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Modification of the Sixth-Degree Polynomial of Rotational Angular Velocity and Mass of Some Spiral Barred Galaxies

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Abstract- ***This work explores the intricate connection between the sixth polynomial of rotational velocity and the mass of particular spiral-barred galaxies. Using a comprehensive reworking of existing data and theoretical models, I aim to shed light on the dynamics behind these cosmic structures. Using complex MATLAB polynomial fitting techniques, the rotational curves of several galaxies were examined to assess the effect of their mass distributions on rotational angular velocity profiles. To better understand the spiral-barred galaxies under study, the data set was refined using Python to convert it to the appropriate units and then tabulated, which was utilized to construct MATLAB syntax. It was reviewed that there was a considerable correlation between the polynomial coefficients and the galaxies' morphological classifications, suggesting that the structural elements of spiral-barred galaxies have a significant impact on their rotational dynamics. The importance of polynomial representations in astrophysical modeling is highlighted in this work, which contributes to our understanding of galaxy formation and evolution. These spiral barred galaxies' mass and rotating angular velocity were analyzed, and it was shown that there are various interactions between the two variables at various polynomial degrees. Lastly, several spiral barred galaxies showed some link at degree one polynomial, but at another degree polynomial, there is no correlation between mass and rotating angular velocity at different reclassification groups.***

Index Terms- ***Barred spiral galaxies, sixth-degree polynomial, Rotational angular velocity, Mass, and Data.***

I. INTRODUCTION

Among the universe's most aesthetically pleasing and dynamically fascinating features are spiral barred galaxies. Both their general mass distribution and stellar dynamics are influenced by their distinctive morphology, which is typified by a core bar-shaped structure. To further our understanding of galaxy creation and evolution, it is essential to comprehend the link between mass and rotating angular velocity in these galaxies. The sixth polynomial representation of rotating angular velocity about the mass of particular spiral-barred galaxies is the main subject of this investigation (Adams et al., 2004). Intersections of cosmology, mathematics, and astrophysics are fascinating in the study of spiral-barred galaxies. Different from other spiral galaxies, these galaxies are distinguished by their distinctive dynamical tendencies and their remarkable bar-shaped structures that radiate from their center regions. To reveal the fundamental physics governing the development and evolution of complex systems, it is essential to comprehend the link between mass and rotational angular velocity. A key concept in galactic dynamics is rotational angular velocity, which describes the motion of various galaxy regions around the center of the galaxy. It is possible to acquire important insights into the mass distribution and the gravitational forces at work by analyzing rotational curve graphs that plot rotational velocity against distance from the galactic center. Historically, a variety of mathematical techniques have been used to model these curves, with polynomial functions being useful for encapsulating the non-linear interactions present in galactic structures (Adams & Laughlin, 2006). The application of the sixth polynomial of rotational angular velocity to a particular subset of spiral-barred galaxies is the main subject of this investigation. A versatile foundation for a thorough depiction of the intricate relationships between mass and angular velocity is provided by the sixth polynomial. Our goal is to find trends and connections in a sample of spiral-barred galaxies that will help us better understand their behavior. The main hypothesis of this study is that spiral barred galaxies' morphological characteristics have a major impact on their rotational dynamics. Different rotational profiles result from the distribution of mass and angular momentum being altered by the presence of a central bar. In this context, we revisit the sixth polynomial representation in an attempt to clarify how these structural features appear in the kinematic behaviors of the galaxies. The ultimate goal of this research is to advance the conversation on galaxy formation and development while also improving the models of galactic dynamics that are currently in use. By combining cutting-edge mathematical methods with observational data, we intend to clarify the complex relationship between structure and dynamics in spiral-barred galaxies and open the door for more investigation in this exciting area of study (Alard, 2001).

II. BACKGROUND STUDY

2.1 Galactic Dynamics and Angular Velocity

The mobility of stars and gas within galaxies is studied by galactic dynamics. Since it represents the speed at which various components of a galaxy revolve around its core, rotational angular velocity is a crucial quantity in this context. Historically, many mathematical models, such as polynomial functions, have been used to evaluate the rotational curves of galaxies. A detailed depiction of the non-linear relationships contained in galactic structures is made possible by the sixth polynomial in particular (Alister et al., 2016).

