

Open Citizen Science: Galaxy Zoo / Zooniverse case study

Jordan Raddick

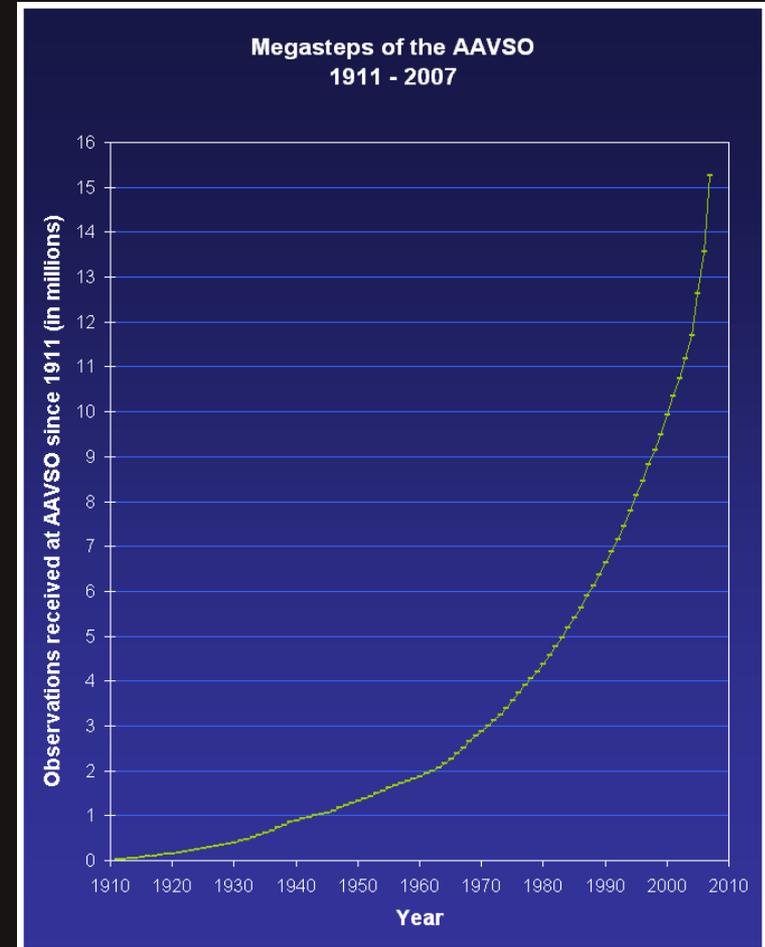
Johns Hopkins University

Context: “Data Avalanche”



- “Data avalanche” in all areas of science
- Doubling time of science data is one year (Szalay & Gray 2006)

Szalay, A.S. & Gray, J. 2006. “2020 Computing: Science in an exponential world,” *Nature*, 440, 413-414.



Context: Beating the Machine



spiral



elliptical

- Some scientific problems can be solved only by humans
- Lots of data, very few astronomers

Problem: Kevin's Sanity (2007)

- Kevin Schawinski (Oxford astronomy grad student)
- His advisor asked him to classify 50,000 galaxies... by Friday
- He complained to a friend in a pub
- But there are 850,000 more!



Solution: Galaxy Zoo



Galaxy Analysis | Galaxy Zoo

http://zoo1.galaxyzoo.org/GalaxyAnalysis.aspx

ENGLISH | POLSKI

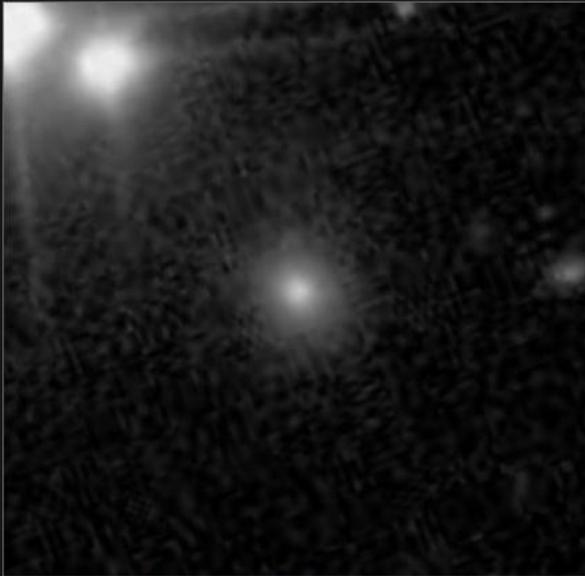
GALAXY ZOO.org

HI astromoose | Home | The Science | How to Take Part | Galaxy Analysis | Forum | Press | Blog | FAQ | Links | Contact Us | Logout | Profile

