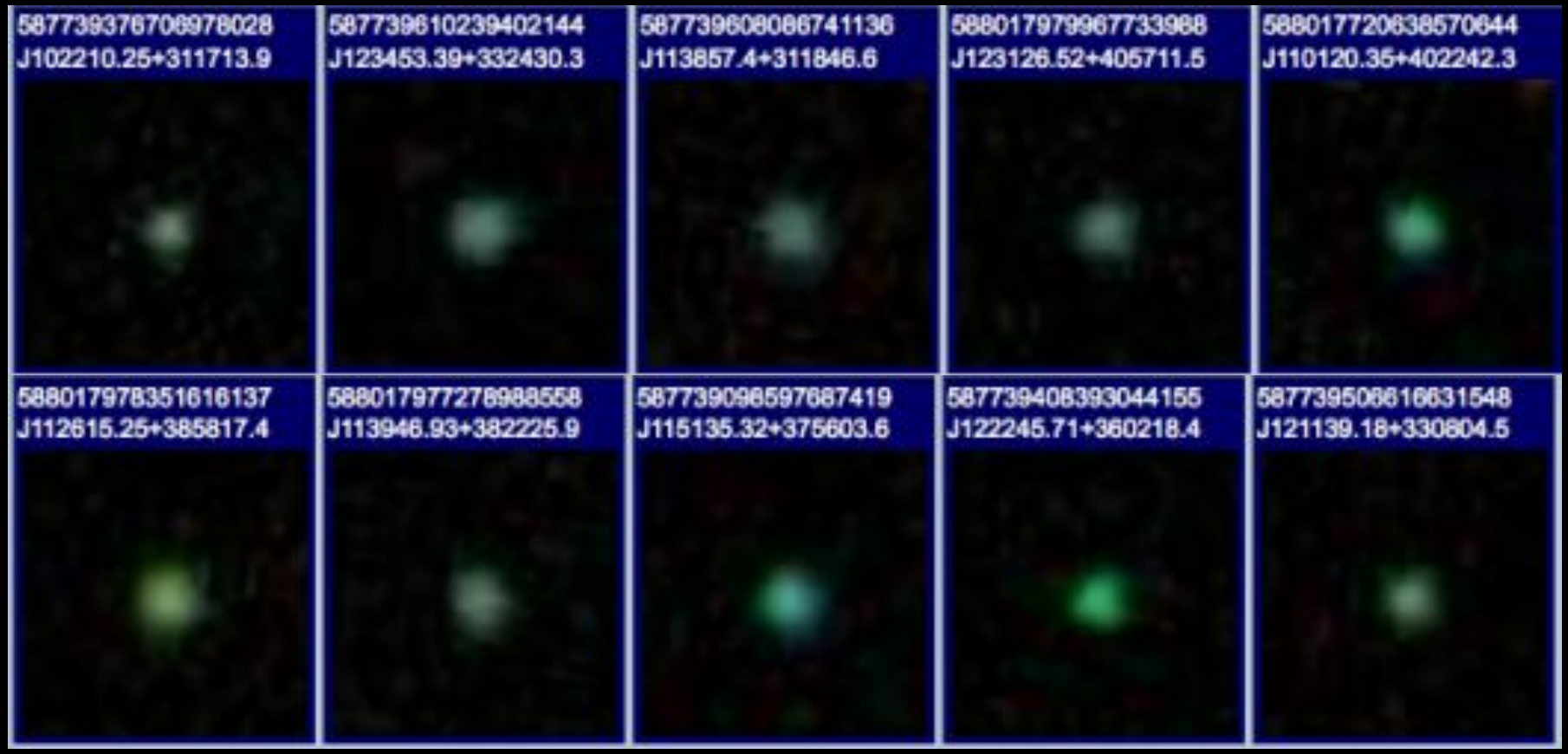
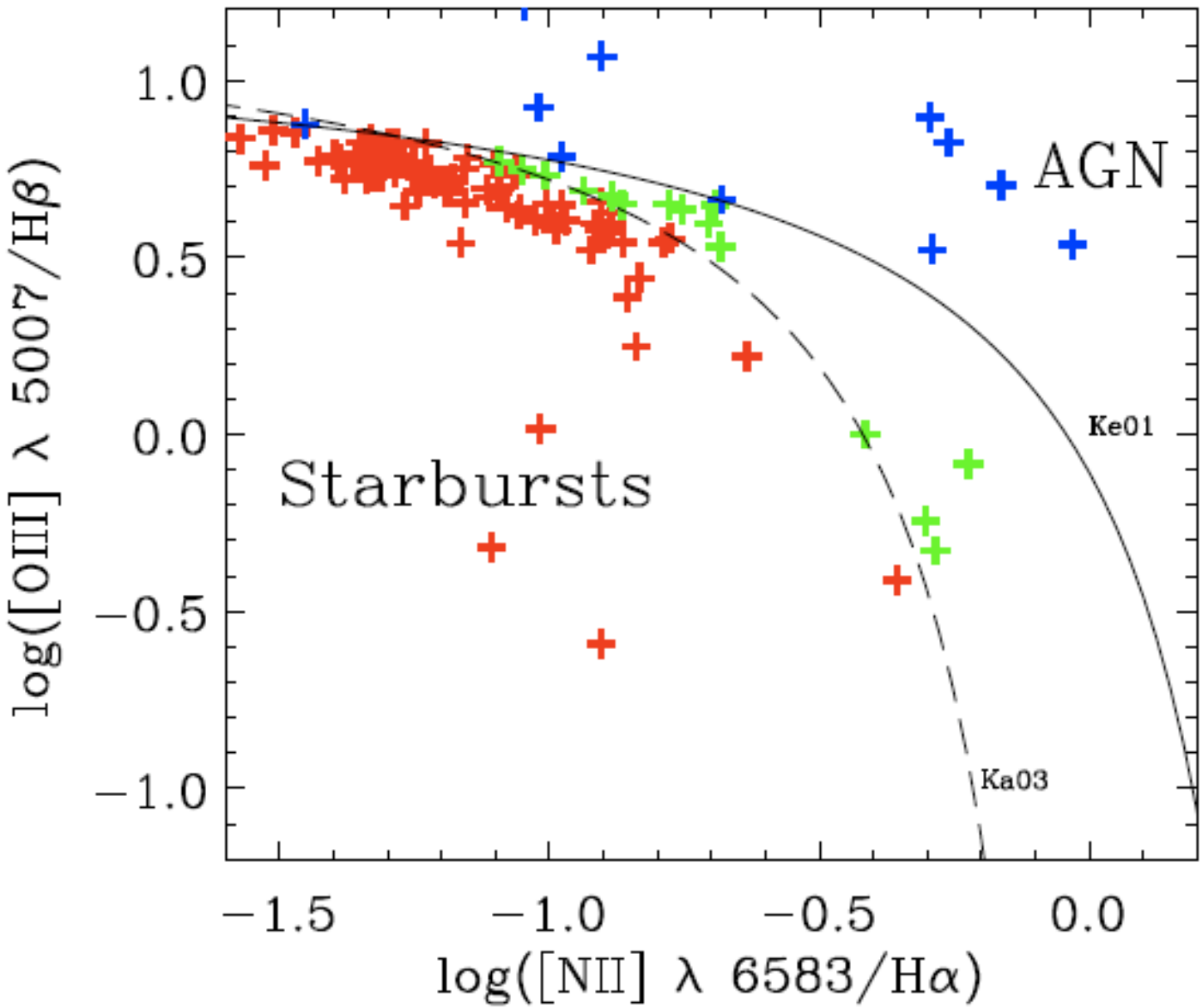
Galaxy Zoo Peas




AGN
Starbursts
Ke01
Ka03
log([OIII] λ 5007/Hβ)
log([NII] λ 6583/Hα)
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0

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Galaxy Zoo Peas

Colour due to strong [O III] 5007 line in SDSS r band

$0.1 < z < 0.35$

All are compact - essentially unresolved

Star forming peas : Extremely high specific SFR
- equivalent to Lyman-break galaxies at z ~ 3

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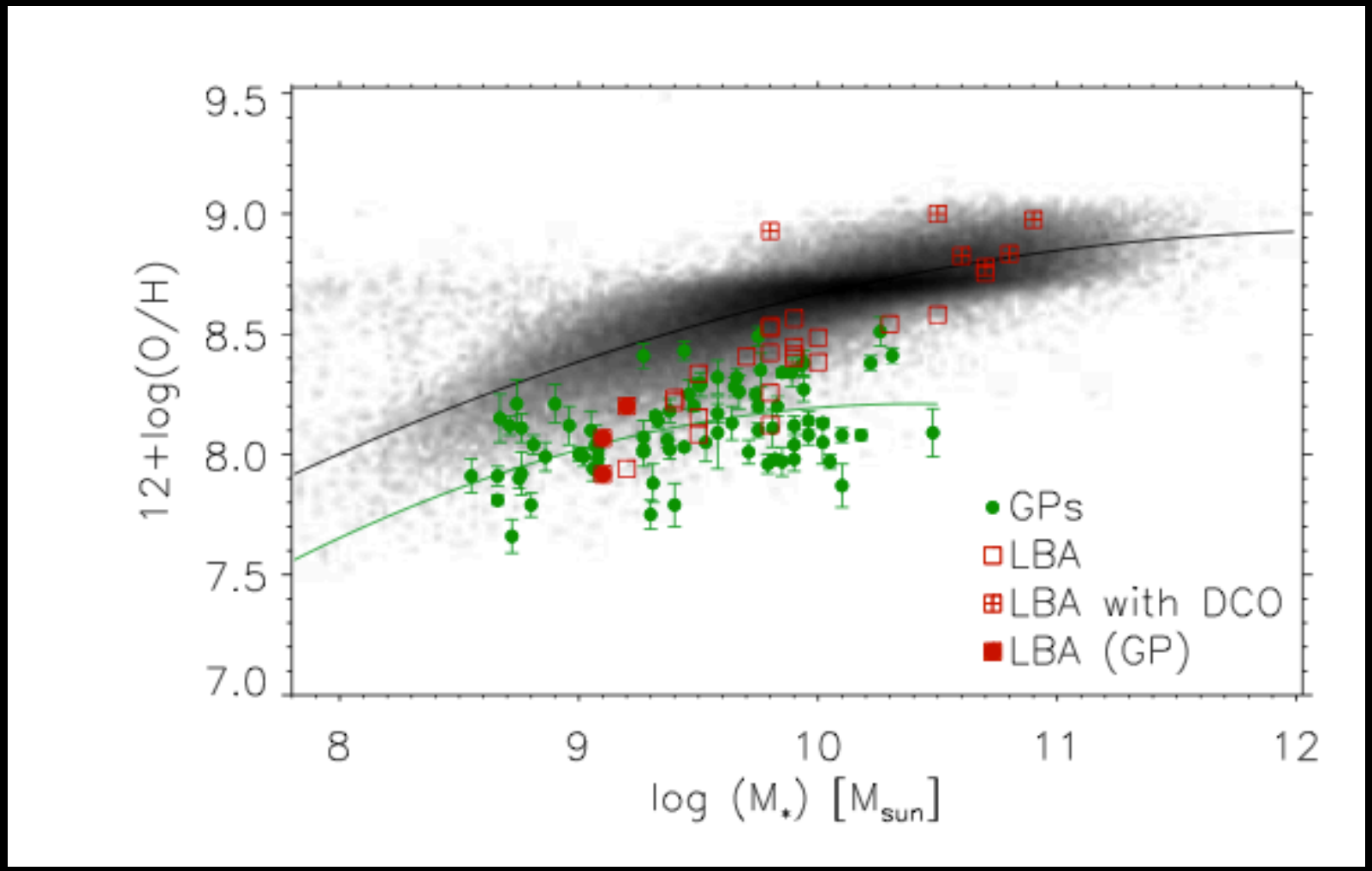
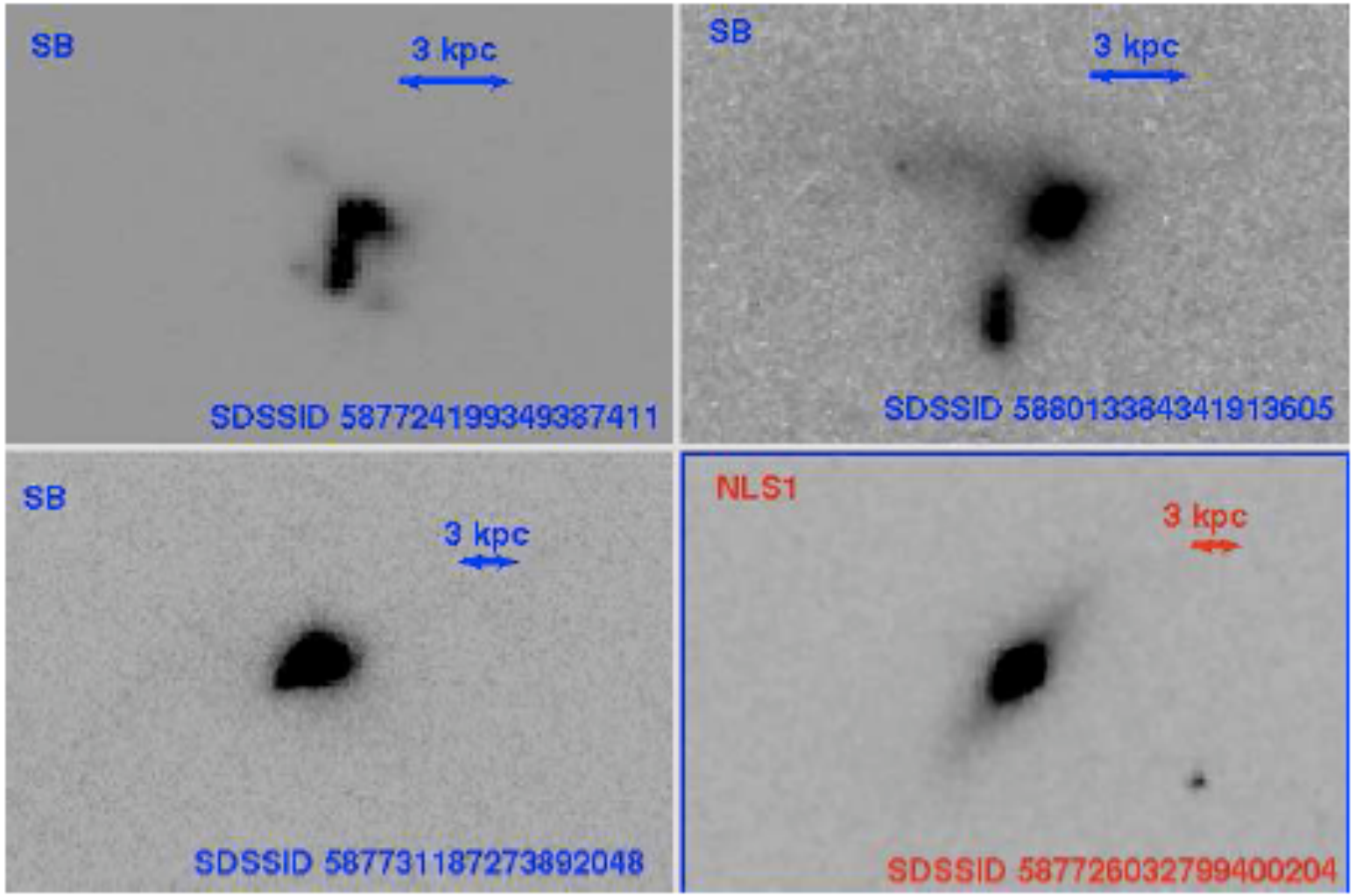

