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Comparative Study Between Rotational Angular Velocity of Some Spiral Barred Galaxies with Mass.

EKWUBIRI, E. C.
University of Benin, Benin-City

Abstract- A lot of emphasis has been paid to the disparity in galaxy rotation, which has led to research on the relationship between mass and radius and the rotating angular velocity of some spiral-barred galaxies. An alternate approach is required because of the morphologies of galaxies. The rotating angular velocities of these spiral-barred galaxies are not currently matched by classifications. The purpose of this study was to reclassify spiral-barred galaxies and establish the correlation between the mass and radius of eighty-four spiral-barred galaxies and their rotating angular velocities. The software used to examine 84 spiral-barred galaxies is Math Lab, Visual Studio, and Python. Information from the National Aeronautics and Space Administration (NASA) and the Internet was utilized to calculate the rotating angular velocity, specific angular momentum, and angular momentum. A Python calculation tool was written using these parameter values and the rotating angular velocity formulae. The results were presented alongside data from the internet along with their units. Among the findings for rotational angular velocity produced for eighty-four spiral barred galaxies are Butterfly Nebula = 2 km/s and Black Eye = 1.17E+03 km/s. The polynomials of spiral-barred galaxies were shown to behave more abnormally in comparison to their groups at higher degrees. It was discovered that at degree one, polynomial groups A and C showed an increasing correlation with rotational angular velocity and mass based on grouped classifications of spiral barred galaxies. Groups B and D, on the other hand, showed a partial retrogressive correlation with mass and rotating angular velocity. In conclusion, the relationship between mass and rotating angular velocity is either nonexistent or very weak.

Index Terms- Spiral Barred Galaxies, Butterfly Nebula, Black eye, Galaxies, Spiral Galaxies

I. INTRODUCTION

A galaxy is defined by Roberts-Borsani et al. (2023) as a system of stars, dust, interstellar gas, stellar remnants, and dark matter that are all gravitationally bound. The word "galaxy" is derived from the Greek word "galaxies," which means "milky," and it alludes to the Milky Way galaxy, which contains the solar system. Galaxies range from dwarfs, which have fewer than 100 million stars, to the largest, known as "supergiant" galaxies, which have 100 trillion stars encircling their center of mass. Galaxies are thought to have 100 million stars. In a normal galaxy, dark matter makes up the majority of the material, with only a small fraction visible as stars and nebulae. Galaxy cores are home to a large number of supermassive black holes (O'Callaghan, 2022). In astronomy, galaxies are classified as irregular, spiral, or elliptical based on their visual shape. It is anticipated that the cores of some will contain supermassive black holes. At four million times the mass of the sun, Sagittarius A* is the Milky Way's core black hole. The observable universe is thought to include between 200 billion (2×1011) and 2 trillion galaxies. Most galaxies are between 1,000 and 100,000 parsecs (3,000 and 300,000 light years) in diameter, and they are separated by millions of parsecs (megaparsecs). For reference, the Milky Way has a diameter of at least 26,800 parsecs (87,400 light-years), and its closest major neighbor, the Andromeda galaxy, is around 152,000 light-years away. This thin gas is called the intergalactic space medium, and it fills the gap between galaxies. The density is typically less than one atom per cubic meter. Clusters, superclusters, and galactic groups are the gravitational organization of the majority of galaxies in the universe. The Milky Way is part of the local group, which also includes the Andromeda galaxy (Lauer et al., 2021). Members of the group are Virgo Superclusters. These connections are typically arranged into sheets and filaments surrounded by massive gaps in the large-scale structure of the universe. The Laniakea Superclusters encompass both the Virgo Superclusters and the Local Group. Galaxies were called spiral nebulae when they were first discovered by telescope. The majority of astronomers in the 18th and 19th centuries classified them as anagalactic nebulae or unresolved star clusters, even though their exact composition and nature were unknown. They were merely believed to be a part of the Milky Way. A few nearby bright galaxies, such as the Andromeda galaxy, began to be resolved into massive star clusters by larger telescope observations; however, the actual distances of these objects placed them far outside of the Milky Way based only on the number of stars and their apparent faintness (Bedregal et al., 2006). They were often called "island universes," a term that quickly became obsolete because the word "universe" suggests the entirety of reality. Instead, they were called galaxies (Adams & Laughlin 2006).

