Student 1 Name:	NetID:
Student 2 Name:	NetID:
Student 3 Name:	NetID:

#### Exploring GalaxyZoo Online Lab ENGAGING IN ASTRONOMICAL INQUIRY 99

## Due April 20, 2012

## This online lab will be graded out of 100 points (point values for each section and/ or question are marked). You may work in groups of up to three students and turn in one report for your group.

**Big Idea:** The countless galaxies of stars spread throughout the Universe have characteristics that can be observed and classified.

**Goal:** Students will conduct a structured series of scaffolded scientific inquiries about the nature of observed galaxies using the Internet sites prescribed, particularly the Sloan Digital Sky Survey via the original Galaxy Zoo [http://zoo1.galaxyzoo.org/]

## **<u>Computer Setup:</u>** (4 pts)

- a) Access <u>http://zoo1.galaxyzoo.org</u>
- b) (2 pts) Select REGISTER and set up a username as: WHF \_\_\_\_\_

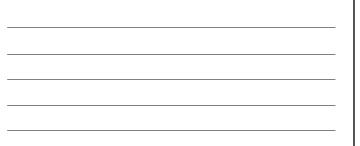
(where the five blanks are numbers) and a password that is identical to your username. *Record this information in the box.* 

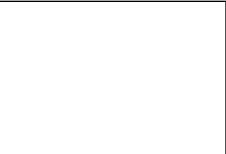
Userid: WHF Password: <i>same as above</i>	
Email:	
Security Question:	
Answer:	

- c) (1 pt) Use one of your team member's email addresses. *Record it in the box.*
- d) (1 pt) Create and enter a security question and answer. *Record it in the box.*
- e) Select CREATE USER and, when set up, select CONTINUE.

# **Background Information** (20 pts)

1. (10 pts) From your book, your class notes, or from the Internet, find a reasonably good definition of a galaxy and write it in the space below. *Include one rough sketch of what one looks like*.

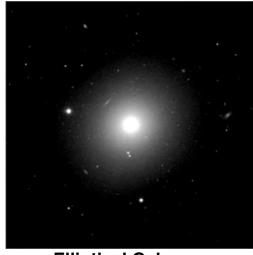




2. (10 pts) Imagine that each of the images below shows a single galaxy of billions of stars.



**Spiral Galaxy** 



**Elliptical Galaxy** 

In the space below, create a detailed listing of the characteristics of each that allow you to distinguish one galaxy from the other.

Obbserwabble Otherrædternisstilics of a Sippinal Galaxy	<b>O bse</b> rvælblæ Chærææt <del>er i sitisso</del> ófa <b>a</b> n Ælligtiget i Geatæxyy

## GalaxyZoo Tutorial (12 pts)

After logging into http://2001rgatax/yzoo?org, select HOW TO TAKE PART and complete the online TUTORIAL, completing the tables below as you go along.

## 3. (1 pt) TUTORIAL PART 1A: SPIRAL or ELLIPTICAL

	I	NGAGING IN ASTRO	NOMICAL INQUIRY	101

First record your answers in the blocks above. Then, check your answers and in the event your answer does not agree, mark a single line through your response. There is no penalty for having an incorrect answer.

### 4. (1 pt) TUTORIAL PART 1B: SPIRAL or ELLIPTICAL

				1
				1
				1
				1
	E	NGAGING IN ASTRO	NOMICAL INQUIRY	101

First record your answers in the blocks above. Then, check your answers and in the event your answer does not agree, mark a single line through your response. There is no penalty for having an incorrect answer.

### 5. (1 pt) TUTORIAL PART 1C: MERGING or NOT MERGING

H	NGAGING IN ASTRO	NOMICAL INQUIRY	10

First record your answers in the blocks above. Then, check your answers and in the event your answer does not agree, mark a single line through your response. There is no penalty for having an incorrect answer. © WH Freeman Publishing Slater Slater & Lyons 2010

### 6. (1 pt) TUTORIAL PART 1D: SPIRAL or ELLIPTICAL

	H	NGAGING IN ASTRO	NOMICAL INQUIRY	10

First record your answers in the blocks above. Then, check your answers and if your answer does not agree, mark a single line through your response. There is no penalty for having an incorrect answer. Slater, Slater & Lyons, 2010

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#### 7. (1 pt) TUTORIAL PART 2B: CLOCKwise or ANTI-clockwise or EDGE on/can't tell

	I	NGAGING IN ASTRO	NOMICAL INQUIRY	101

First record your answers in the blocks above. Then, check your answers and in the event your answer does not agree, mark a single line through your response. There is no penalty for having an incorrect answer.

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8. (	1 pt) TUTORIAL PART 3: GALAXY or -	_"?"
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First record your answers in the blocks above. Then, check your answers and in the event your answer does not agree, mark a single line through your response. There is no penalty for having an incorrect answer. © WH Freeman Publishing Slater, Slater & Lyons, 2010

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10. (5 pts) At the bottom of the HOW TO TAKE PART – TUTORIAL page, select the PROCEED TO THE TRIAL button. Your team will be asked to fully classify 15 galaxies. If your classification agrees with scientists' classifications 8 or more times, you will be able to ENGAGING IN ASTRONOMICAL INOURY 103 enter the GalaxyZoo scientific database to conduct your research. You can repeat this step if necessary.