9.5
9.0
8.5
8.0
7.5
7.0
12+log(O/H)
8
9
10
11
12
log (M*) [Msun]
GPs
LBA
LBA with DCO
LBA (GP)

Amorin et al.


SB
3 kpc
SDSSID 587724199349387411
SB
3 kpc
SDSSID 588013384341913605
SB
3 kpc
SDSSID 587731187273892048
NLS1
3 kpc
SDSSID 587726032799400204

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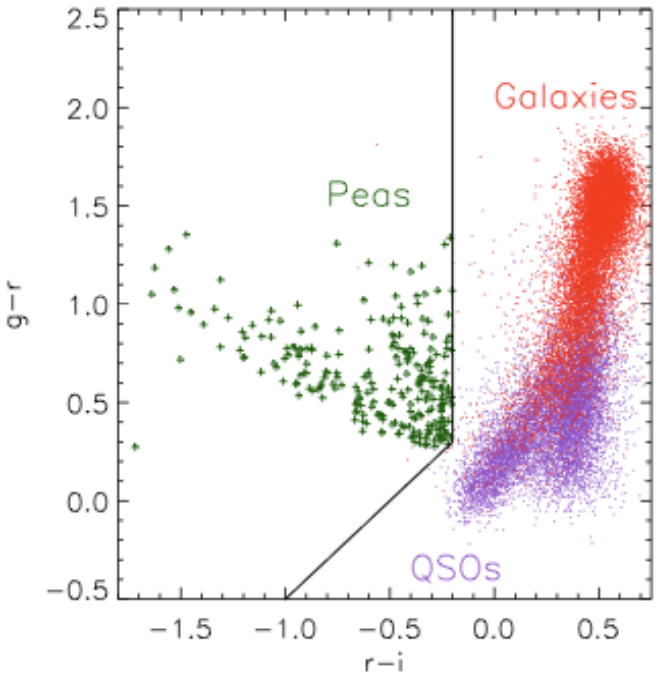

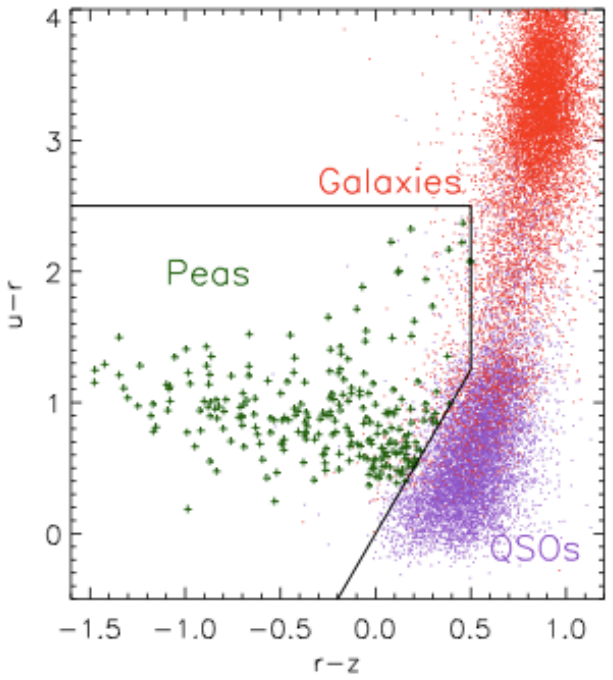

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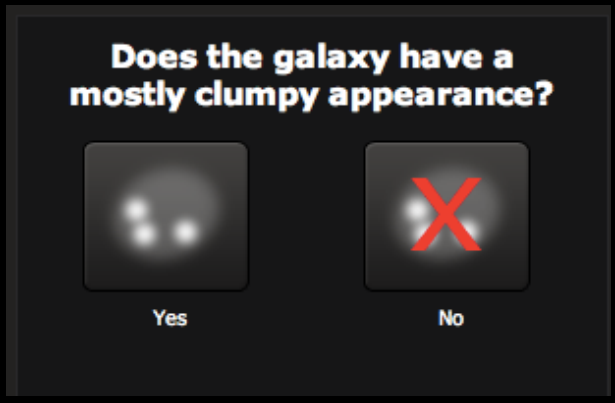

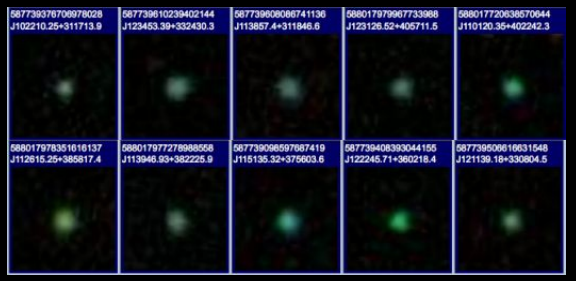

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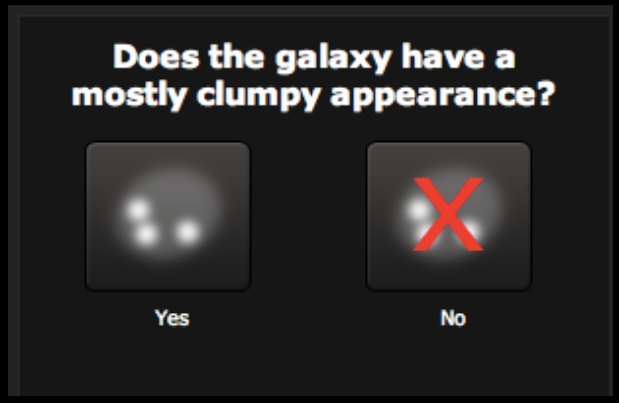
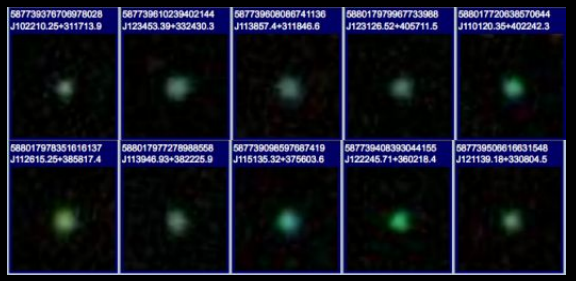
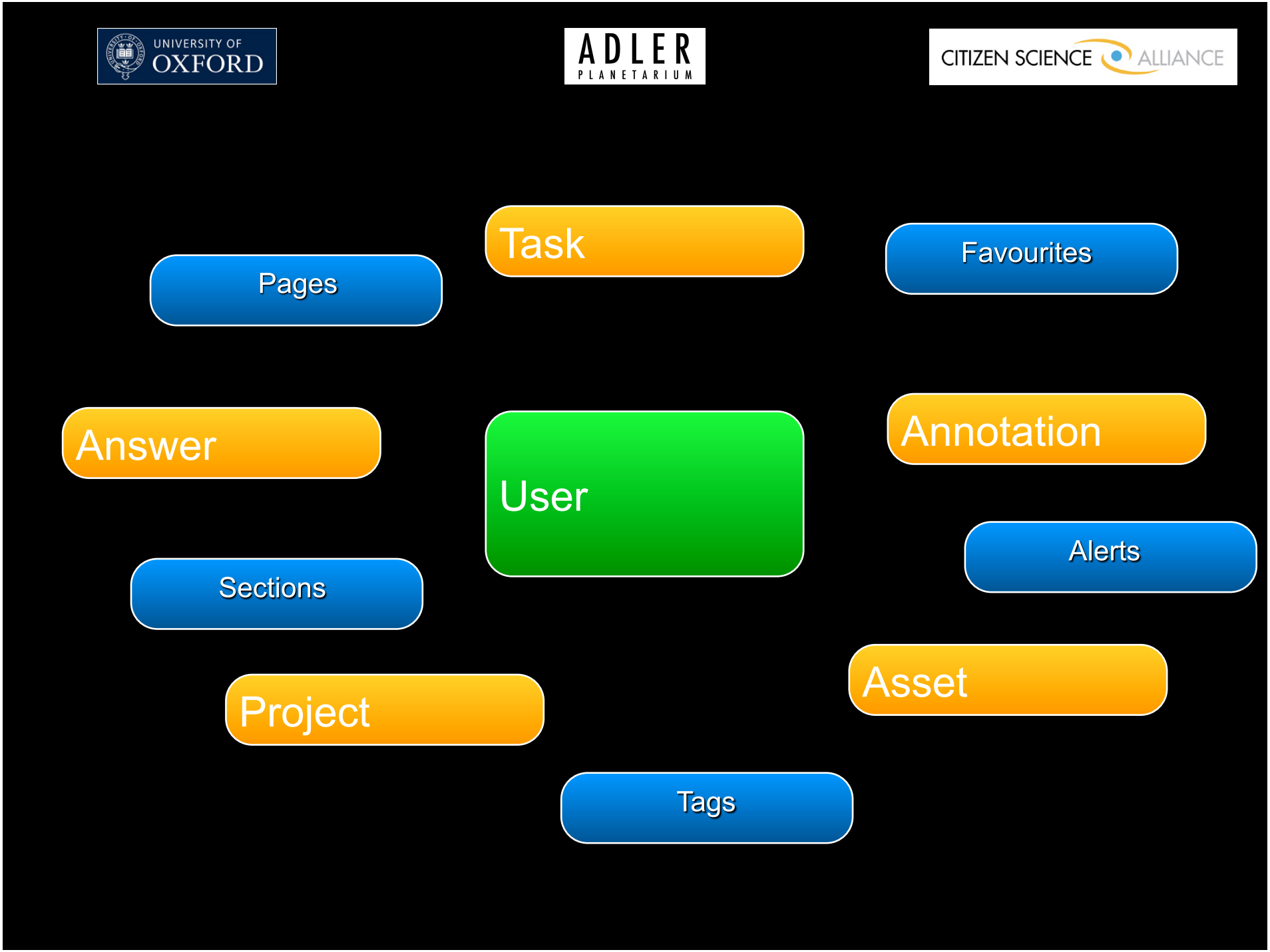
Known knowns : Data reduction by science team