2.1.1 Galaxy Rotation Curve

It is implied from the galaxies' spin that mass and radius are growing quickly. In spiral galaxies, we expect the galaxies to revolve more slowly in their outer regions than what we measure if we merely consider the masses of the stars we observe. Additionally, the gas in the galaxies provides a check on the spin (Graham et al., 2017). Because the gas disk of a galaxy is more widely distributed than the stellar disk, astronomers can measure the mass distribution of a galaxy to greater radii than they can with just stars. We continue to see that the gas's rotation speed remains constant in the distant, outer regions of spiral galaxies. In other words, even in the outer regions of the galaxy where we cannot see any stars, there is still extra mass that increases linearly with distance from the galaxy center. Astronomers have been perplexed by this outcome for ages (Atkinson, 2022).

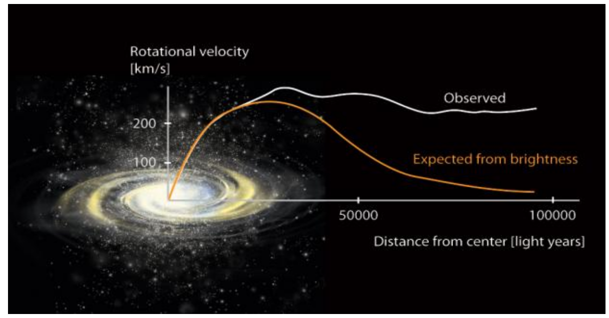

Plate 1: Rotation curve of a galaxy (Wikipedia, 2025)

The image of a galaxy's rotation curve is displayed in Plate 1 above. Based on the brightness of the galaxy, the orange curve displays the expected rotation curve of the galaxy. However, this is the rotation curve that we would anticipate if stars accounted for the majority of the galaxies mass. Through direct measurements of the motion of the galaxy's gas and stars, the white curve displays the measured rotation curve of the galaxy. The two curves differ significantly, and it appears that the galaxy rotation curves' forms conflict with the galaxies' light distribution (Baba et al., 2016). More mass may exist than is visible to us in the form of stars or even gas, according to the motions of gas and stars. In the inner regions of galaxies, where the main disk of stars is found, the difference is around a factor of two. In the outer regions, where we can only utilize the gas disk as a probe, it increases by up to a factor of 10. The discrepancy between the apparent mass and the mass derived from gas and star motion was originally labeled (Balazs et al., 2015). It should be noted that dark matter is the substance that creates these perplexing rotation curves in a galaxy or other system, but does not emit or absorb any light. We can detect it because of its mass and gravitational effects. A disc galaxy's rotation curve, also known as a velocity curve, is a representation of the orbital velocities of its gas or stars according to their radial distance from the galaxy's center. The data seen from either side of a spiral galaxy are frequently asymmetric; the curve is created by averaging the data from each side. It is usually shown graphically as a plot. There is a notable difference between a curve obtained by applying gravity theory to the

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matter observed in a galaxy and the experimental curves observed. The primary hypothesized explanations for the variance are dark matter theories (Fredy et al., 2019). The principles governing the rotational speeds of other orbital systems, such as stars and planets or planets and moons, which contain the majority of their mass at the center, do not apply to galaxies or stars. Over a wide range of distances, stars orbit the center of their galaxy at a speed that is equal to or faster than before. By contrast, Kepler's third law states that the orbital velocities of planets in planetary systems and moons orbiting planets decrease with distance. The mass distributions within those systems are reflected in this. The velocity findings cannot be explained by the mass estimates of galaxies based on the light they emit, which are much too low. The difference between observable galaxy rotation curves and the theoretical prediction, which assumes a centrally dominated mass associated with the observed bright material, is known as the galaxy rotation problem (Savorgnan & Graham, 2016). The masses determined from the observed rotation curves and the law of gravity do not match the mass profiles of galaxies that are computed from the distribution of stars in spirals and mass-to-light ratios in the stellar disks. The existence of dark matter and its assumed dispersion from the galaxy's center out to its halo provide an answer to this puzzle. Thus, the addition of a dark matter halo around the galaxy can explain the difference between the two curves. With differing degrees of success, numerous theories have been put out to explain the rotation problem, but dark matter is by far the most widely accepted. One of the most prominent of the potential substitutes is modified Newtonian dynamics (MOND), which entails altering the laws of gravity (Ekwubiri & Said, 2015).