- Galaxy Tutorial
- Galaxy Analysis
- Galaxy Zoo - Thank You
- Show My Galaxies

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:
587742615100588313

Choose the Galaxy Profile by clicking the buttons below

CLOCK ANTI EDGE ON / UNCLEAR
SPIRAL GALAXY

ELLIPTICAL GALAXY

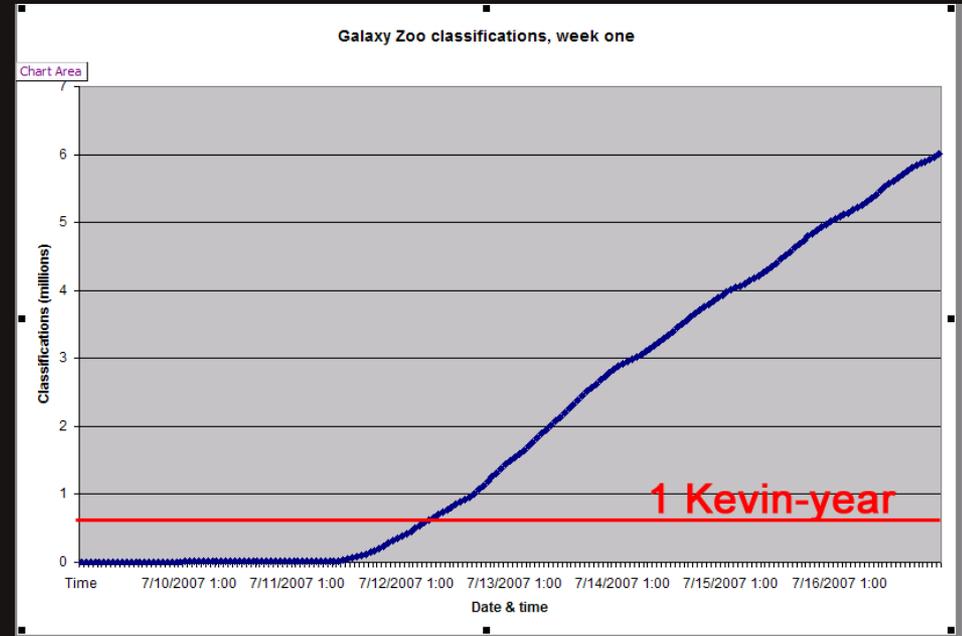
STAR / DON'T KNOW MERGERS

Show Grid Overlay on the next Image

Galaxy Zoo: week one



- June 19, 2007: spot on BBC morning radio, website
- Traffic melted web server
- 50,000 galaxies = 1 “Kevin-week”



Result: Searchable dataset

- 900,000 galaxies
- ~40 classifications each
- Provably reliable
- Online, free
- Other data available

<http://skyserver.sdss3.org>

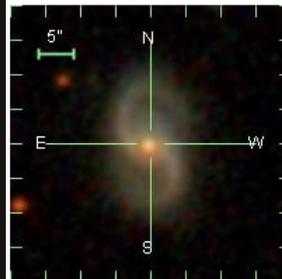
SDSS J094603.07-005044.8

[Look up common name](#)

Type		SDSS Object ID	
GALAXY		1237648720142336185	
RA, Dec		Galactic Coordinates (l, b)	
Decimal	Sexagesimal	l	b
146.51282, -0.84578	09:46:03.07, -00:50:44.81	237.31192	37.41287

Imaging

Flags DEBLENDED_AT_EDGE STATIONARY BINNED1 INTERP COSMIC_RAY CHILD



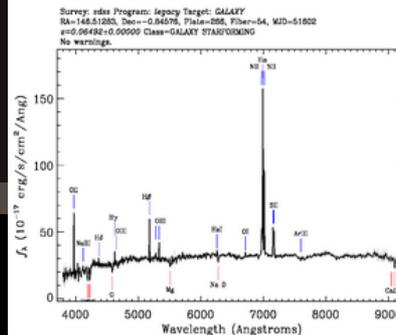
Magnitudes				
u	g	r	i	z
17.37	16.17	15.50	15.06	14.79
Magnitude uncertainties				
err_u	err_g	err_r	err_i	err_z
0.02	0.00	0.00	0.00	0.01