Known unknowns : Results funnelled to specific researchers



Unknown unknowns : Discussion tool allows interesting objects to become prominent.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Task
Favourites
Pages
Answer
User
Annotation
Alerts
Sections
Asset
Project
Tags

```
WorkflowCreator.new(:name => "Galaxy Zoo") do
  starts_with "Is the galaxy simply smooth and rounded?" do
    answer "Smooth", :leads_to => "How rounded is it?"
    answer "Features or disk", :leads_to => "Something else..."
    answer "Star or artifact", :leads_to => :end
  end

  question "How rounded is it?", :leads_to => "Anything odd?" do
    answer "Completely round"
    answer "In between"
    answer "Cigar shaped"
  end

  .......
end
```

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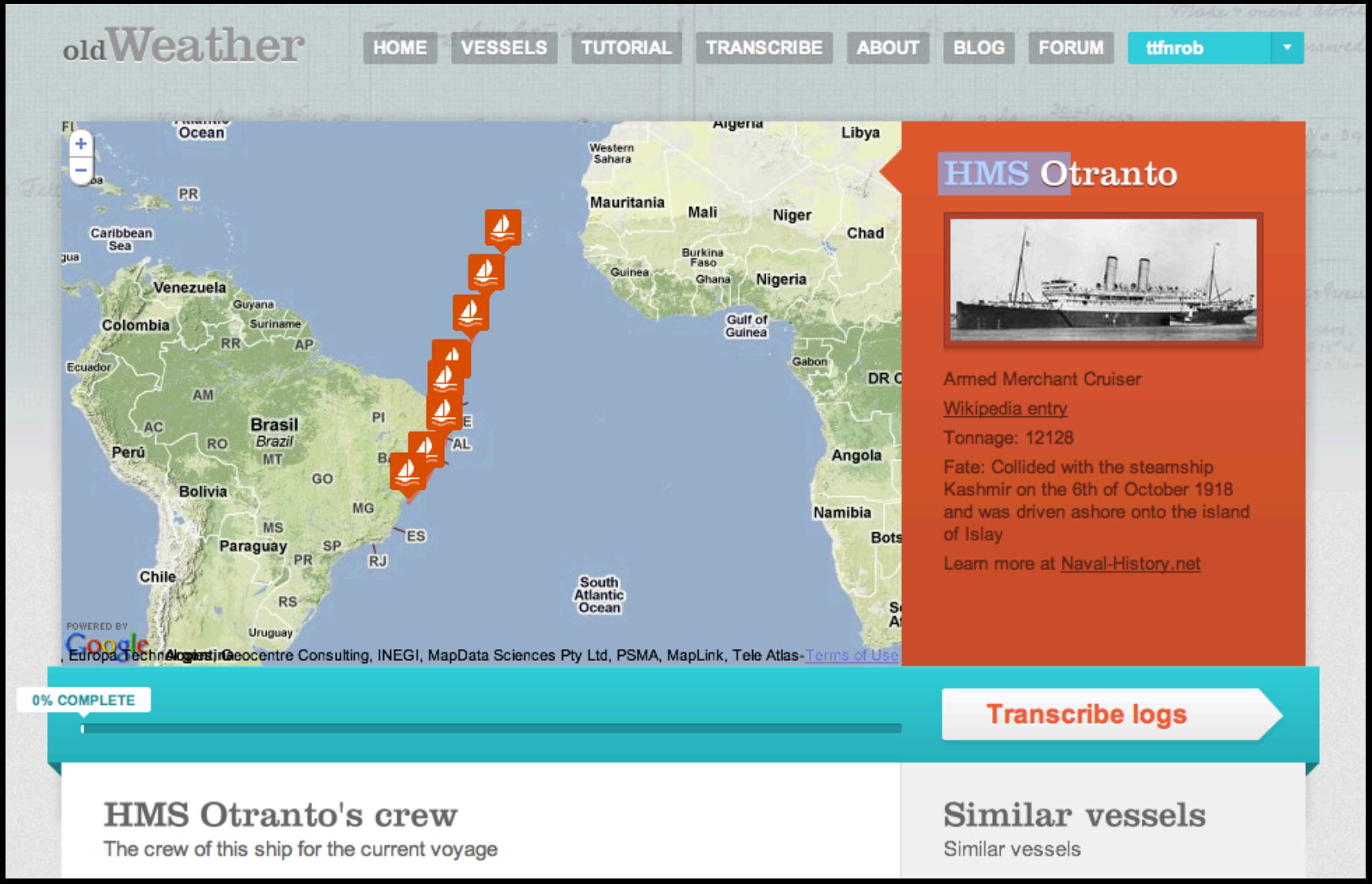

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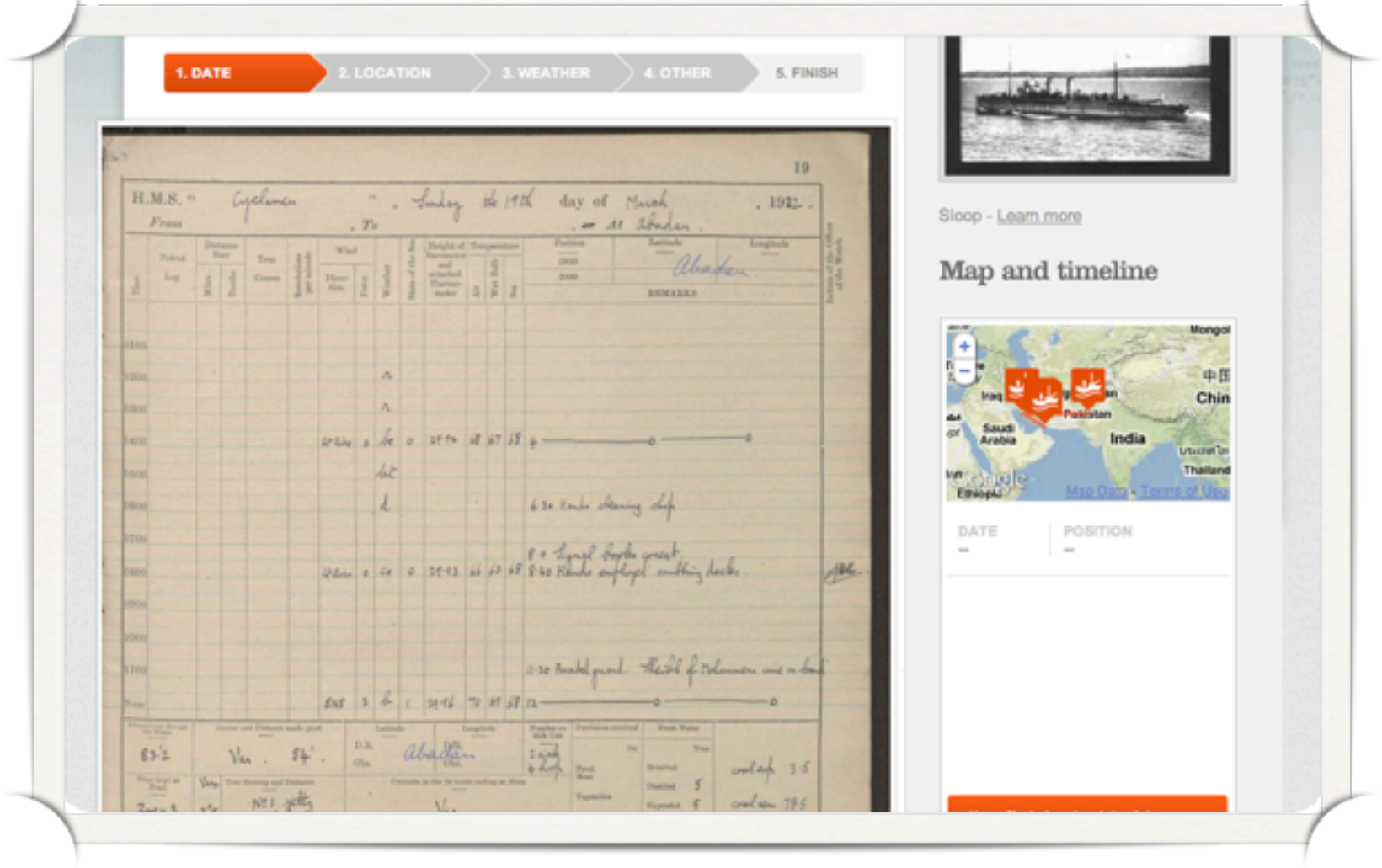
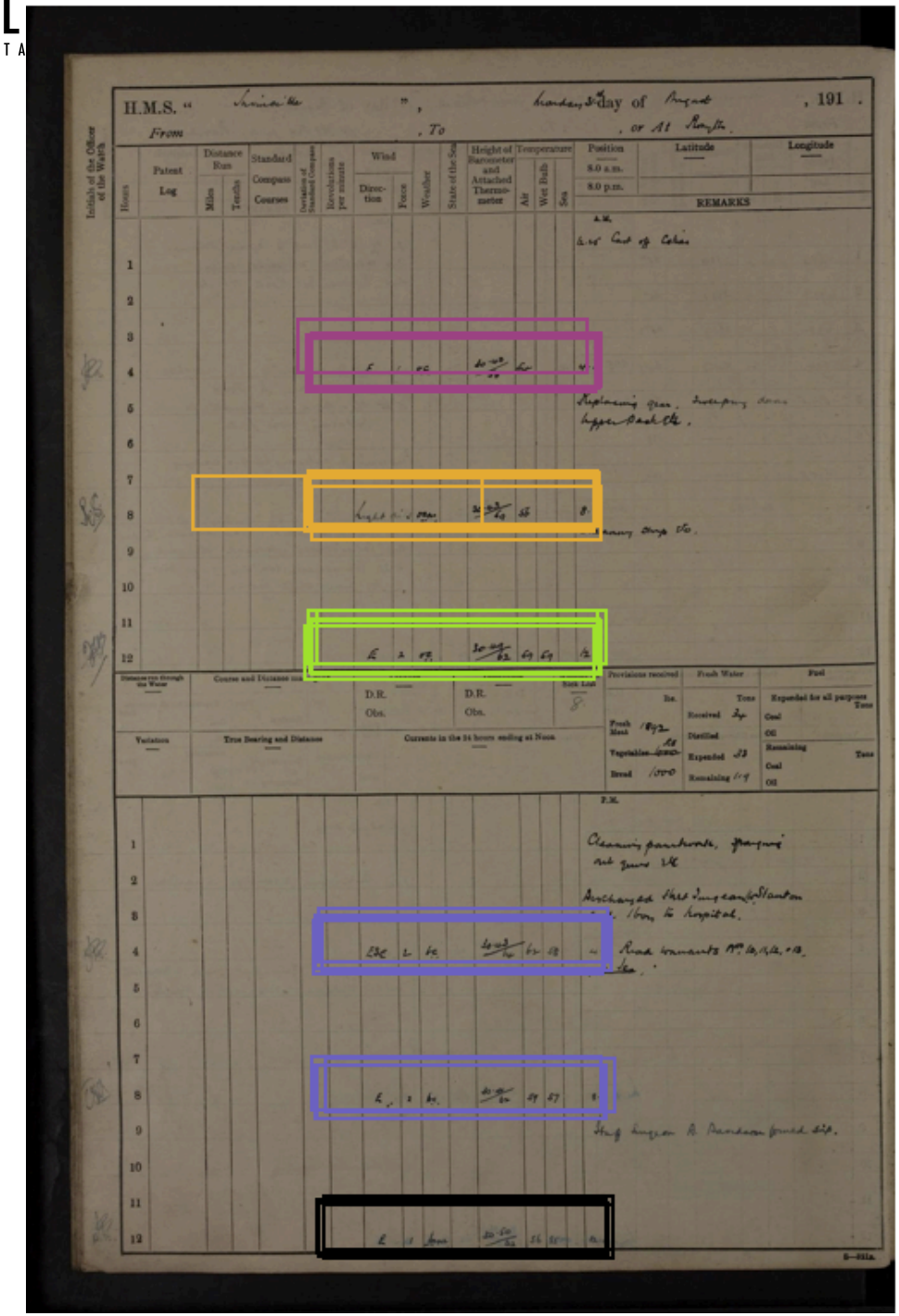