1.2 SPIRAL GALAXY

According to the universal rotation curve concept, spiral galaxies are similar to pinwheels in that most of their mass is contained in a roughly spherical halo of dark matter that extends beyond the visible component, even though the stars and other visible material are primarily on a plane (Kennicutt et al., 2005). A center bulge of older stars and a rotating disk of stars and interstellar space make up spiral galaxies. The bulge's outward-extending arms are fairly brilliant. Type S spiral galaxies are identified by a letter (a, b, or c) that denotes the magnitude of the central bulge and the tightness of the spiral arms. A spiral galaxy must always have a spiral appearance, regardless of whether it is barred or ringed (Knapen et al., 2002).

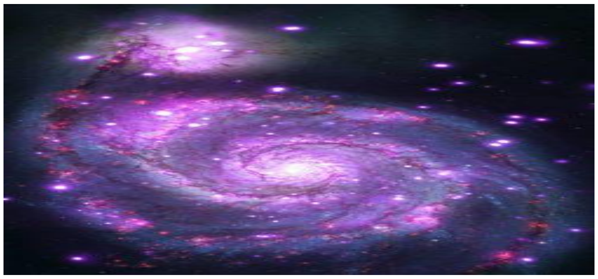

Plate 1: Spiral galaxy (NASA, 2019) (Wikipedia, 2023)

Plate 2: Spiral barred galaxy example The Pinwheel Galaxy (NGC 5457) (NASA 2019)

A Sa galaxy's arms are faintly defined and densely wrapped, and its center is very large. According to Kormendy and Ralf (2012), a Sc galaxy, on the other hand, has a tiny core region and open, clearly defined arms. In contrast to a grand design spiral galaxy, which has prominent and well-defined spiral arms, a flocculent spiral galaxy has weakly defined arms. With some spiral galaxies having large bulges and others being narrow and dense, it is hypothesized that the disc's flatness affects how quickly a galaxy rotates. A possible explanation for the roughly logarithmic spiral-like structure of spiral arms in spiral galaxies is that they are the result of a disturbance in a uniformly spinning stellar mass (Ekwubiri, 2026). Similar to the stars, the spiral arms revolve around the center, but their angular velocity is constant. The spiral arms are thought to be "density waves" or locations of materials with a high density. Each stellar system's space velocity is impacted by the gravitational pull of the increased density as stars pass through an arm. (Once the stars depart the opposite side of the arm, the velocity returns to normal.) A "wave" of slowdowns moving along a road with plenty of moving cars is comparable to this effect. Because of their great density, which encourages star formation and produces a large number of bright, young stars, the arms are observable (Koptelova & Hwang, 2022).

1.2.1 Spiral Barred Galaxy

A spiral galaxy with a bar-shaped nucleus loaded with stars is called a spiral barred galaxy. About two-thirds of all spiral galaxies in the local universe include bars, which typically have an impact on the motions of spiral arms as well as stars and interstellar gas within spiral galaxies (Massey, 2007). The Solar System is part of the Milky Way Galaxy, which is categorized as a barred spiral galaxy. In his Hubble sequence, Edwin Hubble classified spiral galaxies of this type as "SB" (spiral barred) and further classified them into subcategories based on the degree of openness of the spiral arms structure of the galaxy: While SBa types have tightly tied arms, SBc types have loosely bound arms. Between the SBa and SBc spiral-barred galaxies are the SBb-type galaxies. SBo is a lenticular galaxy with spiral bars. The Magellanic Clouds, which were formerly classified as irregular galaxies but have lately been found to have barred spiral components, are examples of somewhat irregular barred spirals that were later described by a second type known as the SBm (McKee, 2005). Hubble classified galaxies into three categories: irregular, elliptical, and spiral. An international research team using the James Webb Space Telescope published findings in Nature in November 2023 that a galaxy named centers-2112, formed shortly after the Big Bang, is a barred spiral, even though theoretical models of galaxy formation and evolution had not previously predicted galaxies to become stable enough to host bars so early in the universe's history (Ekwubiri and Aiyohuyin, 2026).