Image MJD	mode	Other observations	parentID	nChild	extinction_r	PetroRad_r (arcmin)
51259	PRIMARY	1	1237648720142336184	0	0.17	9.46 ± 0.340
photoZ (KD-tree method)		photoZ (RF method)		Galaxy Zoo 1 morphology		
0.106 ± 0.0249		0.105 ± 0.0318		Spiral		

Cross-identifications [Show](#)

Optical Spectra SpecObjID = 299504245504239616

[Interactive spectrum](#)



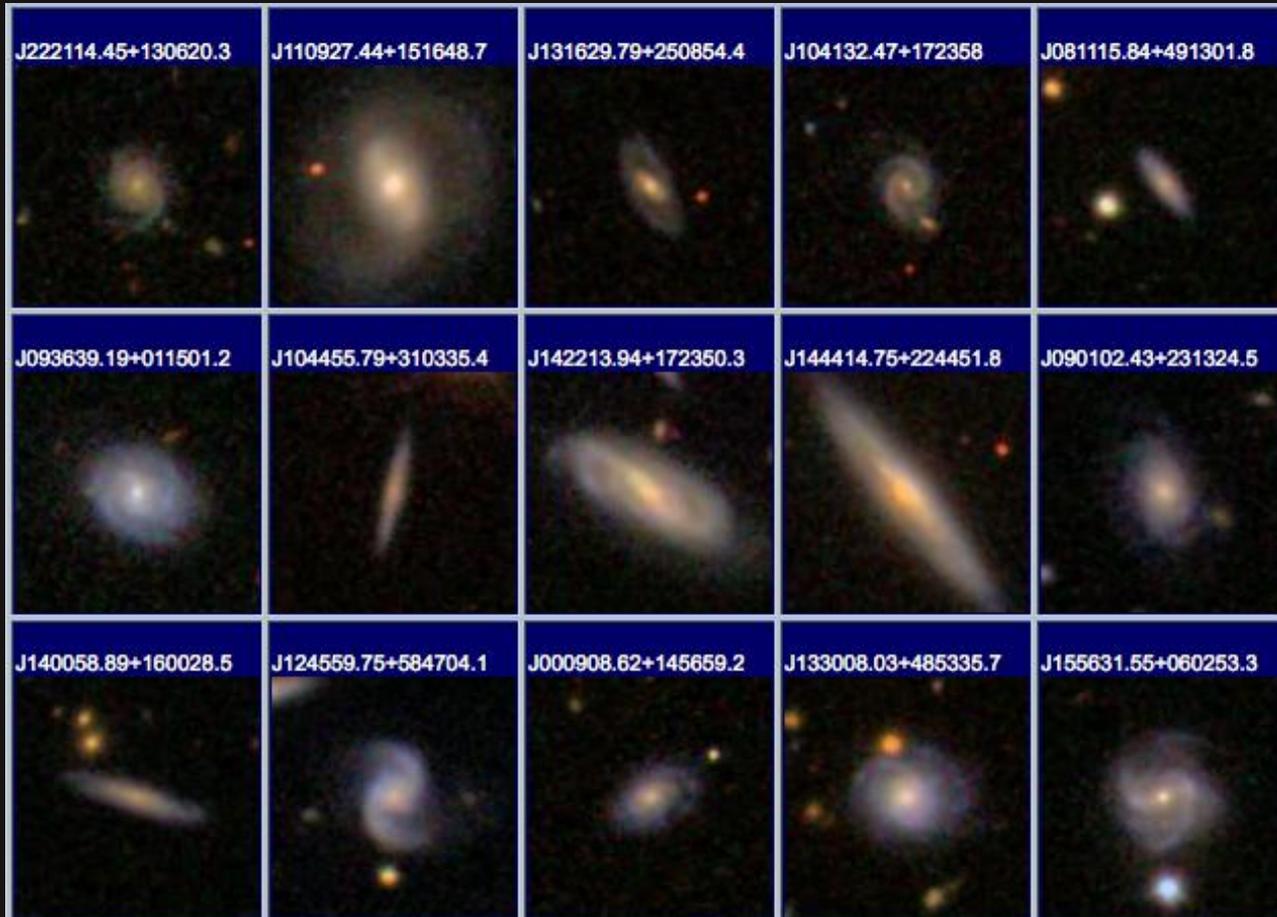
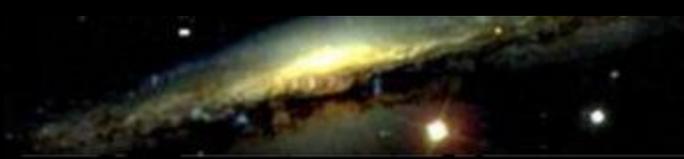
Spectrograph		SDSS	
class	Redshift (z)	Redshift error	
GALAXY	0.065	0.00000	
Redshift flags		OK	
plate	mjd	fiberid	
266	51602	54	
survey	programname	primary	Other spec
sdss	legacy	0	1
sourcetype	Velocity dispersion (km/s)	veldisp_error	
GALAXY	138.75	9.117	
targeting_flags			
GALAXY			