www.oldweather.org

dates event location weather



0 1 2 34

295200-- --541E oc 30.4058
295213-- --541E oc 30.4058
297211-- --541E oc 30.4058
295210 --541E oc 30.4058
299209-- --541E oc 30.4058
289200-- --541E oc 30.4058
294309-- --56 -- ocm30.4359
298316-- --56---- -- 30.4359
216309-- ---- ---- -- -- --
296305-- --56 Light ocm30.4359
297307 --56 Light airsocm30.4359
294310-- --560lt airs ocm30.4359
294309-- --561-- ocm30.4359
29740959--592E oc 30.4962
29441359--592e oc 30.4962
29941059--592E oc 30.4962
30240359 592E oc 30.4962
29640259--592E oc 30.4962
29740959--592E oc 30.4962
30061858--622ESE bc 30.4364
30161558--622ESE bc 30.4364
30661658 622ESE bc 30.4364
30361058--622ESE bc 30.4364
30061858--622ESE bc 30.4364
30171957--592E bc 30.4462
30271957--592E bc 30.4162
30871557 592E bc 30.4162
29971357--592E bc 30.4462
30171957--592E bc 30.4462
30781755--561E bcm30.5062
30381555--561E bmc30.5062
30281355 561E bcm30.5062
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30781755--561E bcm30.5062
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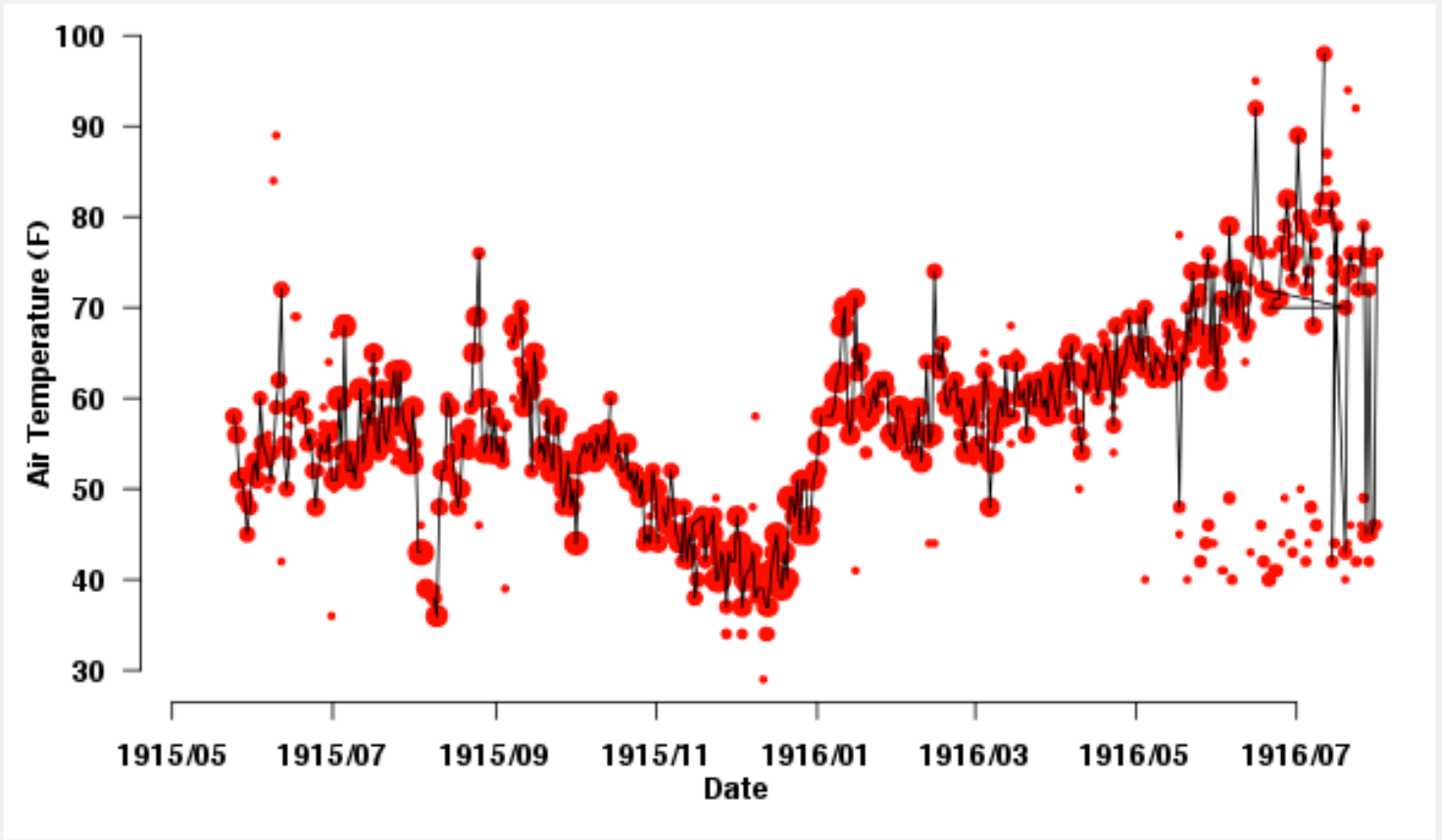

Noon air temperatures from HMS Acacia.

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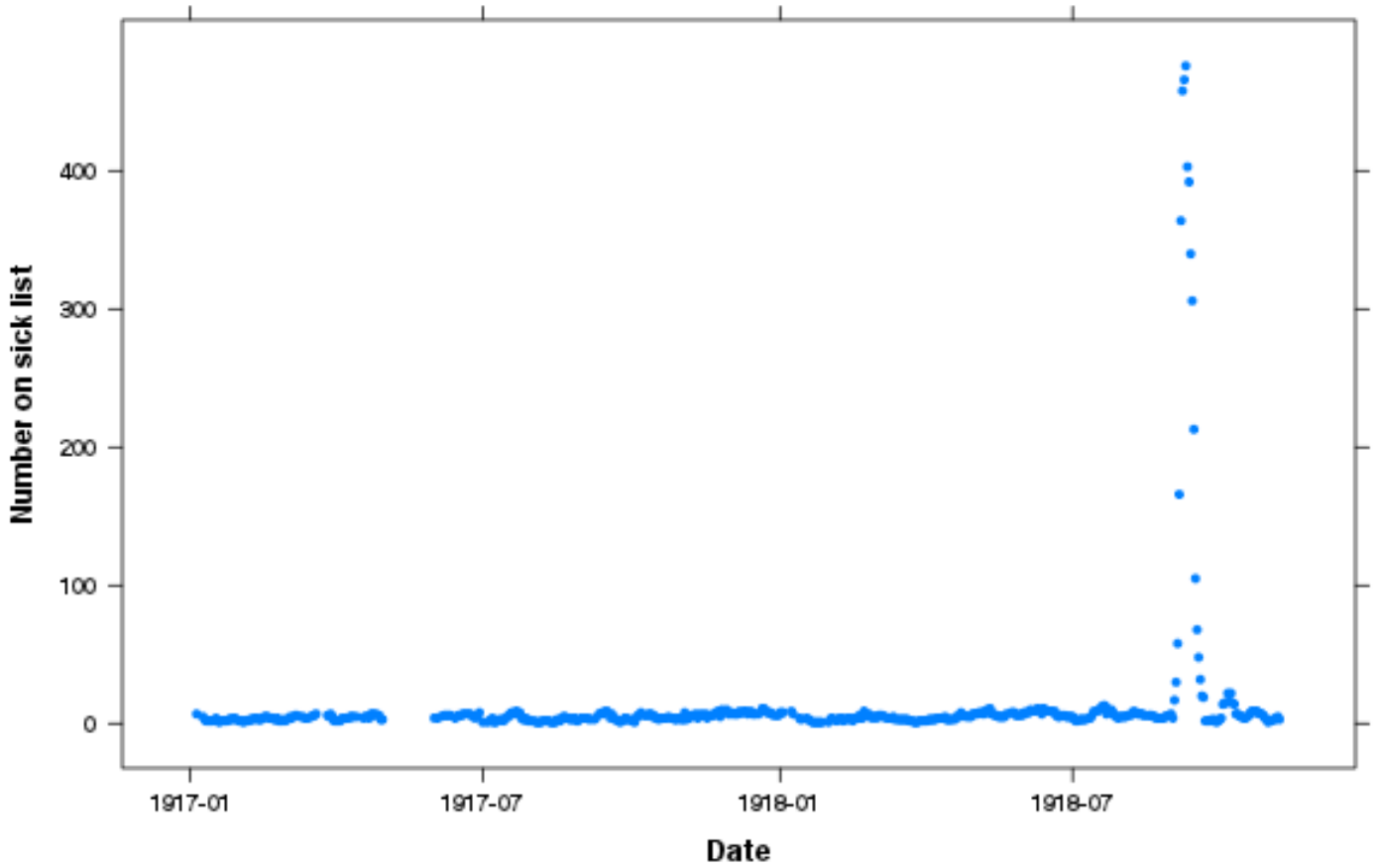

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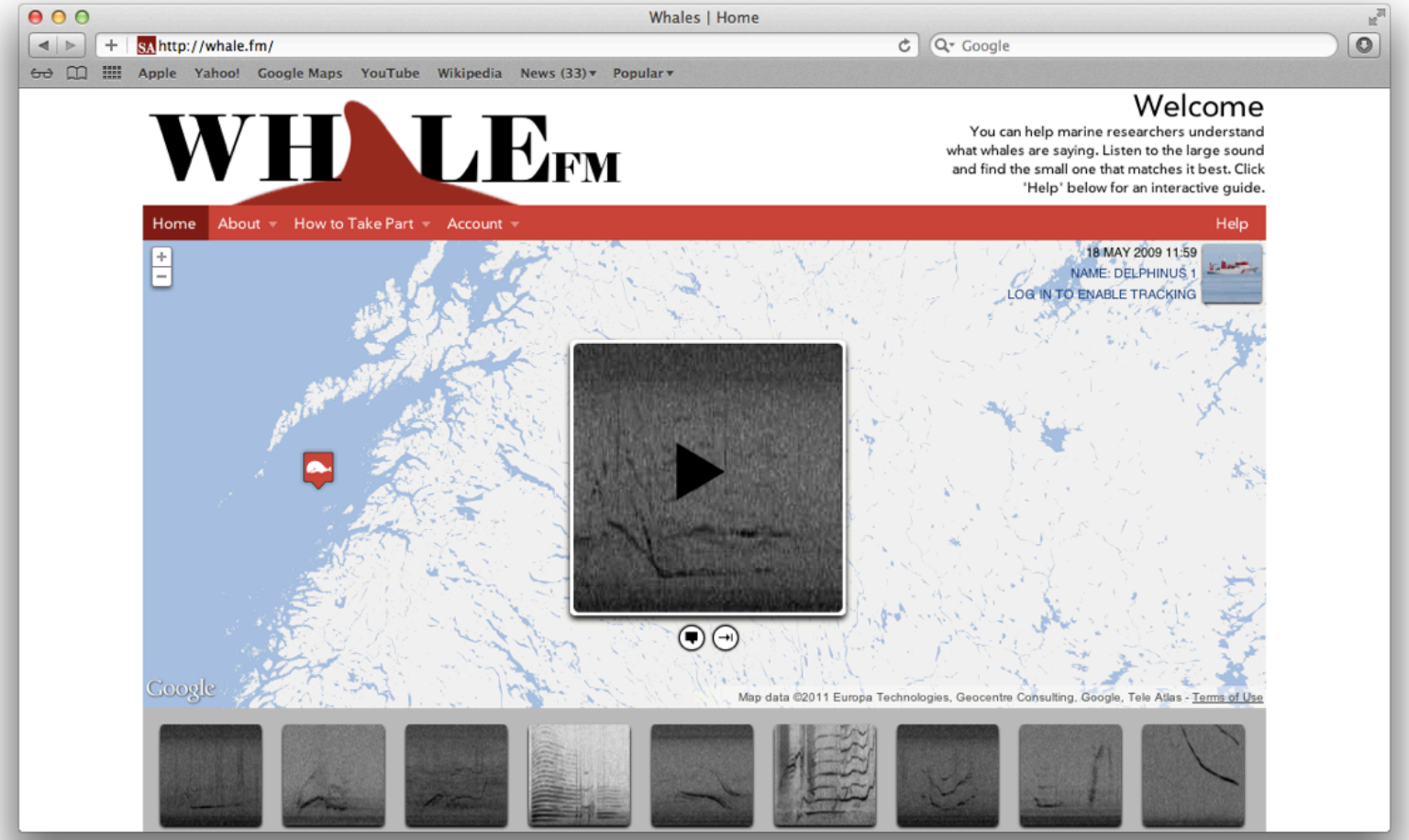