2.1.2 Measurement of Rotation Curves Of Galaxies

As we can observe here, spiral-barred galaxies, like the Milky Way Galaxy, are massive systems that usually consist of three separate parts. The first is the flat disk, which is most noticeable when we see these galaxies in visible light and is made up of stars, gas, and dust. The fact that it is referred to as the disk component won't surprise you. The second element is the bulge, sometimes known as the central bulge, which is a sphere-shaped group of stars close to the galaxy center. The halo is a significantly larger sphere-shaped group of stars and star clusters that extends at least as far as the disk. There are fewer stars in the halo than in the disk or bulge, despite the halo's far greater area than the latter. The galaxy halos are almost invisible due to the extremely low number of stars. The tendency is for us to ignore them. The gravitational pull that all of the materials in the galaxy have on one another holds all of this together (Graham et al., 2015)

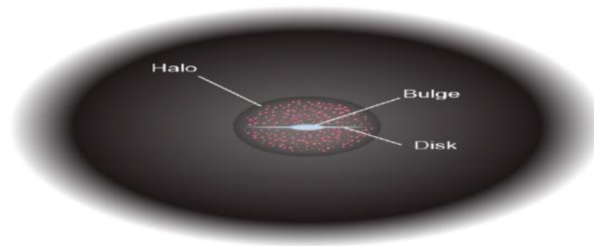

Plate 2: Distinct component of Milky Way Galaxy (Wikipedia, 2025)

Due to the fact that spiral galaxies' disks and bulges are significantly brighter than their halos, we are able to determine the orbital speeds of the gas and stars in those spiral barred galaxy components. Spiral galaxies' disks include gas and stars that have a tendency to revolve around the galaxy's core. The rotation of the galaxy cannot be observed if it is "face-on" from the viewpoint point (Ekwubiri & Aiyohuyin, 2026). However, redshift and blue shift can be used to measure the rotation if the galaxy is "edge-on." On the redshift side of the galaxy that is rotating away from us, an edge-on, revolving spiral-barred galaxy will be visible. Its light will appear "stretched out," with a longer arm and inflammatory wavelengths. As seen in plate 2 below, blue shift will be seen on the side of the galaxy that is rotating in our direction. The light will appear "squeezed" and have shorter, bluer wavelengths (Groshong, 2006).


Plate 3: Rotation of Spiral galaxy showing face on and edge on measurement (Wikipedia, 2025).

We can only estimate the actual redshift and blue shift in a rotating galaxy by capturing a spectrum since they are so tiny. Bright stars are found in large numbers throughout a galaxy. We are able to measure stellar movements for relatively close galaxies. But in a spiral-barred galaxy, gas is also dispersed throughout the disk. Both a brilliant emission spectrum at certain optical wavelengths and bright emission at a specific radio wavelength (21 cm) are provided by this gas. The gas in a spiral galaxy produces more light at these wavelengths than stars do. Additionally, we will have measurements that can provide information about the motions of the gas at various radii from the galaxy's center if we take spectra at various distances from the galaxy's center (Howell & Harvey, 2022). This can be accomplished by covering the galaxy with a slit that excludes all light other than that from a narrow strip running the length of the galaxy. For nearby galaxies, astronomers must take many individual measurements if they want to make a complete rotation curve or velocity-distance plot. Nearby galaxies are fairly large in the sky, often larger than the field of view of a telescope. It is impossible to see them in their entirety with a single exposure due to their enormous seeming size. Rather, distinct observations must be taken at various distances from the galaxy's core throughout the galaxy. This process takes a lot of time. Motions in distant galaxies are easier to measure, which may be counterintuitive. When a galaxy is distant enough to lie completely within the telescope/camera field of view, then a spectrograph slit can be laid down to coincide with the long axis of the galaxy, allowing a complete map of velocities for the entire length of the system to be collected at once (Hu *et al.,* 2002).

2.2 Morphology of Spiral Barred Galaxies Classification

The kinematics of spiral barred galaxies, like the Milky Way, are influenced by unique features. The presence of a central bar can change the distribution of mass and angular momentum, resulting in complex dynamical behaviors. A thorough understanding of galactic evolution requires an understanding of how this morphology affects rotational dynamics (Joachim *et al.,* 2017).