“Probably spirals”



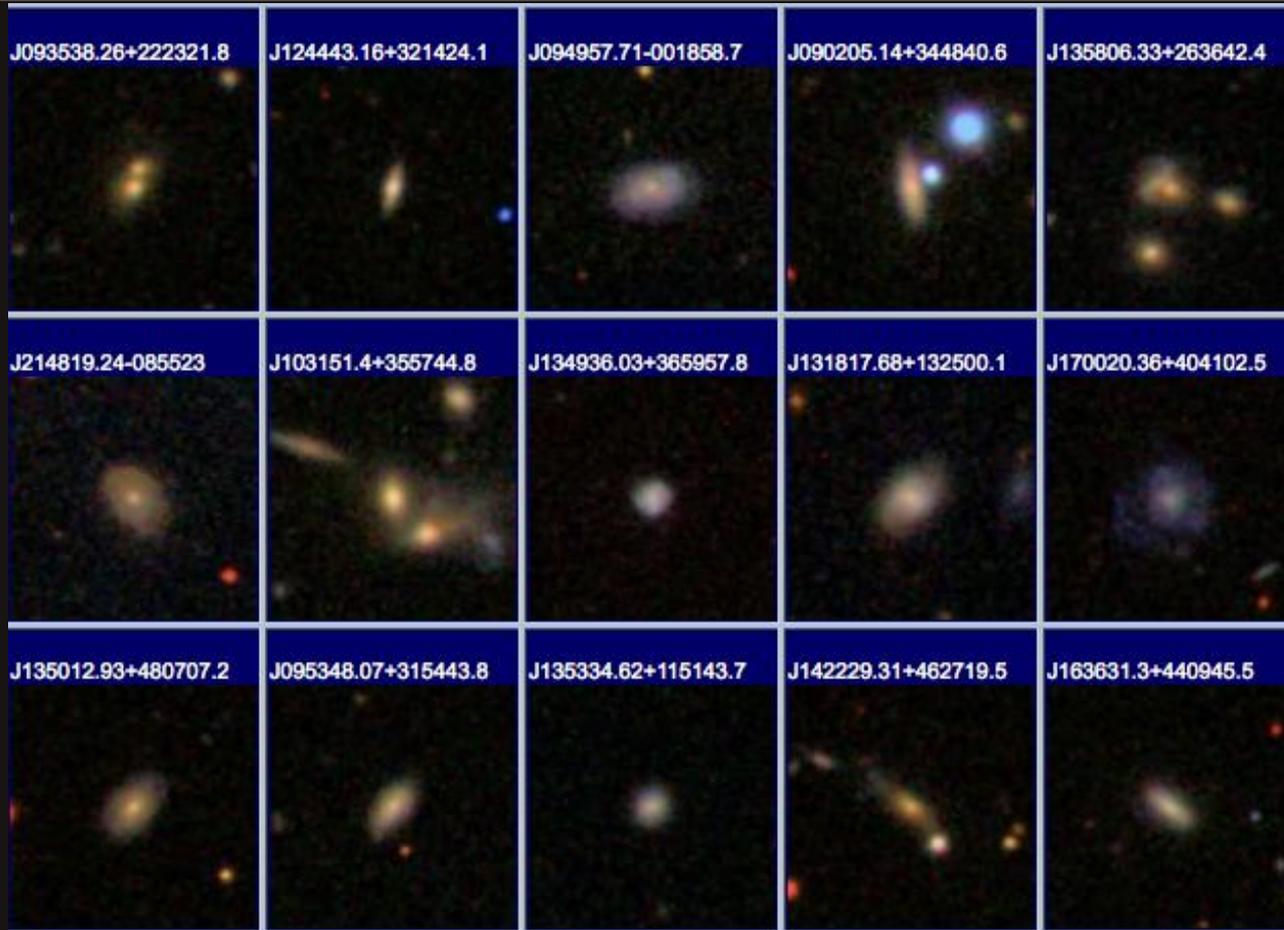
265,000 galaxies to 80% consensus

“Almost certainly spirals”