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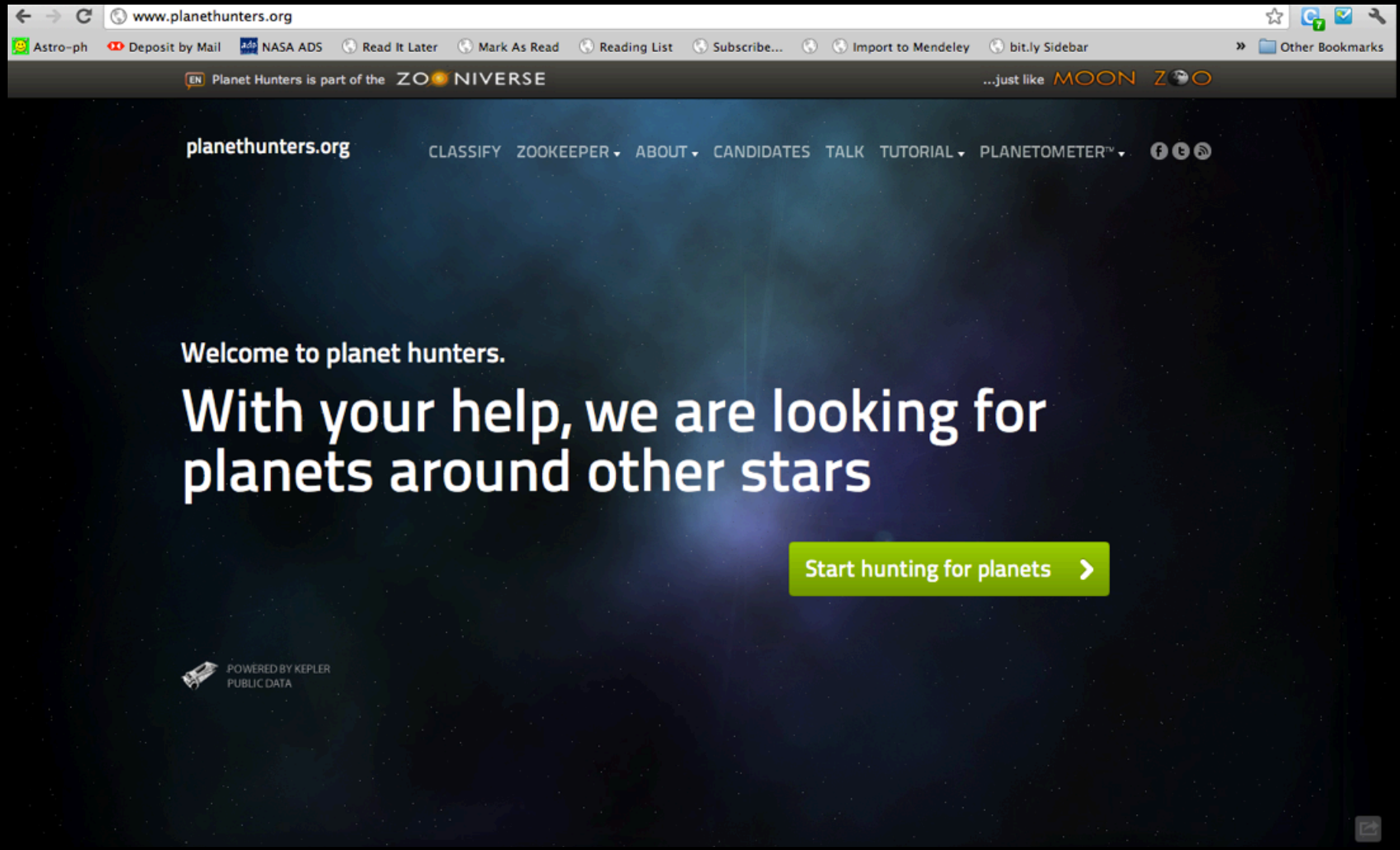

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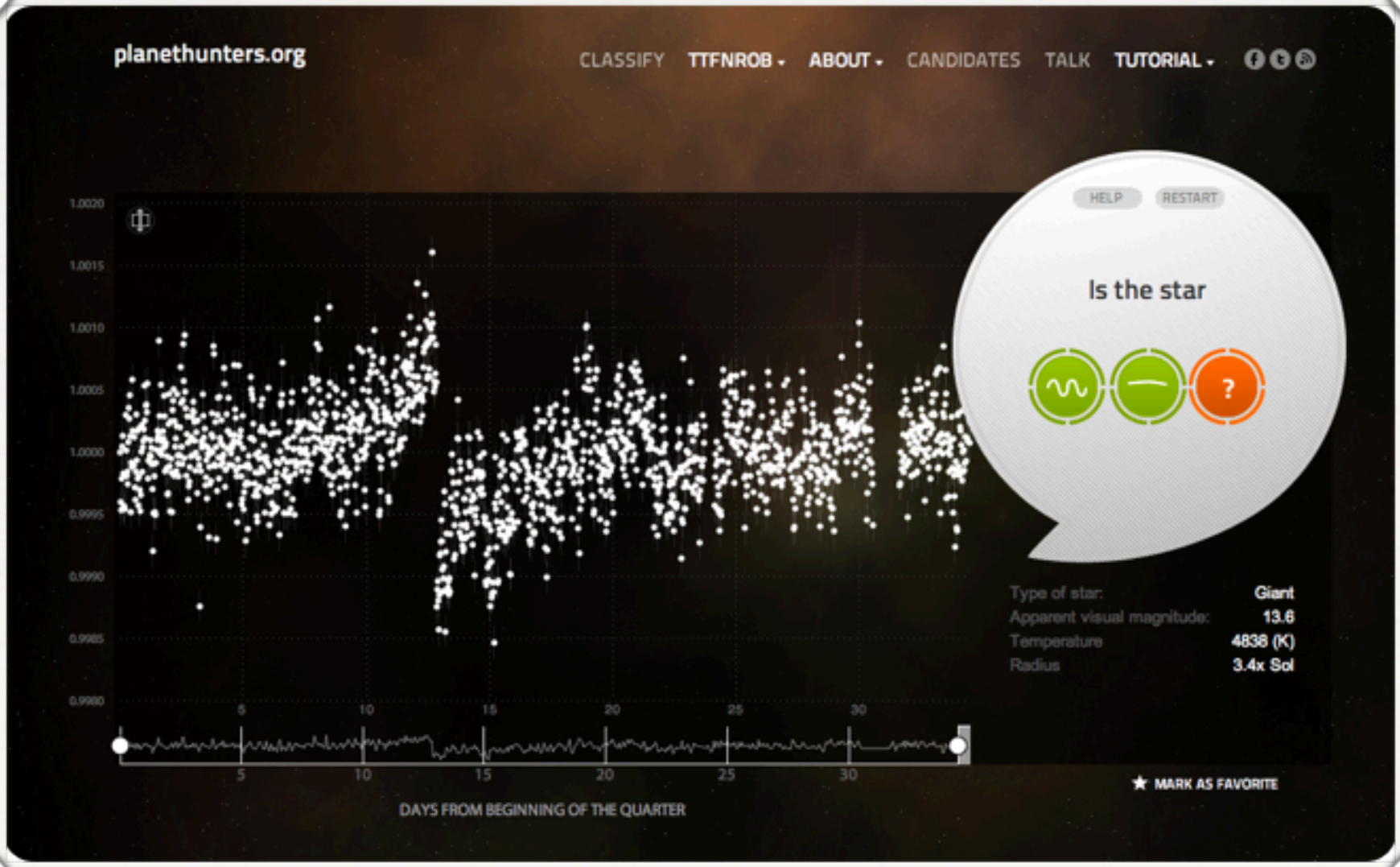

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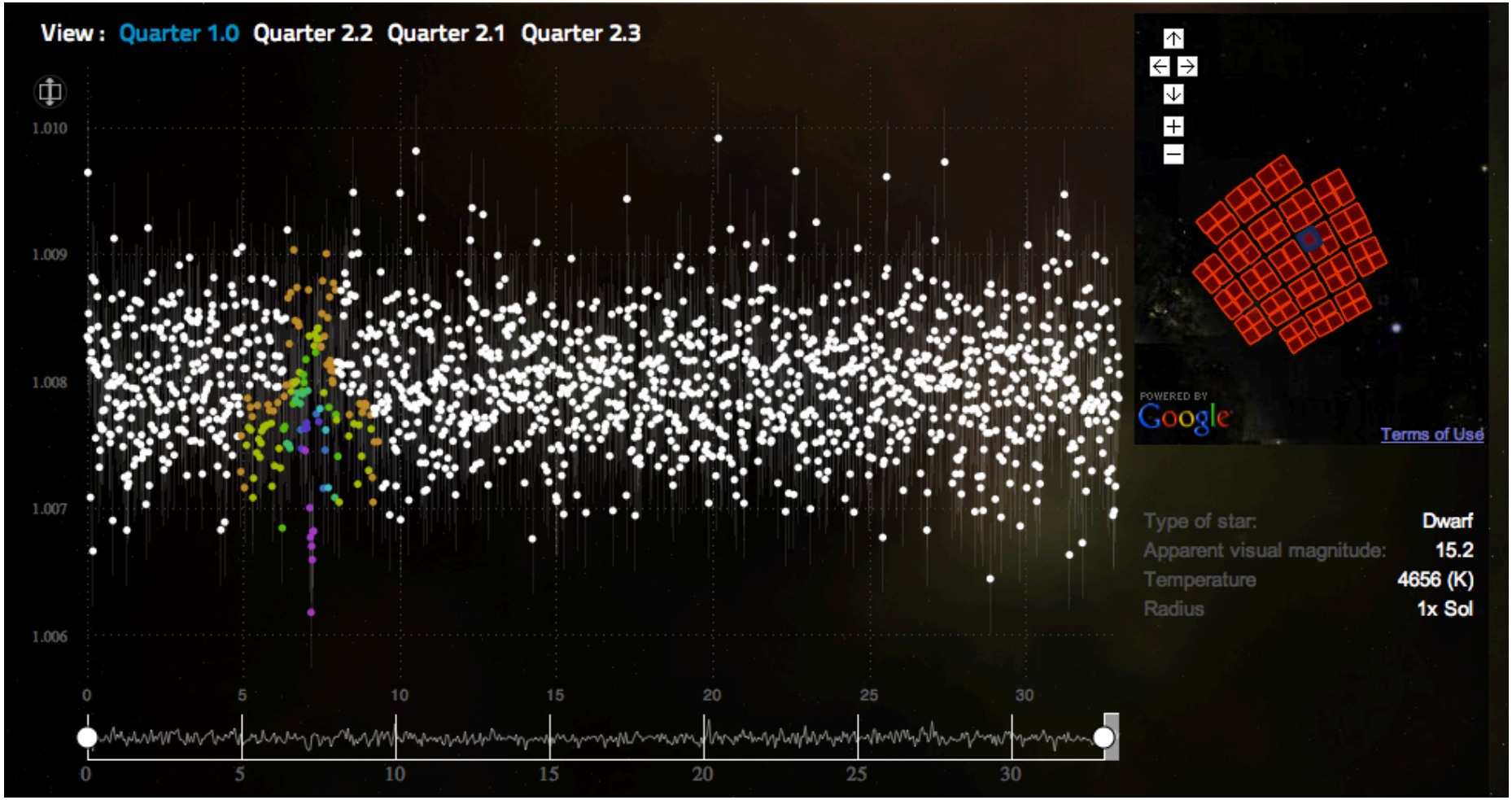

