Continuation/Research Progression Projects Form (7)

Required for projects that are a continuation/progression in the same field of study as a previous project.
This form must be accompanied by the previous year's abstract and Research Plan/Project Summary.

Student's Name(s) Tara Rothenberg

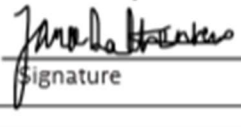
To be completed by Student Researcher: List all components of the current project that make it new and different from previous research. The information must be on the form; use an additional form for 2016–2017 and earlier projects.

Components	Current Research Project (2018-2019)	Previous Research Project Year: 2018-2019
1. Title	The Probability of Galaxy Merging Given Redhshift, Morphology and Stellar Mass	Galaxy Properties and how they Effect Galaxy Merging
2. Change in goal/ purpose/objective	Find the probabilitty of galaxy merging given specific redhsifts, morphologies and stellar masses	Find how redshift and morphology impact galaxy merging
3. Changes in methodology	using conditional probibility to find at what circumstances the probibility of merging is the highest, ten comparing that to the accuracy of galaxy merging simulations	using the Galaxy Zoo database and using 3000 of the 900000 galaxies from their data base then sorting the to find their impat on merging
4. Variable studied	Probilities including stellar mass, morphology and redshift	impacts of redshift and morphology
5. Additional changes		

Attached are:

☐ 2017–2018 Abstract and Research Plan/Project Summary

I hereby certify that the above information is correct and that the current year Abstract & Certification and project display board properly reflect work done only in the current year.

Tara Rothenberg		6-27-19
Student's Printed Name(s)	Signature	Date of Signature (mm/dd/yy)

OFFICIAL ABSTRACT and CERTIFICATION

Galaxy Properties and how they Affect Galaxy Merging

Tara Rothenberg

Though studied on their own, galaxy properties and their effect on galaxy merging has not yet been looked at as a whole.This research is important to developing a greater understanding of galaxy interaction and how the universe works which will further help space exploration and help other scientists know what to expect when traveling through deep space. In order to address the problem, three properties were studied, morphology, redshift and stage. 6,004 merging galaxies were included in the study, each one with its properties compared to other properties and general merging to find trends that would suggest a merging pattern. It was found that redshift had the most effect when it comes to merging as redshift increased so did the amount of galaxies merging. This means that as redshift decreased, so did the amount of galaxies that were found merging. Spiral galaxies were also the most common when looking at morphology, including what morphology merged the most, and what galaxy appeared the most in the data. This means that spiral galaxies were the most common type found in the data and is the morphology that tends to merge the most. In the future, more research on redshift, such as why galaxies tend to merger at higher redshifts and
not lower ones, will be done.
the Left Margin

Category
Pick one only—
mark an "X" in
box at right

- Animal Sciences ☐
- Behavioral and Social Science ☐
- Biochemistry ☐
- Cellular & Molecular Biology ☐
- Chemistry ☐
- Computational Bio/ Bioinformatics ☐
- Computer Science ☐
- Earth Science ☐
- Engineering ☐
- Environmental Science ☐
- Mathematical Sciences ☐
- Medicine and Health ☐
- Microbiology ☐
- Neuroscience ☐
- Physics and Astronomy ☑
- Plant Sciences

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   ☐ human subjects ☐ potentially hazardous biological agents
   ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue
2. This abstract describes only procedures performed by me/us, reflects my/our own independent research, and represents one year's work only ☒ Yes ☐ No
3. I/we worked or used equipment in a regulated research institution or industrial setting: ☐ Yes ☒ No
4. This project is a continuation of previous research. ☐ Yes ☒ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☒ No
6. I/we hereby certify that the abstract and responses to the above statements are correct and properly reflect my/our own work. ☒ Yes ☐ No

This stamp or embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Scientific Review Committee.