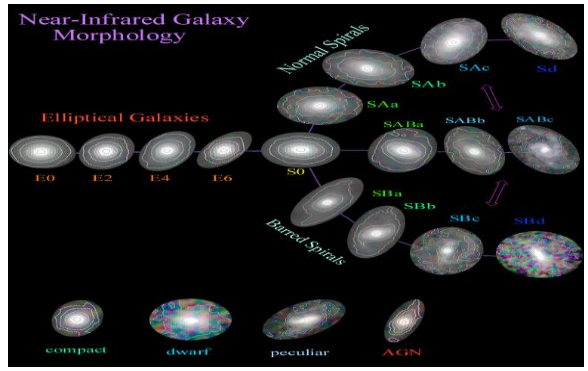

Plate 4: Morphological classification of the spiral barred galaxy (Wikipedia, 2025)

Astronomers utilize the morphological classification system to categorize galaxies according to how they appear to the naked eye. Galaxies can be categorized using a variety of schemes based on their morphologies; the most well-known of these is the Hubble sequence, which was developed by Edwin Hubble and subsequently extended by Gerard de Vaucouleurs and Allan Sandage. However, galaxy classification and morphology are now largely done using computational methods and physical morphology. The Hubble sequence is a morphological classification scheme for galaxies invented by Edwin Hubble in 1926. It is often known colloquially as the “Hubble tuning fork” because of the shape in which it is traditionally represented. Hubble's approach classifies galaxies into three broad groupings based on their optical appearance (Jarrett, 2012).

- Elliptical galaxies appear as ellipses in pictures and have smooth, featureless light distributions. To indicate their degree of ellipticity on the sky, they are represented by the letter "E" followed by an integer n. The ratio between the major (a) and minor (b) axes determines the specific ellipticity rating.
- The components of spiral galaxies are a flattened disk with stars forming a spiral structure, usually with two arms, and a bulge, or central concentration of stars that resembles an elliptical galaxy. "S" is the symbol assigned to them. It is also observed that about half of all spirals have a bar-like structure that extends from the central bulge; these spirals are designated "SB."

- The designation "S0" designates lenticular galaxies, which have a bright central bulge encircled by an extended disk-like structure. In contrast to spiral galaxies, lenticular galaxies' disks do not appear to have a spiral structure and are actively forming stars in any appreciable quantity (Karachentsev *et al.,* 2022).

These general divisions can be expanded to allow for more detailed differences in appearance and to include additional kinds of galaxies, notably irregular galaxies, which lack a clear regular structure (ellipsoidal or disk-like). The Hubble sequence is frequently depicted as a two-pronged fork, with the barred and unbarred spirals forming the two parallel prongs of the fork on the right and the ellipticals on the left (the degree of ellipticity rising from left to right). Lenticular galaxies are positioned at the intersection of the two prongs and the "handle," between the spirals and the ellipticals. In both amateur and professional astronomy, the Hubble sequence is the most widely used classification scheme for galaxies. Hubble's fundamental classification of galaxies into ellipticals, lenticulars, spirals, and irregulars is still present in the de Vaucouleurs system. De Vaucouleurs developed a more complex classification system for spiral galaxies based on three morphological traits, which include (Karen, 2003), in order to supplement Hubble's scheme.

- Bars Galaxies are classified according on whether or not they have a nuclear bar. In addition to Hubble's use of SB for barred spirals, De Vaucouleurs created the notation SA to represent spiral galaxies without bars. Additionally, he permitted an intermediate class with weakly barred spirals, known as SAB. Lenticular galaxies are also categorized as barred (SB0) or unbarred (SA0). The notation S0 is designated for galaxies that are edge-on to the line-of-sight, making it impossible to determine whether a bar is present or not (Karen, 2003).
- Rings Galaxies are classified as either having ring-like structures (designated by "(r)") or not (designated by "(s)"). The sign for so-called "transition" galaxies is (rs).
- The tightness of spiral arms is the primary criterion used to classify spiral galaxies. Hubble's tuning fork's arms are extended by the de Vaucouleur's plan to encompass several more spiral classes:
  - Sd (SBd): relatively weak core bulge; scattered, fractured arms composed of separate star clusters and nebulae
  - Im: a very irregular galaxy; Sm (SBm): irregular in appearance; no bulge component (Balazs *et al.,* 2015).

In Hubble's initial approach, the majority of galaxies in these three classifications were categorized as Irr I. Additionally, some galaxies from Hubble's Sc class are found in the Sd class. Following the Magellanic Cloud, galaxies in the classifications Sm and Im are referred to as "Magellanic" spirals and irregulars, respectively. The Small Magellanic Cloud is irregular (Im), whereas the Large Magellanic Cloud is of type SBm. The whole classification of a galaxy is obtained by combining the various components of the classification scheme in the order that they are mentioned. SAB(r)c, for instance, is a weakly barred spiral galaxy with a ring and arms that are loosely wrapped. With stage (spirals) on the x-axis, family (barrenness) on the y-axis, and variety (redness) on the z-axis, the de Vaucouleurs system can be visually depicted as a three-dimensional version of Hubble's tuning fork (Keck, 2015).