Plate 3: NGC 1300 (barred spiral galaxy) (NASA, 2019)

The barred spiral galaxy, IC 5201, is located around 40 million light-years from Earth. Research indicates that up to two-thirds of spiral galaxies generate bars. It is often believed that the bar was formed as a result of a density wave that originated from the galaxy's center and was caused by star clusters. These clusters alter the orbits of the inner stars (Alister et al., 2017). Over time, stars circling farther away experience this impact as well, creating a self-sustaining bar structure. By attracting gas inward from the spiral arms through orbital resonance and promoting star formation in its center, the bar structure is believed to serve as a stellar nursery. This method is thought to explain the presence of active galactic nuclei in many barred spiral galaxies, such as the Southern Pinwheel Galaxy. In spiral galaxies, bars are thought to be a temporary phenomenon that fades with time, transforming barred spirals into more "regular" spiral patterns (Adams et al., 2004). The total mass of the bar poses a threat to the overall stability of the bar construction after a certain size. According to simulations, many bars probably undergo a "buckling" event, which is an inward collapse where the bar is thicker and shorter as a result of a disruption in the orbital resonances of the stars in the bar structure. The precise mechanism underlying this buckling instability is still up for discussion, though. According to Kyu-Hyun et al., (2020), spiral-barred galaxies have short, stubby bars and a high mass concentration in their core. Such buckling processes indeed occur but are suppressed and delayed by the existence of a supermassive black hole in the galactic center. Bar formations are most likely a recurring event in spiral galaxy development because they are found in so many spiral galaxies. It is estimated that the oscillation evolutionary cycle from spiral galaxy to barred spiral galaxy will take two billion years on average. Bars show that galaxies are nearing full maturity as their "formative years" come to an end, according to recent research. Only 20% of spiral galaxies in the distant past had bars, according to 2008 research, although about 65% of their local counterparts did (McMillan, 2016).

Plate 4: IC 5201(Wikipedia 2023) (Wikipedia, 2023)

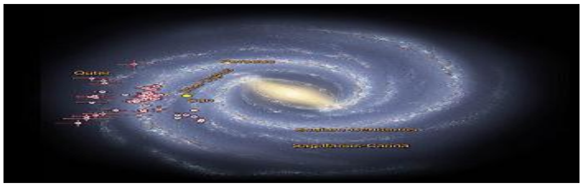

Plate 5: Milky Way Galaxy spiral arms (Wikipedia, 2023)

A linear, bar-shaped band of stars is present in the majority of spiral galaxies, including the Milky Way, and it extends outward to each side of the nucleus before blending into the spiral arm structure. These are denoted by an SB in the Hubble classification system, which is followed by a lower-case letter (a, b, or c) that describes the spiral arms' form (Alister et al., 2016). Bars are hypothesized to be transitory formations produced by a density wave radiating outward from the core or a tidal collision with another galaxy. Numerous spiral-barred galaxies are active, presumably due to gas flowing towards the center through the arms. The Milky Way is a massive disk-shaped spiral-barred galaxy with a diameter of 30 kiloparsecs and a thickness of 1 kiloparsec. It consists of about 200 billion (2×10^{11}) stars and has a total mass of 600 billion (6×10^{11}) times that of the Sun. The Super-luminous Spiral is a newly discovered galaxy with an upward diameter of 437,000 light-years (compared to the Milky Way's 87,400 light-year diameter). Because of its massive mass of 340 billion solar masses, this galaxy produces a lot of ultraviolet and mid-infrared radiation and is expected to have a star production rate that is about 30 times faster than the Milky Way (Mineo et al., 2012).

II. MATERIALS AND THEORY

The rotational velocities seen in spiral galaxies are thought to be perfectly fitted by the relativistic solution, which eliminates the need for extra interest. The following equation can be used to support this (Atkinson, 2022);

- Total Force in General Relativity is given as;

$$F_f(r) = -\frac{GM_2}{r^2} + \frac{L^2}{Mr^3} - \frac{3GML^2}{MC^2r^4} \qquad 2.1$$

Where the orbital angular momentum of the rest mass m is denoted by L and the position vector by r. The Newtonian gravitational force is represented by the first term in equation (1), the centrifugal force in a circular motion by the second term, and the Coriolis force by the third term.