42,000 galaxies to 95% consensus

“We have no idea”



165,000 galaxies to *less than 50%* consensus

Galaxy Zoo science



- We have 40 peer-reviewed publications and counting...
- 203 papers with “Galaxy Zoo” in title or abstract (<http://bit.ly/zoopapers>)

Galaxy Zoo: The large-scale distribution of spiral galaxy spins *

K.Land¹†, A.Slosar²‡, C.Lintott¹, D.Andreescu³, S.Barnford⁴, P.Murray⁵, R.Nichol⁴, M.J.Raddick⁶, K.Schawinski¹, A.Szalay⁶, D.Thomas⁴, J.Van den Berg⁶.

Mon. Not. R. Astron. Soc. 000, 1-12 (2008) Printed 29 April 2008 (MN \LaTeX style file v2.2)

Galaxy Zoo: Morphologies derived from visual inspection of galaxies from the Sloan Digital Sky Survey*

"Galaxy Zoo Peas"



Pages: [1] 2 3 ... 88

< previous next >

REPLY | NOTIFY | MARK UNREAD | SEND THIS TOPIC | PRINT

Author Topic: Give peas a chance! (Read 23700 times)

Hanny
Global Moderator
Hero Member
★★★★★
Posts: 9739

Give peas a chance!
« on: August 12, 2007, 09:13:57 AM »

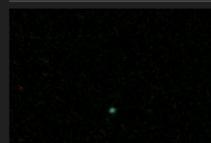
Quote Modify Remove Split Topic



<http://cas.sdss.org/astro/en/tools/chart/chart.asp?ra=10.65386865&dec=16.03407835>



"Voorwerp kid"



"Give peas a chance" (joke)

Rick Nowell
Hero Member
★★★★★
Posts: 624

Re: Give peas a chance!
« Reply #291 on: December 14, 2007, 05:57:32 PM »

Quote Modify Remove Split Topic



Bristol, UK.



Quote from: zookeeperKevin on December 14, 2007, 01:52:19 PM

I wonder if the "pea selection" yields a sample of interesting objects....

I don't know if 85 [OIII] ELGs is of interest to anyone.....14 aren't catalogued.

A telescope in Spain called CADIS has done a lot of Emission Line Galaxy surveys.

<http://www.mpia-hd.mpg.de/CADIS/> **Spectral analysis using pro tools**

In this article in mentions oxygen-rich OIII galaxies at around the same distance as

Published paper:

CITIZEN SCIENCE ALLIANCE

Mon. Not. R. Astron. Soc. **399**, 1191–1205 (2009)

doi:10.1111/j.1365-2966.2009.15383.x

Galaxy Zoo Green Peas: discovery of a class of compact extremely star-forming galaxies*

Carolin Cardamone,^{1,2†} Kevin Schawinski,^{2,3} Marc Sarzi,⁴ Steven P. Bamford,⁵ Nicola Bennert,⁶ C. M. Urry,^{2,3} Chris Lintott,⁷ William C. Keel,⁸ John Parejko,⁹ Robert C. Nichol,¹⁰ Daniel Thomas,¹⁰ Dan Andreescu,¹¹ Phil Murray,¹² M. Jordan Raddick,¹³ Anže Slosar,¹⁴ Alex Szalay¹³ and Jan VandenBerg¹³

[†]Astronomy Department, Yale University, PO Box 208121, New Haven, CT 06520, USA

The Volunteers



The Zooniverse Community

424,305 people just like you...