III. MATERIALS AND METHOD

The qualitative research analysis method is adopted in this article to understand and describe the data generated from the internet. Descriptions and interpretations were carried out based on the graphical representation of the data compiled in a tabular manner.

3.1 Materials

A methodical methodology is used in this study to examine the rotational curves of a number of spiral-barred galaxies. Galaxies with well-defined mass distributions are the focus of the compilation of data from astronomical surveys and earlier research.

Polynomial coefficients that describe the connection between angular velocity and mass can be extracted by fitting the rotational velocities to a sixth polynomial model (Keel, 2006).

1. Data Collection: Astronomical databases are used to compile an extensive dataset of spiral barred galaxies, which includes information on their mass distributions and rotational velocity profiles.
2. Polynomial Fitting: The link between mass and rotating angular velocity is modeled using the sixth polynomial. To assess the importance of the coefficients and their relationship to morphological traits, statistical analysis is incorporated into the fitting process.
3. Analysis: To find patterns and connections between the polynomial coefficients and the mass distributions of the galaxies, the data are examined (Whitt, 2022).

3.2 Methodology

The National Aeronautics and Space Administration (NASA), Wikipedia, and an online encyclopedia were the sources of the statistics employed in the computational analysis in this thesis. Eighty-four (84) spiral barred galaxies were the subject of the data collection. Mass, velocity, radius, speed of light, and gravitational constant values were gathered. The angular momentum, specific angular momentum, and rotational angular momentum were estimated using these values, as shown in the equations above. According to the amounts determined using "Python," it became necessary to convert the parameter values used for the computation from light-years/kiloparsec and solar mass to kilometers per second, kilograms, and other units. An example Python program for the conversion is:

(1)

```
#MILKY WAY GALAXY
#Estimation of the rotational velocity of a barred galaxy
g = 6.674*10**-11   #gravitational constant in meters cube per kilogram per seconds square
c = 3.00*10**8      #speed of light in meters per second
j = 5.40*10**47     #specific angular momentum in meters square per seconds
m = 2.57*10**42     #mass of Galaxy in kilogram
r = 9.50*10**20     #radius of galaxy in meters
v = (3*g*m*j**2/c**2*r**3)**1/2     #rotational velocity in meters per seconds
print(v)
```

(2)

```
#ANDROMEDA GALAXY
#Estimation of the rotational velocity of a barred galaxy
g = 6.674*10**-11   #gravitational constant in meters cube per kilogram per seconds square
c = 3.00*10**8      #speed of light in meters per second
j = -3.27*10**47    #specific angular momentum in meters square per seconds
m = 3.98*10**42     #mass of galaxy in kilogram
r = 1.04*10**21     #radius of galaxy in meters
v = (3*g*m*j**2/c**2*r**3)**1/2     #rotational velocity in meters per seconds
print(v)
```