- Rotational Velocity for Barred Spiral Galaxies

From Earth, the velocity of the gas and stars that make up the spiral galaxy should appear to be an almost uniform rotation of the galaxy. Equation (1) can be simplified to the common term by taking into account the Coriolis force (Cornejo, 2021).

$$F_c = \frac{3GM(mr^2\Omega)^2}{mc^2r^4} = \frac{3GMm\Omega^2}{c^2} \qquad 2.2$$

Compare the 2nd term of equation (1) with equation (2) we obtain

$$F_c = \frac{3GMm\Omega^2}{c^2} = \frac{L^2}{mr^3} \qquad 2.3$$

Simplifying the right-hand side of equation (3) by substituting $L^2 = (mr^2\Omega)^2$ into it to obtain;

$$F_c = \frac{3GMm\Omega^2}{c^2} = \frac{mV^2}{r} \qquad 2.4$$

Solving for V, which is the rotational angular velocity of a barred galaxy, we arrive at;

$$V = \left[\frac{3GMr\Omega^2}{c^2}\right]^{1/2} \qquad 2.5$$

Recall that $L^2 = (mr^2\Omega)^2$ 2.6

Considering equation (6), we can write that the angular momentum of a barred galaxy is

$$J = M_g r^2\,\Omega. \qquad 2.7$$

The specific angular momentum of the galaxy can be calculated from the angular momentum as;

$$j = \frac{J}{M_g} \qquad 2.8$$

$$j = r^2\Omega \qquad 2.9$$

We can re-write equation (7) by comparing it with equation (9) to obtain a new equation for angular momentum as;

$$J = M_g r^2\,\Omega = j\,M_g \qquad 2.10$$

We can derive the equation for angular velocity by making Ω the subject of the formula from equation (10) to obtain;

$$\Omega = \frac{J}{M_g r^2} \qquad \Omega = \text{Angular Velocity} \qquad 2.11$$

Deducing the equation for the rotational angular velocity of barred galaxies, we substitute the value of angular velocity as in equation (11) into equation (5) to obtain (Cornejo, 2020).

$$\mathrm{V} = \left[\frac{3GM_0 r}{c^2} \times \left(\frac{J}{M_g r^2}\right)^2\right]^{1/2} \qquad 2.12$$

$$\mathrm{V} = \left[\frac{3GM_0}{c^2} \times \frac{J^2}{{M_g}^2 r^3}\right]^{1/2} \qquad 2.13$$

Equation (8) can be re-written as; $J = j\,M_g$ 2.14

Put equation (14) into equation (13) to obtain;

$$\mathrm{V} = \left[\frac{3GM_0}{c^2} \times \frac{(jM_g)^2}{{M_g}^2 r^3}\right]^{1/2} \qquad 2.15$$

Further simplification of equation (15) will result to

$$\mathrm{V} = \left[\frac{3GM_0 j^2}{c^2 r^3}\right]^{1/2} \qquad 2.16$$

Equation (16) is the equation for the rotational angular velocity of barred galaxies, (Cornejo, 2021).

III. METHODOLOGY

Using information from the National Aeronautics and Space Administration (NASA) (NASA 2019) and the internet, the rotational angular velocity and other parameters were computed. The results for rotational angular velocity, specific angular momentum, and angular momentum were determined using other parameters. The letters in equation (16) correspond to spiral-barred galaxy parameters. Python was used to create a program for calculating the rotational angular velocity of spiral-barred galaxies because their parameters are too big to be computed using a plain calculator. Here is an example of a Python program:

```
#MILKY WAY GALAXY
#Estimation of the rotational angular velocity of a barred galaxy
g = 6.674*10**-11    #gravitational constant in meters cube per kilogram per seconds square
c = 3.00*10**5    #speed of light in kilometers per seconds
j = 9.4*10**5    #specific angular momentum in kilometers square per seconds
m = 2.0*10**12    #mass of Galaxy in solar mass
r = 39.5    #radius of galaxy in kiloparsec
v = (3*g*m*j**2/c**2*r**3)**1/2    #rotational angular velocity in kilometers per seconds print(v)
```