Name: Michael

Age: 62

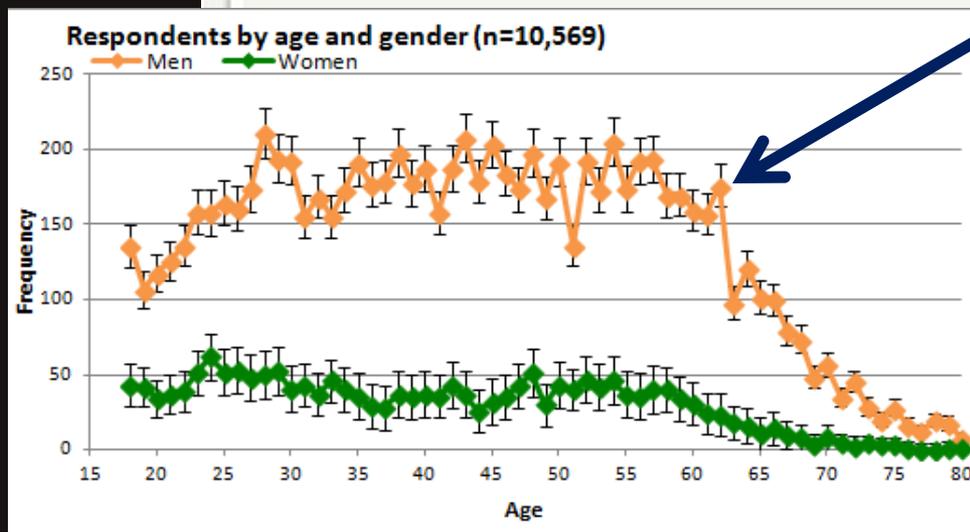
Occupation: **Amateur astronomer**

Joined Zooniverse: **December 2007**

Michael's Zooniverse: *"I like working in astronomy, exploring the universe with fellow explorers - and without all the number-crunching I had to deal with in theoretical astrophysics, before I dropped out."*



Michael

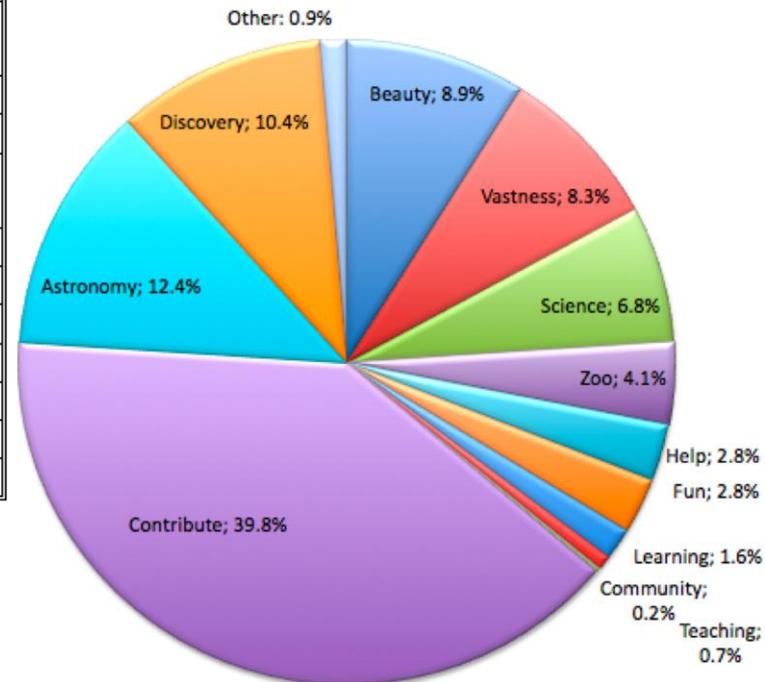


Motivations to Volunteer



- Interviews & posts coded into themes (3 raters)
- Twelve categories of motivation
- Follow-up survey (n=10,532)

Category Name	Description (used in survey instrument)
Contribute	I am excited to contribute to original scientific research.
Learning	I find the site and forums helpful in learning about astronomy.
Discovery	I can look at galaxies that few people have seen before.
Community	I can meet other people with similar interests.
Teaching	I find Galaxy Zoo to be a useful resource for teaching other people.
Beauty	I enjoy looking at the beautiful galaxy images.
Fun	I had a lot of fun categorizing the galaxies.
Vastness	<u>I am amazed by the vast scale of the universe.</u>
Helping	I am happy to help.
Zoo	I am interested in the Galaxy Zoo project.
Astronomy	I am interested in astronomy.
Science	I am interested in science.



Zooniverse.org



- “Portal” for citizen scientists
- Many projects accessible
 - Volunteers move from one to another
- Tech platform (Ruby on Rails, MongoDB, Amazon cloud)
- Structure for adding new projects





- Historical temperature data for climate change

oldWeather

HOME VESSELS TUTORIAL TRANSCRIBE ABOUT BLOG FORUM Jordan

Cadet Jordan
0 weather reports on 0 pages contributed to this voyage. 30 weather reports more for promotion to Lieutenant

HMS Cumberland
Active: Atlantic convoys

1. DATE 2. LOCATION Enter the vessel's location [Show help](#)

Date Location Weather Event

Lat Long Port

or

16th day of May
, or At Bermuda

H.M.S. "Cumberland"
From

Hour	Lat	Long	Wind	Sea	Temp	Bar	Dir	Dist	Remarks
1									A.M. One drum fed in furnace.
2									
3									
4									
5									