Record the results of your TRIAL data collection here: ENGAGING IN ASTRONOMICAL INQUIRY 103

	CIRCLE ONE	
Image #1	Clockwise Spiral   Anticlockwise Spiral   Edge On   Unclear     ENGrécal NGal NyASTRONOMICAL INQUIRY     Star   Don't Know   Merging Galaxies	103
Image #2 Image #2	Clockwise SpiralAnticlockwise SpiralEdge OnUnclearENiprical Octainsy ASTRONOMICAL INQUIRYStar Don't KnowMerging Galaxies	103
Image #3 Image #2	Elockwise Spiral Anticlockwise Spiral Edge On Unclear   ENIPHEAL CALANS Enge On Unclear   ENIPHEAL CALANS Anticlockwise Spiral Edge On Unclear   ENIPHEAL CALANS Anticlockwise Spiral Edge On Unclear   ENIPHEAL CALANS Anticlockwise Spiral Edge On Unclear   Edge On Edge On Unclear Edge On Unclear   Edge On Edge On Edge On Edge On Edge On	103
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Image #7 Image #9	Elloekwise Spiral Antieloekwise Spiral Edge On Unelear Elliptical Galaxy Star Don <sup>3</sup> t Know Merging Galaxies	
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Image #10 Image #9	Elliptical Galaxy     Star   Don <sup>3</sup> t   Know	
© WH Freeman Publishing	Exploring Galaxy2     Elliptical Galaxy2     Star   Don3t Know	.00 4

	ENGAGING IN ASTRONOMICAL INQUIRY 103
	CIRCLE ONE
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	Star Don't Know Merging Galaxies
Image #11 Image #2	Eleckwise Spiral     Anticleckwise Spiral     Edge On     Unclear       Ehippical Calaxy     Astronomical Inquiry     103
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Image #12 Image #3	Ellekwise Spiral Antieleekwise Spiral Edge On Unelear Elliptical Galaxy
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Image #13, Image #2	Ellekwise Spiral Antieleekwise Spiral Edge On Unelear Elliptical Galaxy
e	Star Don <sup>3</sup> t Know Merging Galaxies
Image #14,	Ellekwise Spiral Antieleekwise Spiral Edge On Unelear Elliptical Galaxy
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Image #15,	Eloekwise Spiral Antieloekwise Spiral Edge On Unelear Elimtical Galaxy
image #9	Star Bont Know IN ASTRONOMICAL Merging Galaxies
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image #8	Elliptical Galaxy Star Don <sup>3</sup> t Know Merging Galaxies Exploring GalaxyZoo 5
© WH Freeman Publishing Image #8	Elliptical Galaxy

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Cosmic Rays or Satellite Streaks		Imposs.	Chall.		Varies		Easy	
<b>Does the Evidence Match the Conclusion:</b> (44 pts)								

12. (15 pts) Enter the GALAXY ANALYSIS Galaxy Zoo scientific database and classify thirty

(30) images. Keep a record of your results in the Tally Sheet below using tick marks. After you have classified 30 galaxiasvislightan "Shawi Max Galaxies" on the baft hand side of the screen and print your lists of "Recent Galaxies WHFXXXXX has Analyzed." Attach these to the end of your lab guide.

	Elliptical Galaxy					
TALICY oSHAFE Spiral	Anticlockwise	Spiral	Edge On	Unclear		
Data Table #1						
	Star Don't Kno	W	Mer	ging Galaxies		
Elliptical Galaxy						
	1					
Star Don't Know		Merging Galaxies				

Consider the research question, "What type of galaxy is most common?"

- 13. (3 pts) How many total galaxies did you classify (exclude "Star/Don't Know" from this total)? WH Freeman Publishing Slater, Slater & Lyons, 2010
- 14. (9 pts) What was the total number of:
  - a. elliptical galaxies?
  - b. spiral galaxies? \_\_\_\_\_ (Note: you need to sum up all three sub-types of spirals to get the total numbers of spirals in your data.)
  - c. merging galaxies?

Freeman Publishingts) What percentage of the galaxies in Statesur States Lyons, 2010

- a. elliptical galaxies?
- b. spiral galaxies?
- c. merging galaxies?

16. (3 pts) What type of galaxy did you find to be the most common?

17. (5 pts) If a student proposed a generalization that **"most galaxies are elliptical,"** would you *agree* or *disagree* with the generalization based on the evidence you collected? *Explain your reasoning and provide specific evidence from your observations.* 

# What Conclusions Can You Draw From the Evidence? (20 pts)

Galaxies are observed to have numerous different shapes. Consider the research question, "which direction do spiral galaxies usually spin?"

For this part of the exercise, we will use the following data collected by a student from Galaxy Zoo.

Clockwise Spiral	Anti-clockwise Sprial	Edge-on/Unclear
30	27	16

18. (3 pts) What was the total number of spiral galaxies classified by this student?

19. (12 pts) What percentage of spiral galaxies in the data table

- a. rotate clockwise?
- b. rotate anti-clockwise?

c. are edge-on or have an unclear direction of rotation?

20. (5 pts) What conclusions and generalizations can you make from your data in terms of DO SPIRALS GENERALLY SPIN CLOCKWISE OR ANTI-CLOCKWISE? *Explain your reasoning and provide specific evidence either from the above questions or from evidence you yourself generate using GalaxyZoo.*