Using the MATLAB predictive modal, the computed values were tabulated and utilized to forecast the behavior of eighty-four (84) barred galaxies. To help reduce the risks associated with overpopulation, the population impact of the United States of America was predicted using the MATLAB predictive model known as the prediction of the United States population. An illustration of MATLAB syntax for forecasting and linking rotating angular velocity, mass, and radius is provided below:

```
% Mass
R = []';
% Rotational Angular Velocity
Rav = []';
% Plot
plot(M,Rav,'bo');
axis([9.2e-13 2e1 9.8e-8 2e4]);
title('Correlation between Rotational Angular Velocity and Radius');
ylabel('Rotational Angular Velocity');
xlabel('Mass');
p
n = length(t);
s = (t-8.5)/8.5;
A = zeros(n);
A(:,end) = 1;
for j = n-1:-1:1, A(:,j) = s.*A(:,j+1); end
c = A(:,n-3:n)\p
v = (9.2e-13:2e1)';
x = (v-8.5)/8.5;
w = (1.5e1-8.5)/8.5;
y = polyval(c,x);
z = polyval(c,w);
hold on
plot(v,y,'k-');
plot(1.5e1,z,'ks');
text(1.5e1,z+15,num2str(z));
hold off
c = A(:,n-4:n)\p;
y = polyval(c,x);
```

```
z = polyval(c,w);
hold on
plot(v,y,'k-');
plot(1.5e1,z,'ks');
text(1.5e1,z-15,num2str(z));
hold off
cla
plot(M,Rav,'bo'); hold on; axis([9.2e-13 2e1 9.8e-8
2e4]);
colors = hsv(8); labels = {'data'};
for d = 1:8
[Q,R] = qr(A(:,n-d:n));
R = R(1:d+1,:); Q = Q(:,1:d+1);
c = R\(Q'*p); % Same as c = A(:,n-d:n)\p;
y = polyval(c,x);
z = polyval(c,11);
plot(v,y,'color',colors(d,:));
labels{end+1} = ['degree = ' int2str(d)];
end
legend(labels,2)
```

The plots generated using MATLAB syntax as shown will be used in the discussion of this work.

IV. DISCUSSION

The "MATLAB" prediction model was used to create the results shown here. Eighty-four spiral-barred galaxies were extracted and studied, and their data is shown. The software was used to group these spiral-barred galaxies into A, B, C, and D based on best fit. This grouping was based on the relationship between the spiral-barred galaxy's mass and rotating angular velocity. Graphic appearance, or the interpretation of the data as it reflects the mass, radius, and rotating angular velocity of spiral barred galaxies, will be used to explain the plots.

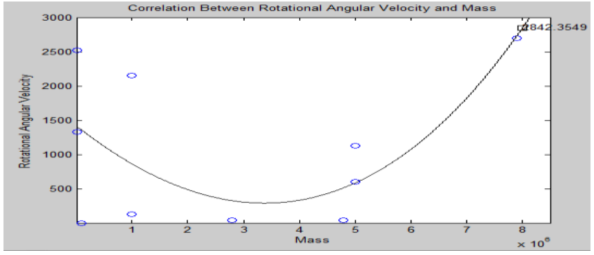

Fig. 4.1: Plot of 3rd–degree Polynomial of Rotational Angular Velocity against Mass of Group A Spiral Bared Galaxies.

The sample plot, which shows the gradual shift in the cosmos and the celestial bodies, exemplifies the universe's ongoing expansion by turning some of the barred galaxies into a quantized state. It is observed that black holes and dark energy undergo significant changes as the universe expands, gaining greater gravitational force that will continue to draw galaxies with weaker fields to themselves, ultimately ending their life. A celestial body's rotation speed can be greatly influenced by the distribution of mass within it. Because of its greater moment of inertia, a heavier item with the same angular momentum as a lighter object would typically rotate more slowly. On the other hand, the object may rotate more quickly and have a smaller moment of inertia if the mass is concentrated in the center. Therefore, the relationship between barred galaxies' mass and rotating angular velocity depends on their moment of inertia, which includes other gravitational interactions.

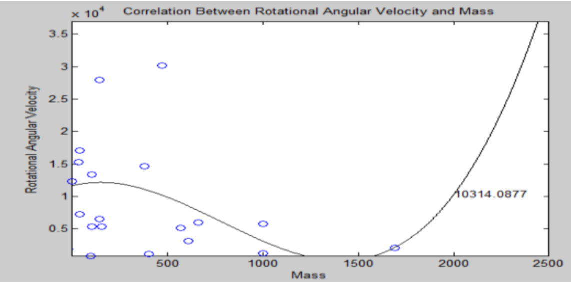

Fig. 4.2: Plot of 3rd–degree Polynomial of Rotational Angular Velocity against Mass of Group B Spiral Bared Galaxies

Some of the plots in the polynomial degree three (3) plot, as seen in Figure 4.2, were not observed experimentally. This could be due to model faults or anomalies in the mass and rotating angular velocity of the barred galaxies being studied. A semi-convex plot that began lower from the midway on the vertical axis and ended at the edge above the horizontal axis looked to be revised in Figure 6 of group B Spiral Barred Galaxies.