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PlanetHunters.org

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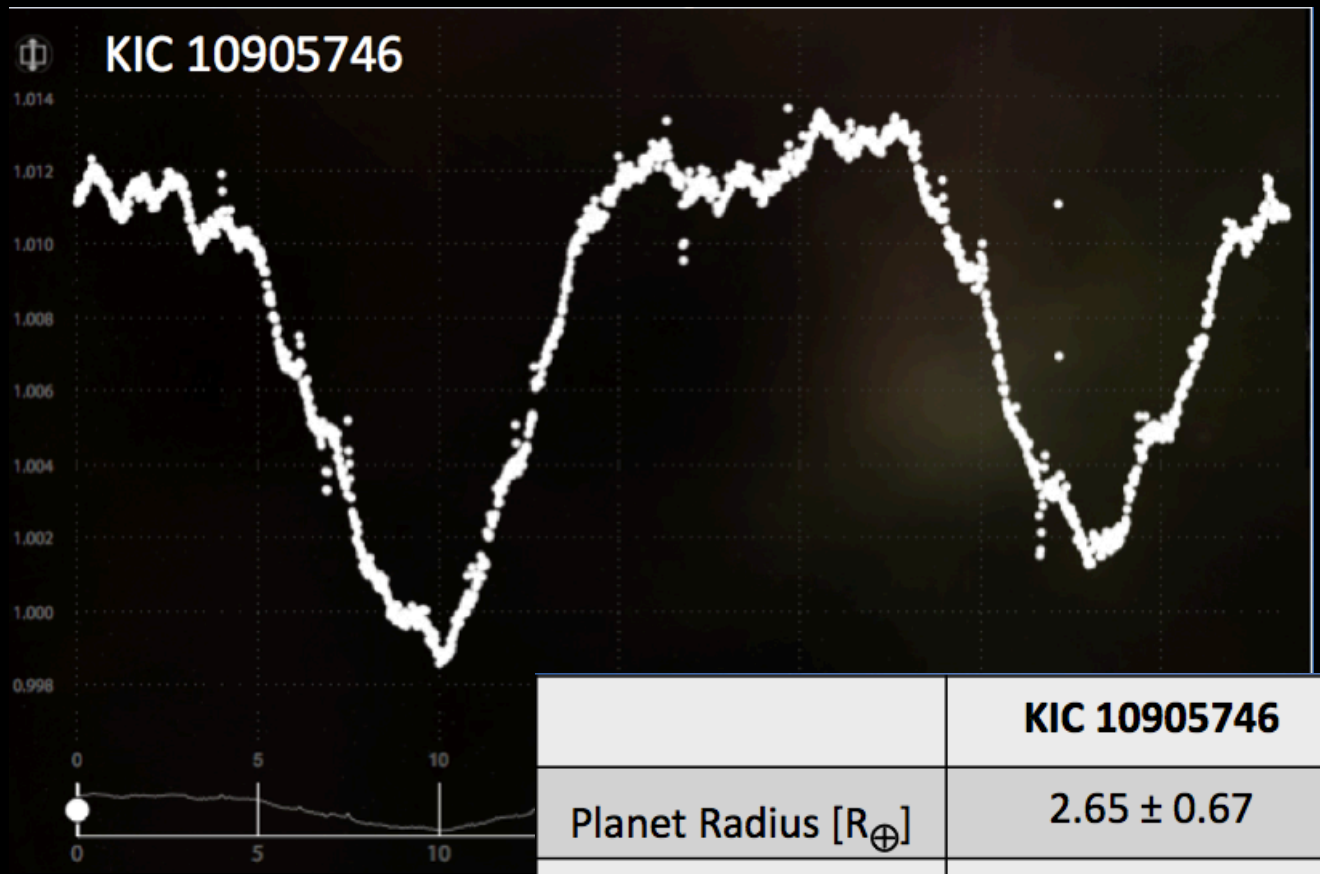

	KIC 10905746	KIC 6185331
Planet Radius [$R_\oplus$]	2.65 ± 0.67	8.05 ±1.08
Period (days)	9.88	49.77
Semimajor axis (AU)	0.075	0.267
$R_{planet}/R_\star$	0.0442 ± 0.01	0.0581 ± 0.0018
Transit depth (ppm)	1881 ± 343	3633 ± 59

arXiv : 1109.4621

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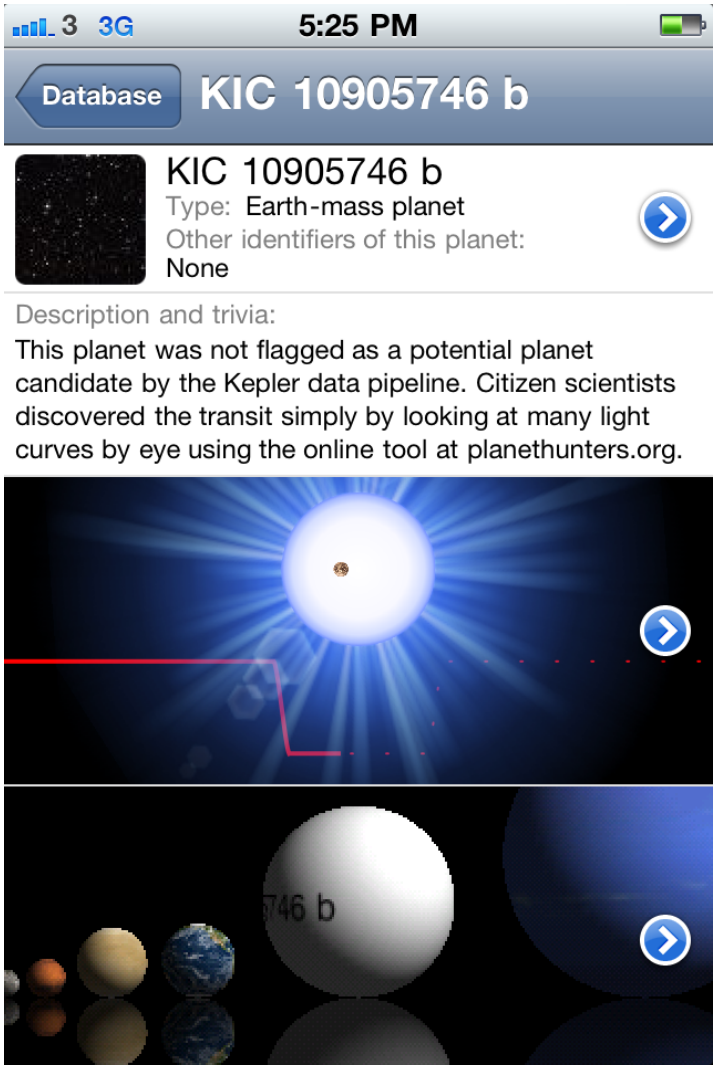
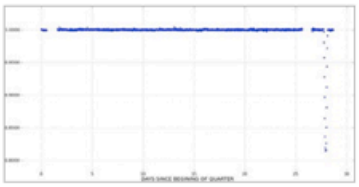


Exoplanets iPhone app.

Planet Hunters | Talk | APH2

talk.planethunters.org/objects/APH23221592

OBJECT APH23221592



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Feature this object

COLLECTIONS WITH THIS OBJECT

EB'S & ODDITIES

Q2 PROSPECTIVE TRANSITS

What do you think? 140

Submit

Good job everybody, this is a beautiful #unlistedEB, coming so late in the season.

kianjin 6 days ago

Agree on #unlistedeb, nice find!

nighthawk_black 6 days ago

DISCUSSIONS

Phased Curve APH23221592

2 users 2 comments

Start a discussion

KEYWORDS

unlistedeb

eclipsingbinary

Create a Keyword Set of objects like this

MENTIONS

186 NEW EB Candidates

Phased Curve APH23221592

APH22221592

Unlisted EBs

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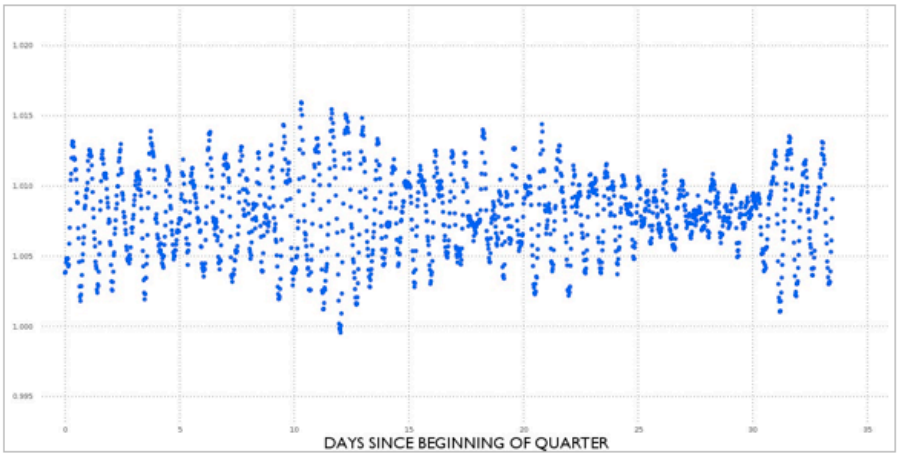
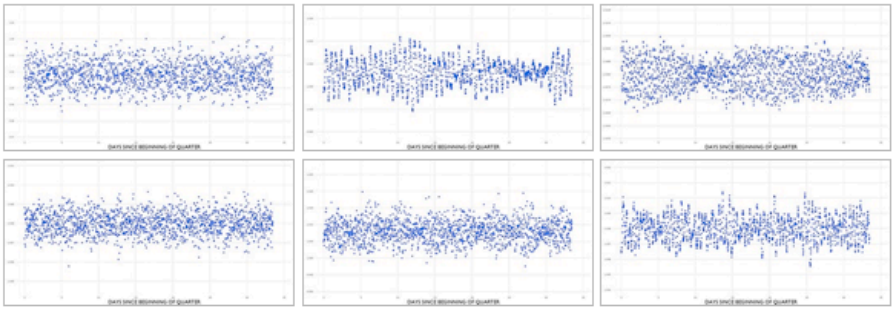
Collection *"Multiperiodic Delta Scuti Stars"* by tristrambrelstaff