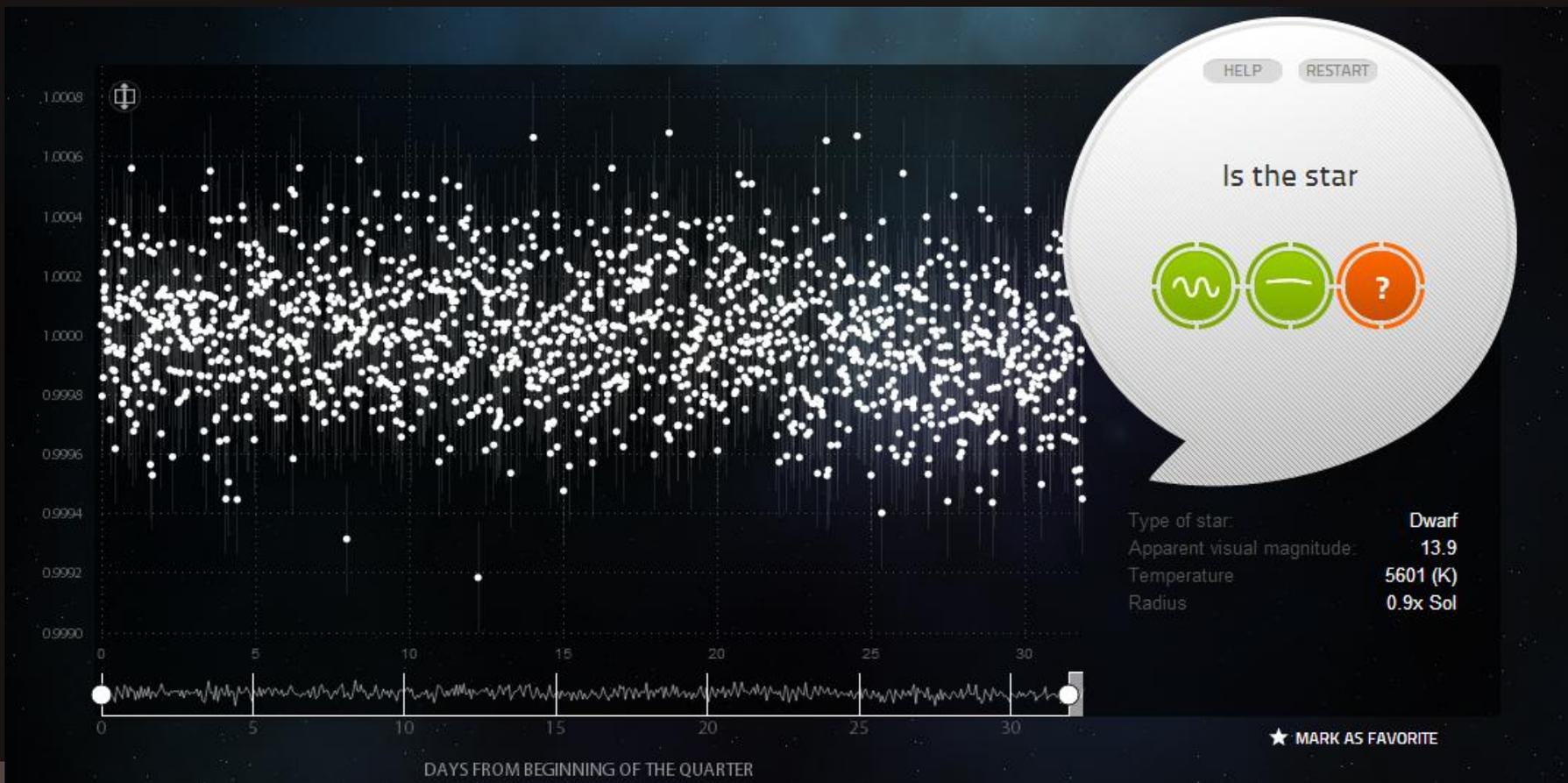
Map and timeline

North Atlantic Ocean

PlanetHunters.org



- Search for extrasolar planets in star data



SnapshotSerengeti.org



- Animals in motion-camera photos from Africa

English

SNAPSHOT SERENGETI



Looks like

Pattern	Color	Horns	Tail	Build
Aardvark	Giraffe		Porcupine	
Aardwolf	Guinea fowl		Reedbuck	
Baboon	Hare		Reptiles	
Bat-eared fox	Hartebeest		Rhinoceros	
Bird (other)	Hippopotamus		Rodents	
Buffalo	Honey-badger		Secretary bird	
Bushbuck	Hyena (spotted)		Serval	
Caracal	Hyena (striped)		Topi	
Cheetah	Impala		Vervet monkey	
Civet	Jackal		Warthog	
Dik dik	Kori bustard		Waterbuck	
Eland	Leopard		Wildcat	
Elephant	Lion (female or cub)		Wildebeest	
Gazelle (Grant's)	Lion (male)		Zebra	
Gazelle (Thomson's)	Mongoose		Zorilla	
Genet	Ostrich		Human	

Nothing here Finish

Tutorial Clear filters

Proposing New “Zoos”



- Apply for “click time”
- Peer-reviewed
- We’ll help you build your “Zoo”

Proposal Submission

CITIZEN SCIENCE  ALLIANCE

Welcome to the proposal submission tool for the recent [call for proposals](#) to the Citizen Science Alliance. It should be straightforward to use and examples for most questions are also available. Submission is final, so please make sure you’re happy before pushing the button.