Using the MATLAB predictive model, the computed values were collated as presented in Table 2 and utilized to forecast the behavior of eighty-four (84) spiral barred galaxies. To help reduce the risks connected with overpopulation, the population effect of the United States of America was predicted using a MATLAB predictive model named the prediction of the United States population. To determine how the galaxies behaved over time, a "MATLAB" prediction model was used to assess the correlation between the rotational angular velocity and the radius and, subsequently, the rotational angular velocity and the mass for different polynomial degrees. The syntax generated with MATLAB used to plot the graph discussed is:

```
% Radius
R = []';
% Rotational Angular Velocity
Rav = []';
% Plot
plot(R,Rav,'bo');
axis([9.2e-13 2e1 9.8e-8 2e4]);
title('Correlation between Rotational Angular Velocity and Radius');
ylabel('Rotational Angular Velocity');
xlabel('Radius');
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(R,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 results generated from the plots is discussed below.

IV. RESULTS AND DISCUSSION

The "MATLAB" prediction model was used to create the results. Eighty-four spiral-barred galaxies were extracted and studied, and their data is shown. Based on best fit, the software was used to group these spiral barred galaxies into A, B, C, and D. 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.

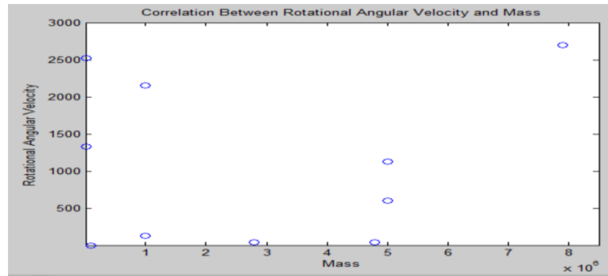

Fig. 1: Rotational Angular Velocity Plot against Mass of Group A Spiral Barred Galaxies

The galaxies shown here are the result of some galaxies having very similar mass and rotational angular velocity, even if they are located at different latitudes and altitudes. Considering the mass (m) of an object circling a circle of radius (r) with a tangential velocity (v). The object's angular momentum will be expressed using the formula L = mrʋ̈. The relationship between linear velocity and angular velocity, which can be expressed in equation form as $\upsilon = r\varpi$, must be taken into consideration to demonstrate the equation of the relationship between an object's mass, angular momentum, and angular velocity. This equation can be solved using the formula $m = L/r^2\varpi$. The mass of a barred galaxy is directly connected to its angular momentum and inversely correlated with the product of its rotational angular velocity and radius. Rotational angular velocity and the mass and radius of a spiral-barred galaxy will therefore always be weakly related. Increasing the spinning rotational velocity has no substantial effect on the masses of barred galaxies.

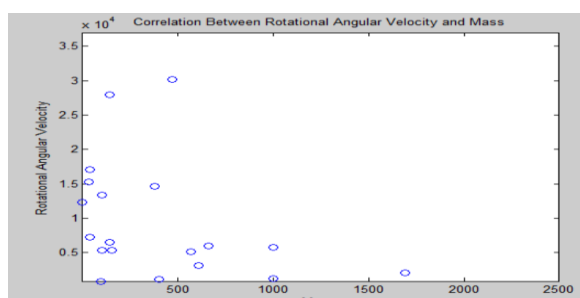

Fig. 2: Rotational Angular Velocity Plot against Mass of Group B Spiral Barred Galaxies.

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There is no guarantee that a galaxy with minimal mass will have a high rotational angular velocity. The pace at which spiral-barred galaxies rotate is determined by the acceleration force exerted on them, regardless of their mass. Regardless of their size, barred galaxies tend to revolve about the orbital axis; gravity is the decisive force. Although the barred galaxies under study have comparable masses, there is a minor difference in their rotational angular velocities. In contrast, the conservation of momentum is what we mean when we talk about the conservation of angular momentum. This may indicate that the spinning angular velocity is directly related to the angular momentum and inversely proportional to the mass and the square of the radius of the barred galaxies. A portion of the gravitational force that exists within the celestial bodies is caused by the fact that all mass-containing objects, such as our Earth and other galaxies, actually bend and curve space-time, the fabric of the cosmos.