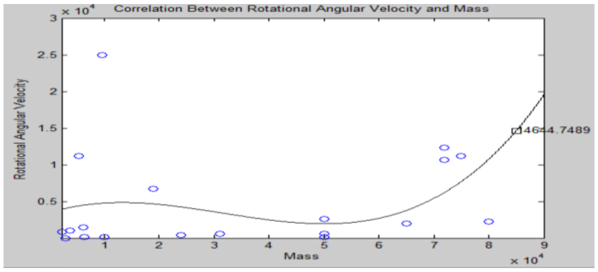

Fig. 4.3: Plot of 3rd–degree Polynomial of Rotational Angular Velocity against Mass of Group C Spiral Bared Galaxies

This polynomial plot of rotational angular velocity and mass is shown in Figure 4.3 of the third-degree polynomial. The plot look more of semi-convex shape, beginning from the vertical axis close to the origin and ending above the horizontal axis. Given their nearly identical plot forms, spiral galaxies at the third-degree polynomial level seemed to interact similarly with one another. An analytical explanation of the experiment's result is provided by the molded plot appearance. When objects are in their classical state, less massive objects move more quickly, whereas massive objects move more slowly. We may deduce from the plot sample that spiral-barred galaxies have an unequal increase in rotating angular velocity that happens in tandem with an increase in mass. The observed potholed relationship between the mass and rotational angular velocity of barred galaxies under investigation suggests that the relationship between the rotational angular velocity and the mass of spiral barred galaxies is patchy. It is also possible to observe that the spiral-barred galaxies in this area belong to different local groups or share different characteristics. Nonetheless, spiral-barred galaxies differ from one another while yet sharing some characteristics. By limiting this analysis to a few spiral-barred galaxies plotted in the sample above, we can infer that these galaxies share a rough relationship between mass and rotational angular velocity, which is more apparent at the fifth and sixth-degree polynomials of the individual spiral-barred galaxies

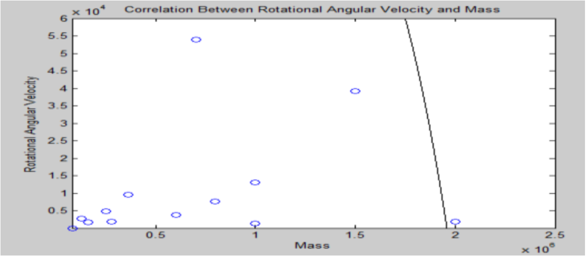

Fig. 8: Plot of 3rd–degree Polynomial of Rotational Angular Velocity against Mass of Group D Spiral Bared Galaxies

Plotting of polynomial degree 3 as seen in Figure 8 revealed that the plot was not observed experimentally. This can be attributed to either model flaws or aberrations related to the mass and rotational angular velocity of the barred galaxies being under investigation. Galaxies with the potential to combine or collapse can be inferred from the group D spiral-barred galaxies depicted above. Most of the plot is not visible in experiments, which may be due to flaws in the program used for this work or the behavior of group D spiral-barred galaxies, which can lead to galaxy mergers or collisions.

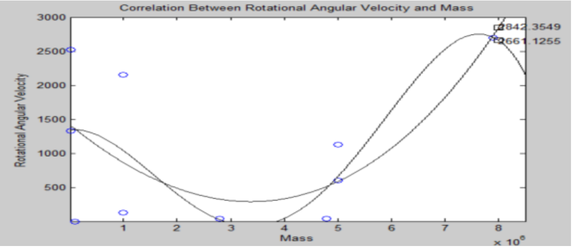

Fig. 9: Plot of 3rd and 4th degree Polynomial of Rotational Angular Velocity against Mass of Group A Spiral Bared Galaxies.

As seen in figure 9 of group A spiral barred galaxies, the mass of barred galaxies and their rotational angular velocity were plotted on the vertical and horizontal axes using a 4th power polynomial. This plot was more convex than a similar one using a 3rd degree polynomial, with a portion of the plot deviating from experimental observation. According to the plot above, spiral-barred galaxies' degree of disorderliness grew as their mass and rotating angular velocity increased in comparison to group A spiral-barred galaxies. For instance, the collapse of gas and dust clouds produces stars. As the cloud compresses, its rotation speed increases and its angular momentum is conserved. The star's ultimate rate of revolution will be accelerated by the cloud's initial mass and angular momentum. In galaxies, the relationship between mass and rotational angular velocity is more complex. Generally, the apparent mass (stars and gas) within galaxies cannot be used to explain the observed rotation curves of those galaxies. Dark matter, an intangible substance untouched by electromagnetic radiation, is thought to account for a significant portion of a galaxy's mass and to be crucial in determining the galaxy's rotational angular speed. In addition to the mass of visible matter, the distribution of dark matter affects the rotating angular speed and overall mass distribution of galaxies. In other words, the 4th power polynomial image indicates that there is only a slight correlation between the mass of barred galaxies and the spinning rotational velocity.