Please report any problems to cs@zooniverse.org

Team

Proposer name

Proposer email

Proposer affiliation

Team members

Name	Affiliation	Email	Researcher
			Researcher 

Background information

Project title 200

Abstract 250

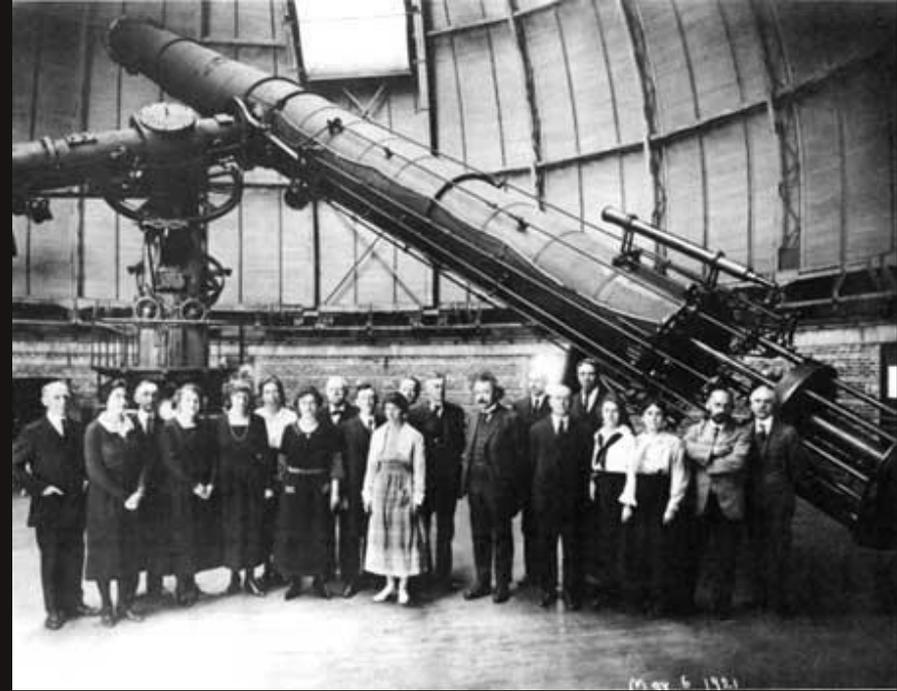
Subject

Recent relevant papers 200

The big dream for science



- Citizen science should be a standard tool in scientists' toolkit
- Analogy: observatory
- Part of open science



The big dream for volunteers

- Participating in science should be as common as participation in sports today
- **Difference:** citizen science adds to goals of professional science
- **Difference:** everybody wins

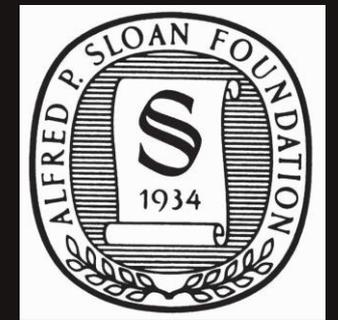


Acknowledgements



400,000 Zooniverse volunteers, including...

- Mark Wiltshire
- Jerrold Grochow
- Alexandra Walker



Contact information

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raddick@jhu.edu
410-516-8889



*Football photos from Flickr:
(1) Hector Alejandro
(2) Maryland Government*