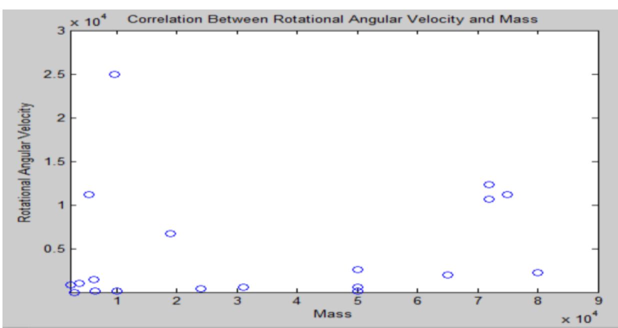

Fig. 3: Rotational Angular Velocity Plot against Mass of Group C Spiral Barred Galaxies

The mass of the galaxies and their rotational angular velocity were used to group them. Each galaxy's occupants' position and distance from the others in space are indicated by the plots' spacing and placement inside the experimental limit. Mass on the horizontal axis and rotational angular velocity on the vertical axis served as the basis for the plots. Higher rotating angular velocity has no major effect on the masses of barred galaxies, while other factors such as gravity and angular momentum are responsible for mergers and collisions between galaxies.

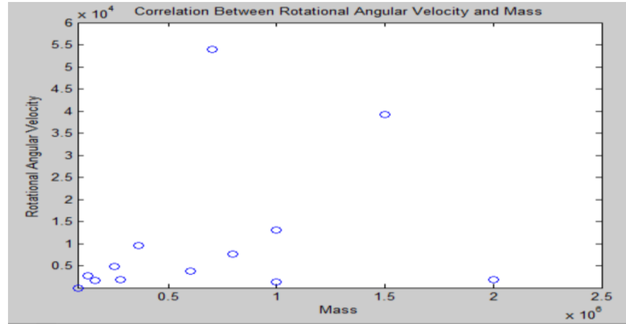

Fig. 4: Rotational Angular Velocity Plot against Mass of Group D Spiral Barred Galaxies

The reason for the clusters of galaxies observed here is that, despite their varying latitudes and altitudes, some galaxies have comparable masses and rotational angular velocities. A low-mass galaxy does not necessarily have a high angular velocity of rotation. Regardless of their mass, spiral-barred galaxies rotate at a certain speed due to the force of acceleration pressing on them. We can conclude that some barred galaxies have a slight association between rotating angular velocity and mass, while others do not exhibit any linear correlation. The gravitational forces associated with spiral-barred galaxies, such as black holes and dark matter, are responsible for the fluctuations in the correlations between rotating angular velocity and mass. As the universe gets bigger, all of these forces get stronger.

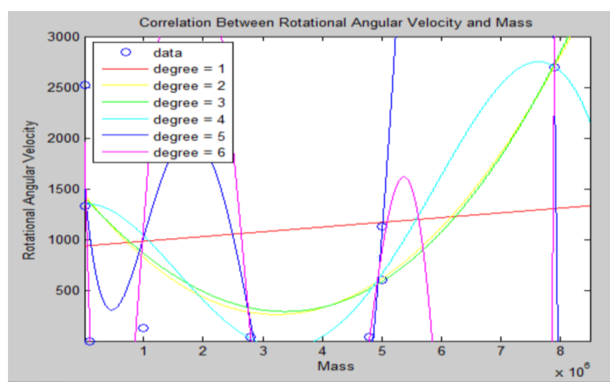

Fig. 5: Polynomial Degrees Plot of Rotational Angular Velocity against Mass of Group A Spiral Bared Galaxies.

While polynomial degrees five and six reviewed unrestricted random plot lines on the vertical and horizontal axes, with some parts appearing outside experimental observations, the plot in Figure 5 is slightly progressive and linearly correlates between the mass of group A spiral barred galaxies and the rotational angular velocity. While the degree two polynomial plot of rotating angular velocity and mass of group A spiral barred galaxies is nearly identical to the third and fourth-degree polynomial plots of the same group A, the plot lines for the third and fourth-degree polynomials have already been examined. Dark energy is believed to be the cause of the acceleration of the expansion of the universe since it offers a constant outward push that does not decrease with cosmic expansion. This relentless pressure is eroded by the gravitational pull of the universe's remaining matter and energy. Gravity is a long-range force that has the potential to bring mass-containing objects together over vast distances to form stars, galaxies, and planetary material. These things all result from the initial conglomeration of atoms and ions into huge gas clouds, which in turn causes the mass of spiral-barred galaxies to change their spinning rotational velocity. Divergent spiral-barred galaxies have their own idiosyncrasies and associative forces of contact with other things that coexist with them in the universe, which is why their mass and rotational angular velocity are generally inconsistent.

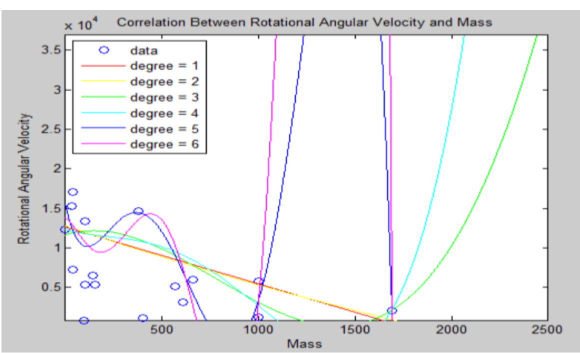

Fig. 6: Polynomial Degrees Plot of Rotational Angular Velocity against Mass of Group B Spiral Bared Galaxies.

The variables associated with group B spiral barred galaxies were evaluated in relation to the degree functions by plotting the mass and polynomial degrees of rotating angular velocity in Figure 6 above. In contrast, as the mass grows from the center of the plot's vertical axis toward its horizontal axis, the rotating angular velocity in the degree two polynomial progressively diminishes until it disappears beyond the experimental perimeter. Degrees five and six showed more chaotic activity, and some of the narrative lines seemed to have failed beyond the plot frontier.