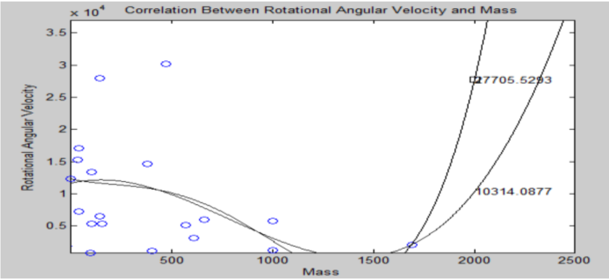

Fig. 10: Plot of 3rd and 4th degree Polynomial of Rotational Angular Velocity against Mass of Group B Spiral Bared Galaxies.

The plot began somewhere in the center of the vertical axis and ended on the other side of it. The plot of the group B spiral barred galaxies' third and fourth degree polynomials is shown in Figure 10. Similar to the third-degree polynomial plot, the plot seemed convex, with some plot lines vanishing from experimental view. Group B spiral barred galaxies have a similar relationship between their mass and rotating angular velocity at the third and fourth degree polynomials.

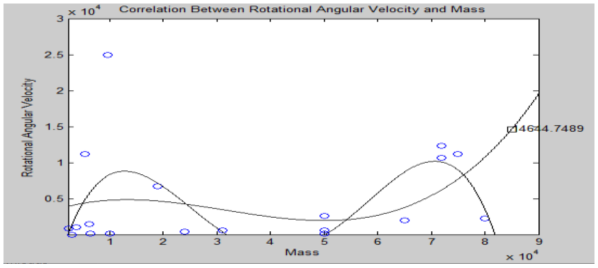

Fig. 11: Plot of 3rd and 4th degree Polynomial of Rotational Angular Velocity against Mass of Group C Spiral Bared Galaxies.

The plot of the group C spiral barred galaxies' third and fourth degree polynomials is shown in Figure 11. Group C Spiral Barred Galaxies behaved differently under polynomial degree four than the same group's third-degree polynomial. Due to their degree of ambiguity between the mass and rotating angular velocity of group C spiral barred galaxies, a portion of the plot of the degree four polynomial failed out of the experimental limit. Although some of the plot fails out of experimental supervision, the inconsistencies connected with group C spiral barred galaxies gave the 4th power degree polynomial a sinusoidal wave-like modus appearance.

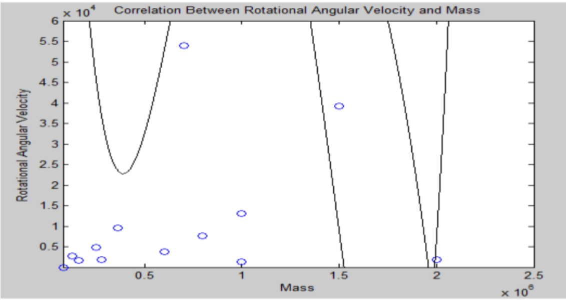

Fig. 12: Plot of 3rd and 4th degree Polynomial of Rotational Angular Velocity against Mass of Group D Spiral Bared Galaxies.

The third and fourth-degree polynomials of rotating angular velocity and mass of group D spiral barred galaxies are plotted in Figure 12. Due to the limitation linked with the Matlab model or the degree of irregularities associated with this collection of spiral-barred galaxies, most of the plot is outside the scope of experimental observation. Additionally, additional spiral-barred galaxies in other groups were plotted to the same degree, with varying outcomes. The conclusion is that this group's spiral-barred galaxies are not like those of other groupings. With these resolutions, it is possible to conclude that there is no trivial relationship between the mass of galaxies and their rotational angular velocity. It is clear from the degree of arbitrariness associated with the Figure 12 plot that group D spiral barred galaxies will show more gravitational contact with one another in terms of their mass and rotating angular velocity, which could result in a higher influence on galaxy merger or collision.