a) **Rational**- Colliding galaxies, also known as galaxy mergers, are thought to be the driving force in evolution. A galaxy is a large collection of billions of stars along with gas and dust all held together by gravity. A galaxy merger is the prosses in which two galaxies of different properties (ex; different type, mass, size, gas amount, etc.) pass through each other and eventually combine to create one galaxy. This merge is due to the gravity of both galaxies pulling each and direction each galaxy travels in. Scientists and qualified people continue to sort out merging galaxies from non-merging galaxies and large data pools of sored galaxies exist. Finding averages and percentages of merging galaxies, types of merging galaxies and more can be a huge help to developing a further understanding of galaxy evolution. Without galaxy interaction and merging a galaxy will remain the same as nothing has caused it to change. When galaxies merge, their type is changed, all the dust and gas is moved around, star production tends to increase, can change luminosity, color change is more rapid and occasionally, stars collide. Studying galaxy mergers and finding percentages of merging galaxies will help aid future research done on galaxy evolution by not only pinpointing possible galaxies to study but to find a pattern in these galaxies that will add more information to how galaxy evolution works.

b) **Research Questions**- What is the average of total overall merging galaxies to all galaxies pulled from data base? What is the average of specific galaxies properties (type, mass, size) to all merging galaxies pulled from data base.

   Hypothesis- It is hypothesized that overall percentage of merging galaxies will be less than the percentage of non-merging galaxies because most galaxies are moving apart and the circumstances for collision do not exist. It is also hypothesized that merging galaxies with certain properties will have a higher percentage compared to other merging galaxies with different properties because different properties can enable or hinder a galaxies ability to merge.

   Goal- The goal of this research is to find and compare the percentage of merging galaxies to all galaxies and within all merging galaxies compare the percentages certain properties of merging galaxies (type, mass etc.)

c) **Procedure**- This experiment will use data from Galaxy Zoo 1 data release, Galaxy Zoo 2 data release, Galaxy Zoo: HUBLE data release and Galaxy Zoo: CANDLES data release. All galaxy images are pulled from the slogan digital sky survey. Over one million galaxies are classified and sorted for use. Data will be put into a spreadsheet for study. Data will be categorized by redshift, galaxy type and galaxy mass after merging galaxies are separated from non-merging galaxies. Once data is sorted and categorized averages will be taken of merging galaxies out of all galaxies. Averages will also be found of types of merging galaxies (elliptical, spiral and irregular) to all merging galaxies, mass groups of merging galaxies to all merging galaxies. Percentages will be compared to find if certain properties are higher in amount and if merging galaxies are more common than non-merging galaxies

Risk and safety- There are no safety risks or precautions that need to be taken in this experiment

Data Analysis- the data gathered from Galaxy Zoo data base will be sorted in a spread sheet and data will be categorized by merging galaxies compared to al galaxies, types of galaxies and mass of galaxies. Data will then be analyzed and percentages of category's will be found and compared to each other.

Bibliography-

Cosmology - Galaxy Mergers. (n.d.). Retrieved July 14, 2018, from http://astronomyonline.org/Cosmology/GalaxyMergers.asp

Hooper, E., & Wolf, M. (n.d.). Galaxy Mergers. Retrieved July 14, 2018, from http://www.astro.wisc.edu/our-science/research-areas/extragalactic-astronomy/distant-univserse/galaxy-mergers/

N. (n.d.). What is a Galaxy. Retrieved July 14, 2018, from https://spaceplace.nasa.gov/galaxy/en/

S. (n.d.). COSMOS - The SAO Encyclopedia of Astronomy | COSMOS. Retrieved July 15, 2018, from http://astronomy.swin.edu.au/cosmos/E/Evolution Of Galaxies

Z. (n.d.). Galaxy Zoo 1 data release. Retrieved July 15, 2018, from https://data.galaxyzoo.org/

Role of Mentor- Help sort through and categorize data as well as help analyze data and check over work.

Role of Student Researcher- Collect, sort, categorize and analyze data, then find averages for all category's and compare.