Short-period A and F-type pulsating stars with amplitude modulation





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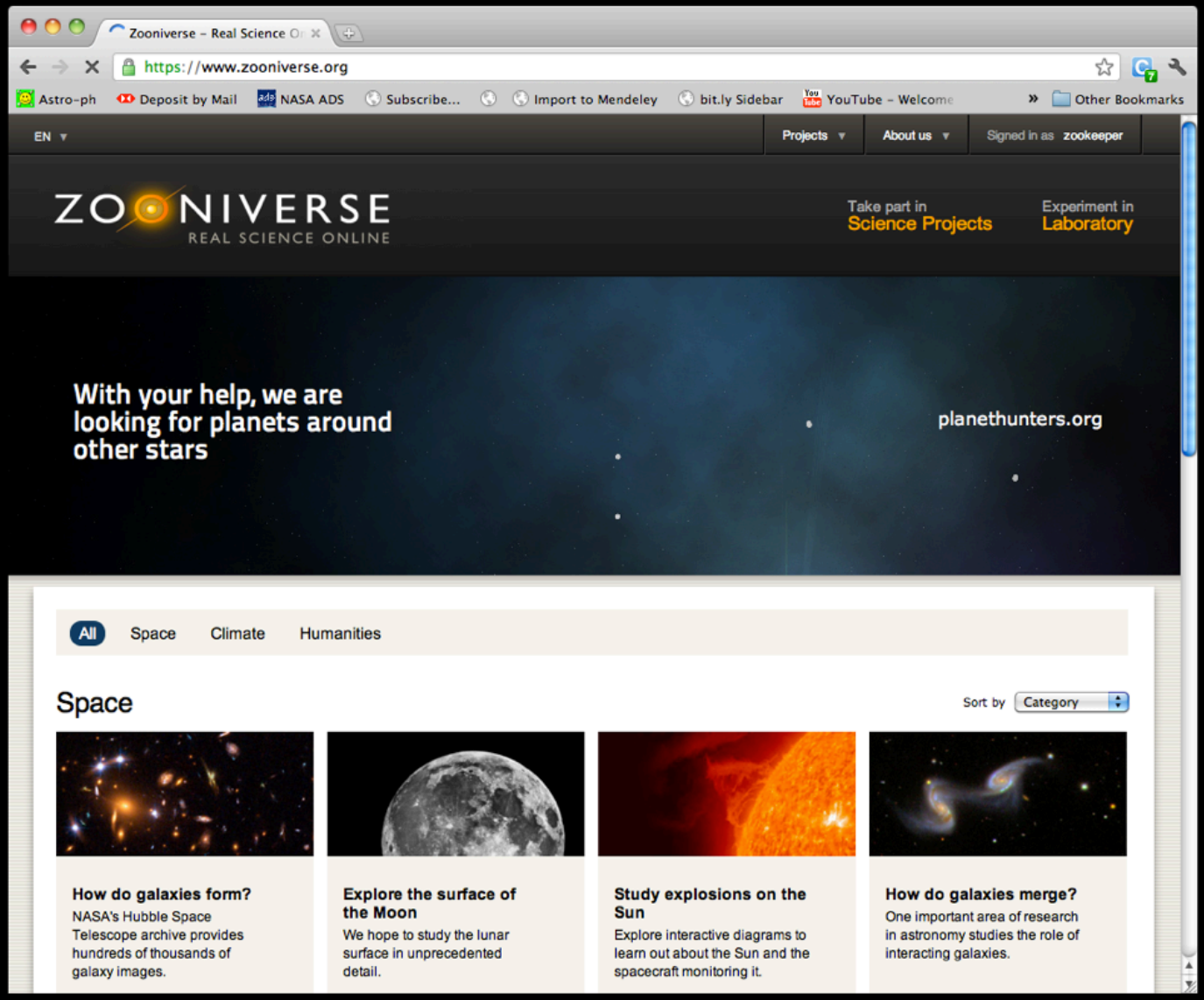
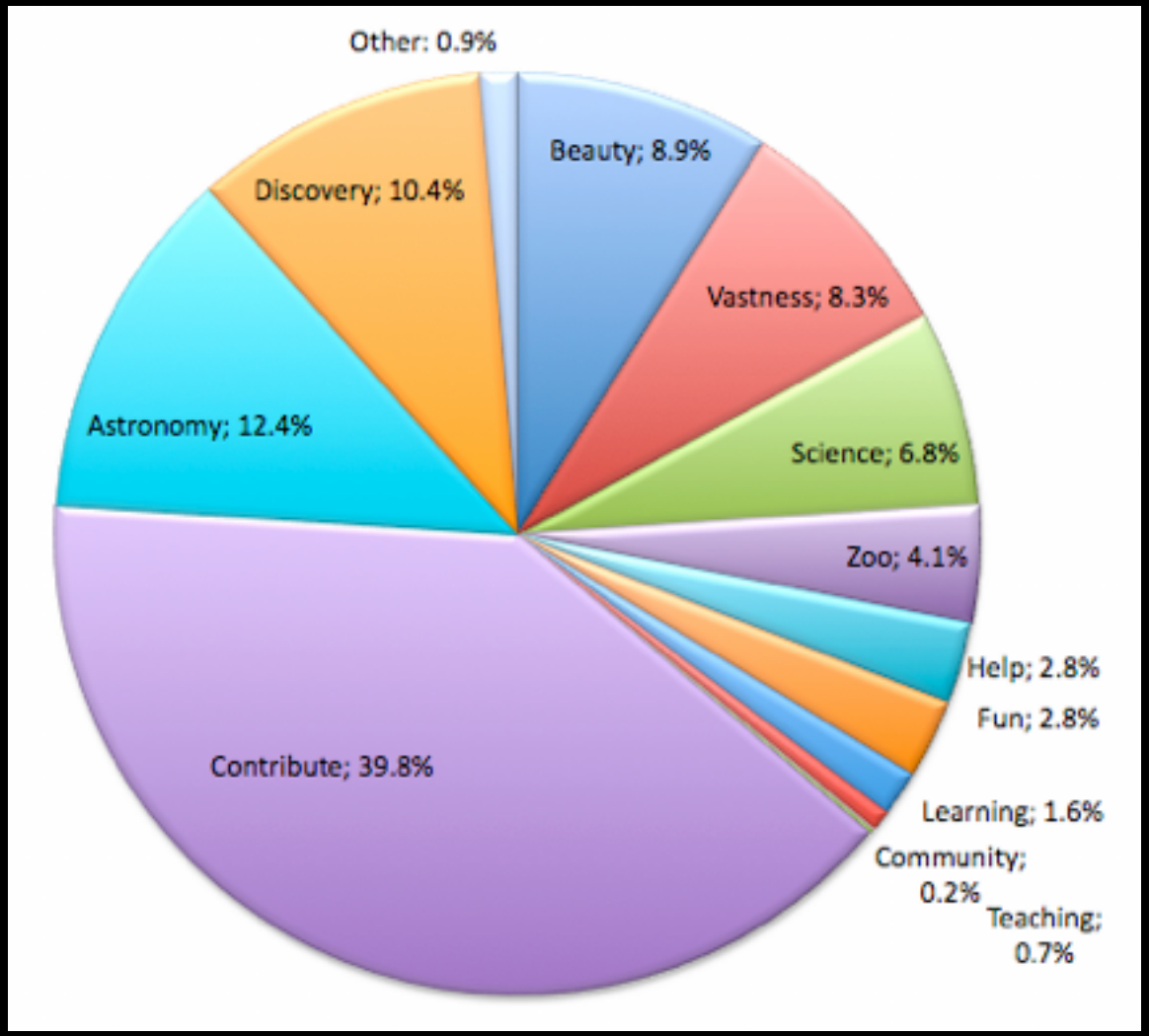


www.zooniverse.org


Other: 0.9%
Beauty; 8.9%
Discovery; 10.4%
Vastness; 8.3%
Astronomy; 12.4%
Science; 6.8%
Zoo; 4.1%
Help; 2.8%
Fun; 2.8%
Contribute; 39.8%
Learning; 1.6%
Community; 0.2%
Teaching; 0.7%

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Goggle Boxes

Hours spent...

200 billion hours
a year spent watching TV by US adults

16 years

every day!

100 million hours
to create Wikipedia

// source: Cognitive Surplus by Clay Chirky // InformationIsBeautiful.net

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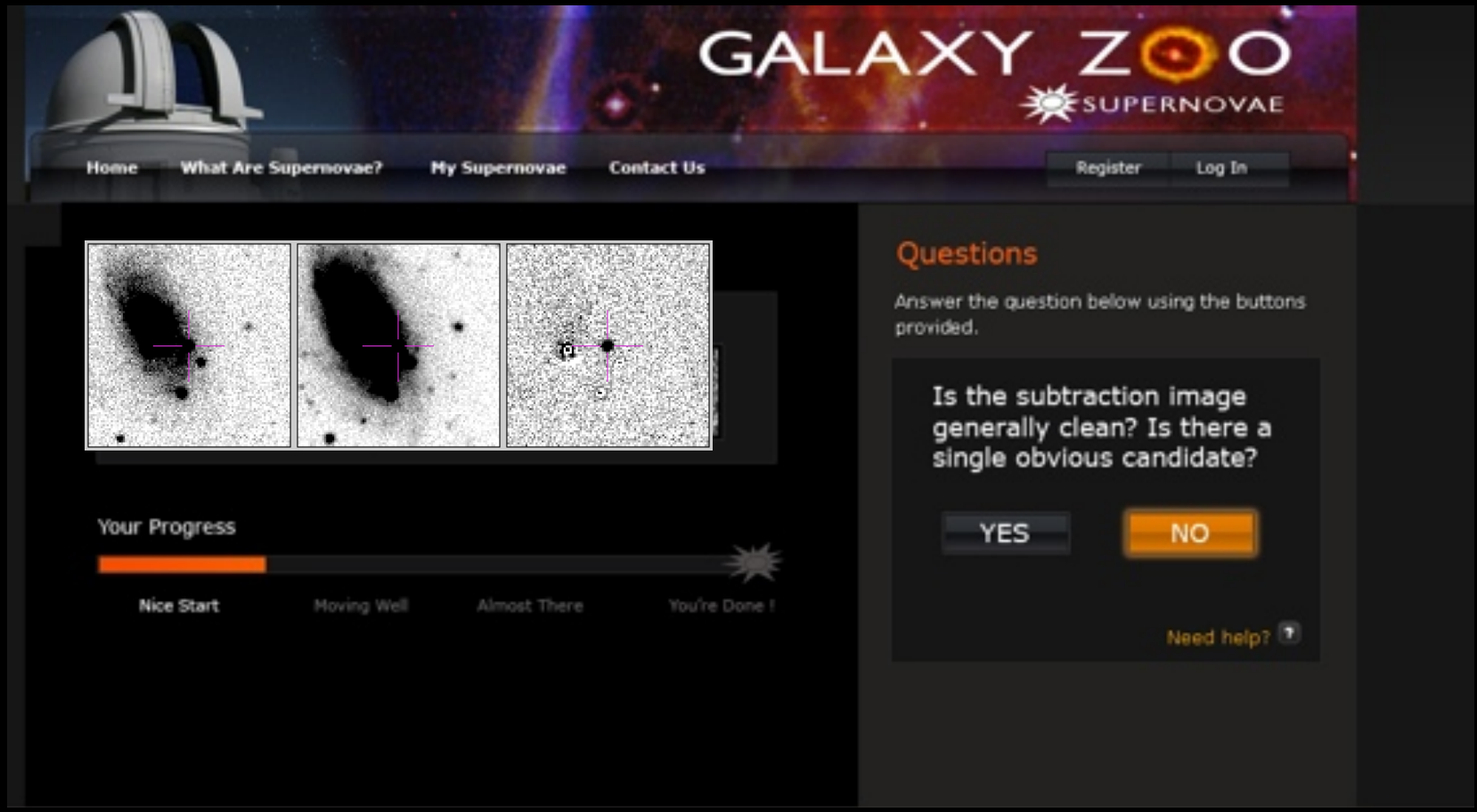

Smith et al 2010

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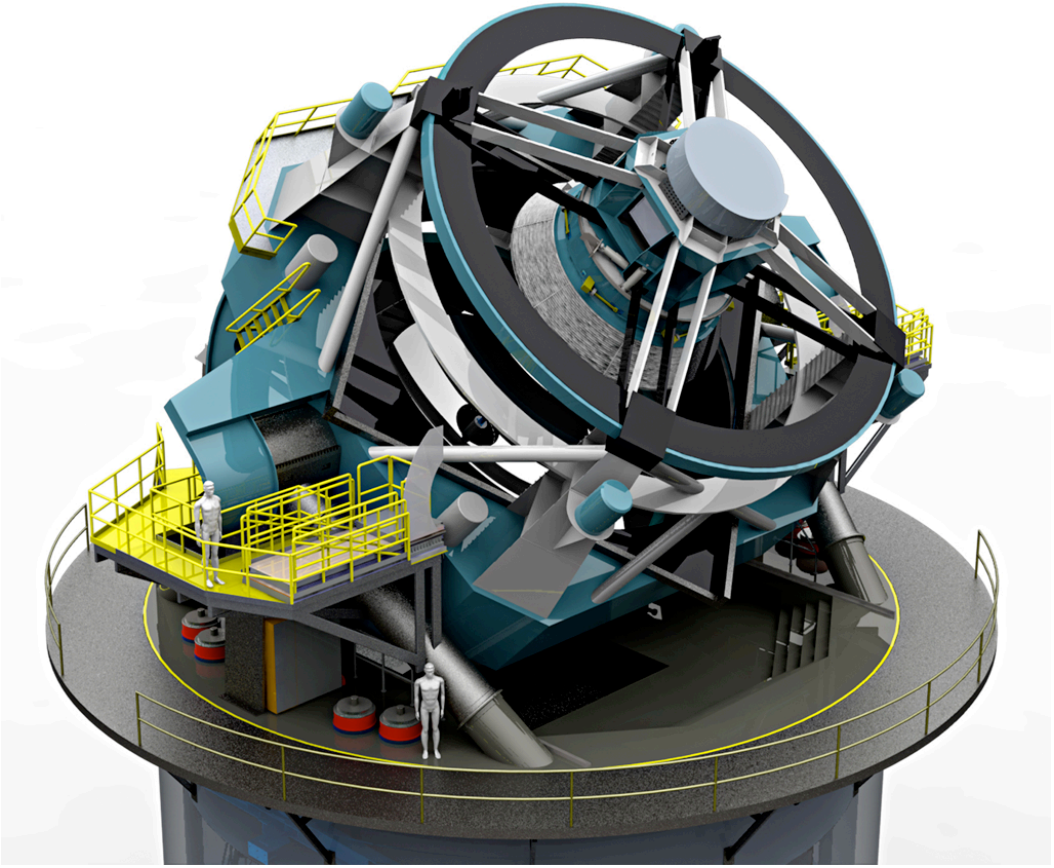