V. SUMMARY

We must evaluate the methods used to achieve the results in order to discuss this aspect of the work. The outcomes mentioned above were predicted using a MATLAB predictive model. Eighty-four (84) barred galaxies' rotational angular velocities were calculated using values for mass and other parameters that were taken from the internet. Because of the size of the values, the rotational angular velocity was estimated using the Kerr metric formula of relativistic solution and its associated equations in Python. The generated and sorted data were used to make predictions and find relationships between spiral barred galaxies' mass and rotating angular velocity. We can infer from the extrapolative fallouts that there was little to no link between the rotating angular velocity and mass. However, the fact remains that certain spiral barred galaxies exhibit peculiarities in their internal forces and how they interact with external gravitational forces in the cosmos. Values of the parameters found in the equations used to estimate physical quantities are data that has been retrieved and sorted from the internet. In order to anticipate the behaviors of barred galaxies with regard to their mass and rotating angular velocity, the primary study's rotational angular velocity values were calculated in conjunction with their mass and radius. The results were then rummaged through on the MATLAB prediction model. The data was separated into two sections for convenient access and analysis due to the size of the data being examined. A few of the fallouts are unoccupied and outside the experimental range of the MATLAB predictive model. There is little to no association between the rotating angular velocity and mass, according to the results of the MATLAB prediction model. Similar to a rigid body rotating around its axis, barred galaxies have an orbital velocity. The bar visible in barred galaxies is caused by abnormalities in the gasses and stars that approach black holes. These anomalies change the orbital velocities of these objects and cause them to shift their orbital rotation, which results in the bars seen in the middle region of barred galaxies. Strong gravitational forces called black holes exist in the universe and have the power to alter the motion of nearby bodies. While angular momentum between galaxies governs how they interact with one another, dark matter is the gravitational pull that keeps them in orbit. The linear velocity of barred galaxies is the product of the angular velocity and the radius, whereas the angular momentum of barred galaxies is the product of the mass, radius, and angular velocity. The linear velocity divided by the radius of the barred galaxies is known as the angular velocity. Thus, the gyratory angular velocity and the barred galaxies' radius do not directly correlate; rather, the revolving angular velocity is the opposite of the barred galaxies' radius. As the inverse of the product of mass and radius of barred galaxies, the rotating angular velocity is the ratio of angular momentum to the product of mass and radius. It is mathematically impossible to establish a direct correlation between barred galaxies' mass and their orbital angular velocities. The angular momentum, which results from the interactions between the internal and external gravitational forces that exist within barred galaxies and their surroundings, is the decisive factor for the behavioral characteristics—whether they are anomalous or typical that are observed in these galaxies. Rotational angular velocities thus vary according to the angular momentum established within its orbital axis of rotation.

VI. CONCLUSION

It's really interesting to prove that barred galaxies are different from one another. The features of the local groups of galaxies vary, yet they are unique in their orbital states and structures. Their gravitational interactions with other galaxies, dark matter, gravitational attraction, and angular momentum are all examples of the unitary nature of barred galaxies. The external and internal gravitational forces that exist between galaxies are the sources of gravitational interactions; similarly, the gravitational pull is the force that attracts galaxies with high angular momentum to those with low angular momentum.

There is a direct or indirect gravitational pull between galaxies as a result of the dark matter force of gravity holding them in their axis of orbit. The force of revolving gases and stars within barred galaxies interact internally to produce the angular momentum of these galaxies. Large or robust galaxies tend to be more venerable than galaxies with weaker or lower angular momentum. While galaxies with nearly or the same angular momentum merge together, swishing and fraternization occur in the two situations described. Galaxies with scrawnier angular momentum are eaten by galaxies with strong angular momentum. While the mass of barred galaxies is a function of their orbital angular momentum, the rotational angular velocities of barred galaxies have little to no effect on their mass. Instead, other factors, such as the gravitational forces and angular momentum that occur in them, determine their correlations with angular velocities and masses of barred galaxies. It was determined from the correlation coefficient estimation that there is either no direct relationship or a weak one between rotational angular velocity and mass.

VII. RECOMMENDATION

The study of barred galaxies and their skirts is an incessant process as such deliberations and crucial courtesies should be considered on the following points. Firstly, the correlation between the rotational angular velocity and the orbital angular momentum of barred galaxies and other galaxies. Secondly, the correction between orbital angular momentum and the radius of galaxies (Spiral barred galaxies), and thirdly, the correlation between the specific angular momentum and angular momentum of galaxies (Spiral barred galaxies).

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