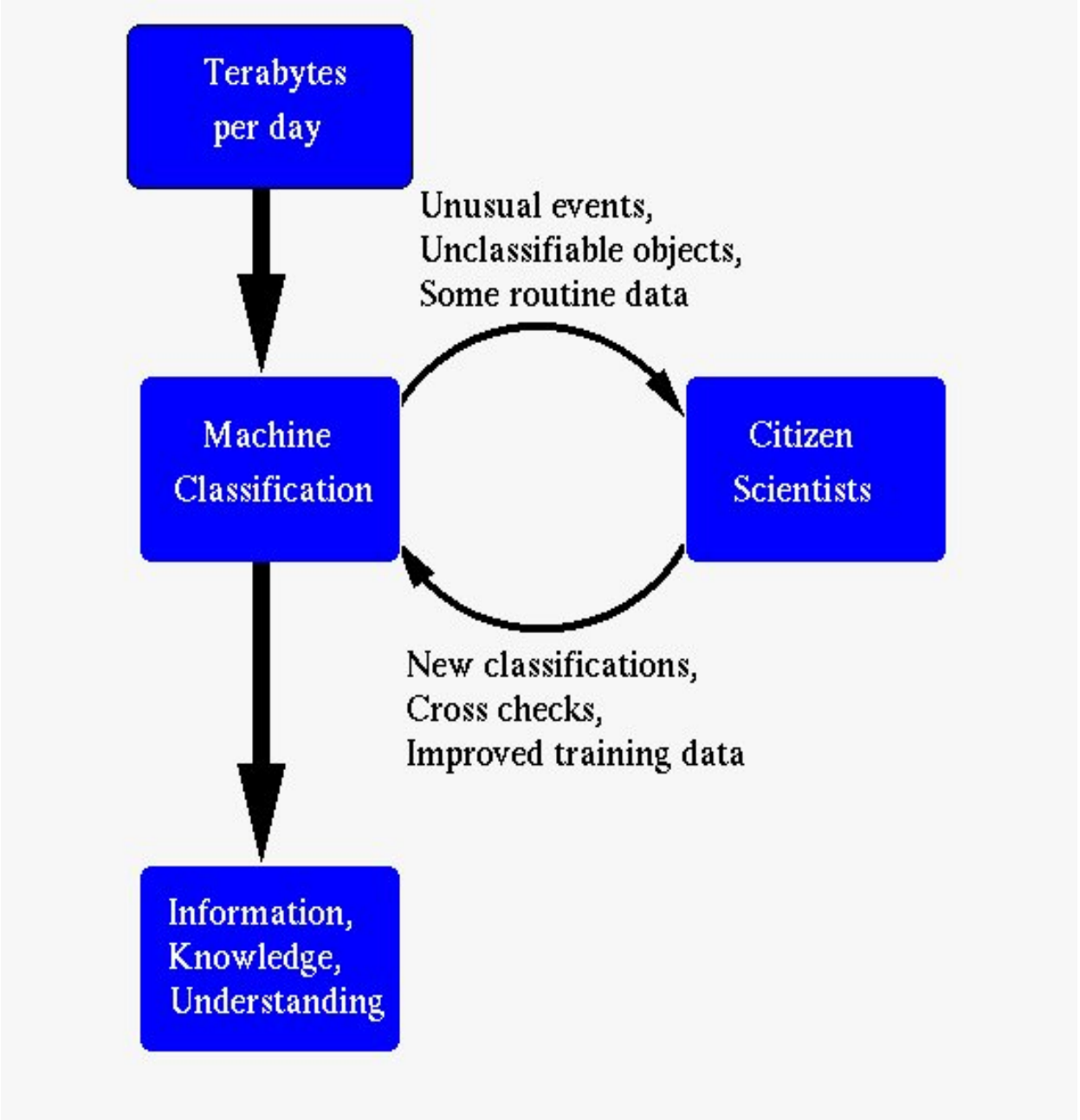
Terabytes per day
Unusual events,
Unclassifiable objects,
Some routine data
Machine Classification
Citizen Scientists
New classifications,
Cross checks,
Improved training data
Information, Knowledge, Understanding

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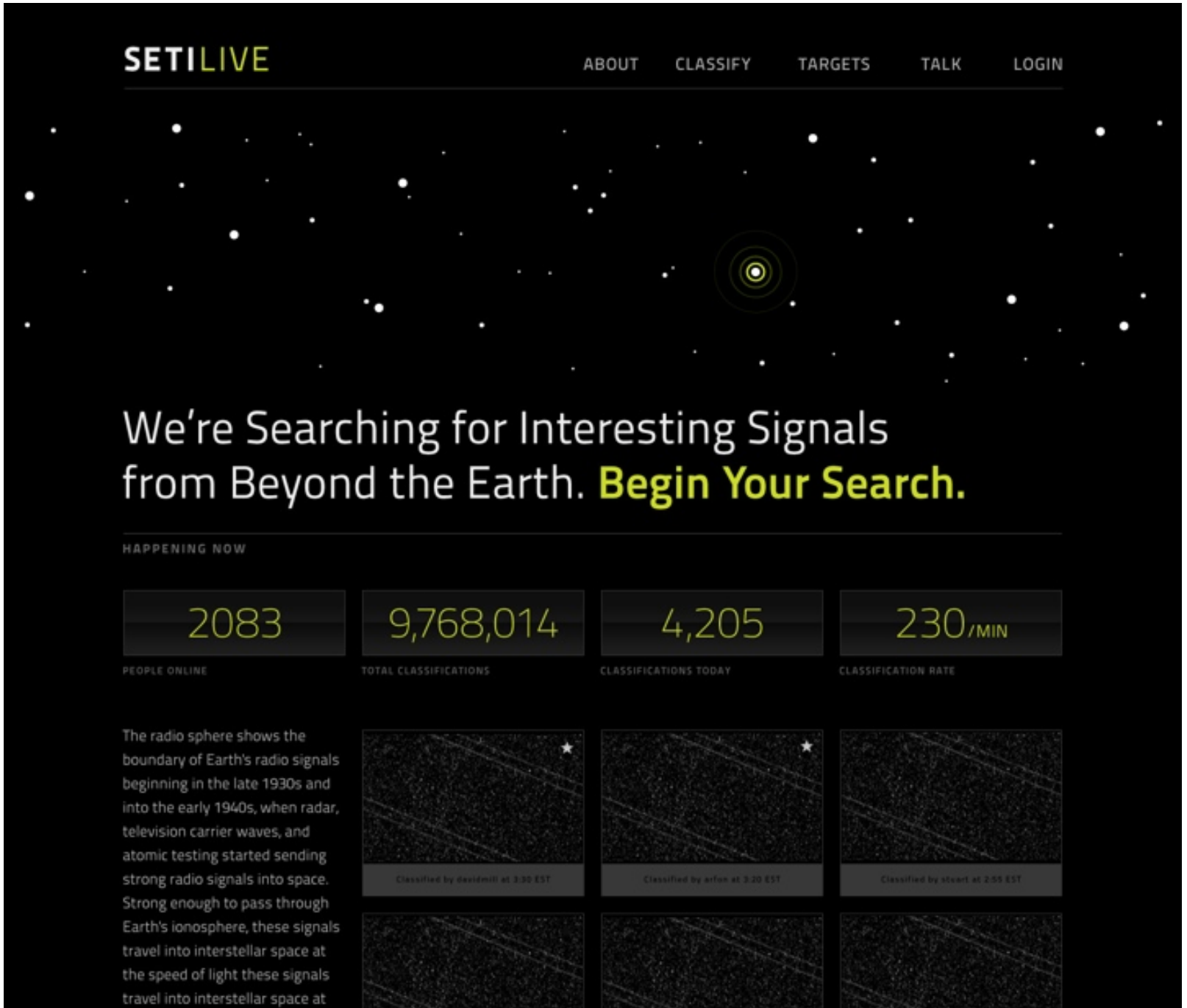

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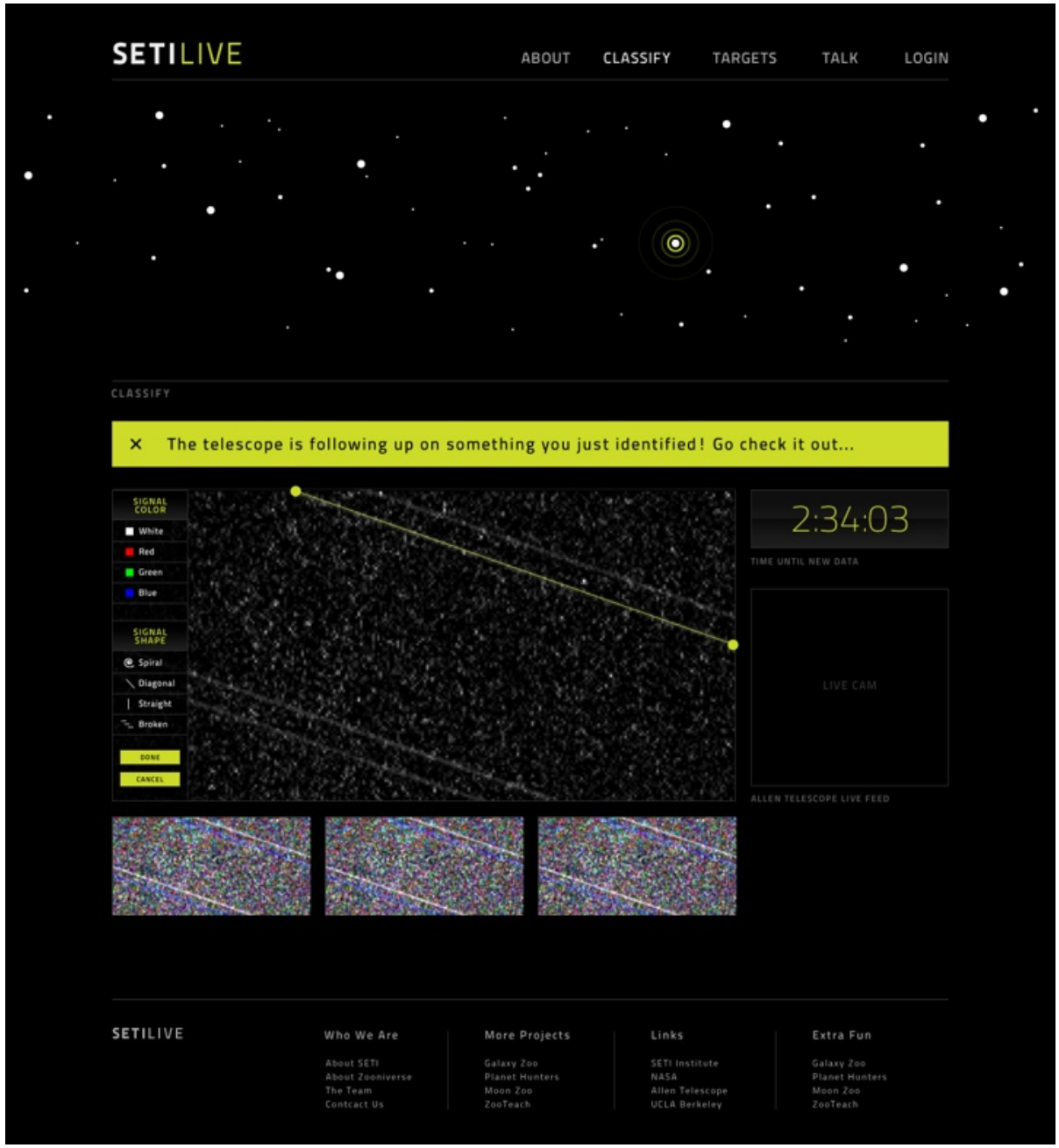

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chris@zooniverse.org

Call for new projects (with development fully funded) at
www.citizensciencealliance.org/proposals

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