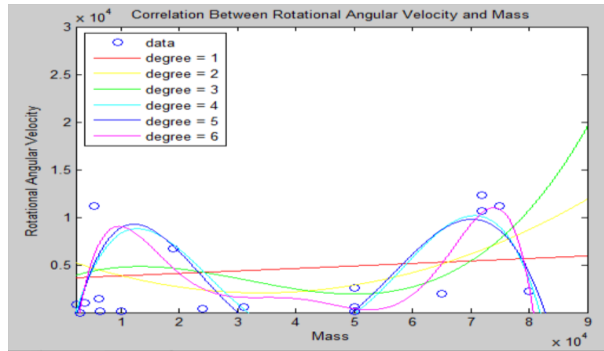

Fig. 7: Polynomial Degrees Plot of Rotational Angular Velocity against Mass of Group C Spiral Bared Galaxies.

The polynomial plot of mass and rotational angular velocity for group C spiral barred galaxies is shown in Figure 7. The mass and rotational angular velocity of group C spiral barred galaxies exhibit a progressive linear relationship within a degree one polynomial. Group C spiral barred galaxies were observed to have a sinusoidal wave-like pattern at the sixth, fifth, and fourth power polynomials, with a portion of the fifth and fourth power polynomials failing out of experimental observation. The polynomial plots of degrees two and three had a convex appearance. The Group C spiral barred galaxies are not as unpredictable as the Group B spiral barred galaxies. Spiral-barred galaxies that are part of the same local cluster and those that do not exhibit distinct features indicate that they are all different from one another. The peccadillos related to rotating angular velocity and mass were clarified by the polynomial plot, which revealed no association between them. A somewhat progressive trend down the degree two polynomial plot's horizontal axis suggests that the mass and rotating angular velocity of galaxies in this group are correlated.

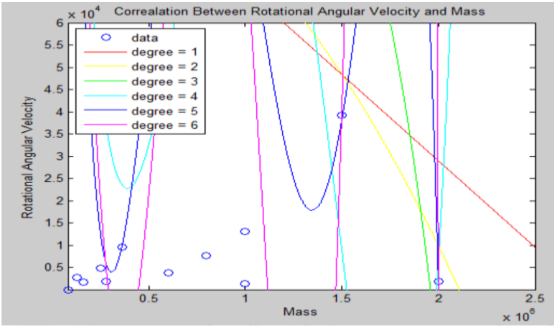

Fig. 8: Polynomial Degrees Plot of Rotational Angular Velocity against Mass of Group D Spiral Bared Galaxies.

The rotational angular velocity and mass of group D spiral barred galaxies exhibit a sudden linear correlation in Figure 8, where the rotational angular velocity gradually decreases from the plot box's center on the horizontal axis as the mass of these galaxies increases. The graphic above illustrates the degree of improbability with degree two, degree three, degree four, degree five, and degree six polynomials occurring more randomly within the plot. This indicates that galaxies in group D that are spiral-barred may now merge or crash with other galaxies in the vicinity. Based on the MATLAB predictive model used to investigate this scheme, we can conclude that the mass of spiral barred galaxies of all local groups is weakly correlated with their rotational angular velocities. This is because each barred galaxy has peculiar characteristics that set it apart from other galaxies, including different ways of interacting with the universe and other galaxies both inside and outside of its range. The spinning angular velocity of barred galaxies is based on the relativistic solution. Relativity dictates that the barred galaxy disk would revolve as a single, inflexible, solid body. It is thought that the Solar System and spiral-barred galaxies both exhibit stiff body behavior when rotating. It is therefore possible that the same dynamical behavior in both systems can be explained by the same relativistic solution, which therefore validates it. The gas and stars in the barred galaxy must be rotating with the system at almost the same uniform rotational angular velocity, regardless of the amount of mass in the galaxy. In the spiral-barred galaxy zone, gas and stars must be shifting their orientation to follow the polar spin of the black hole. The uniform rotational pattern in the stars and gas around the black hole zone alters the angular momentum of barred galaxies of any mass, sometimes indirectly affecting their rotational angular velocities.

V. SUMMARY

The analysis carried out in this research paper reveals several key findings as summarized below:

- Correlation with Morphology: There is a notable correlation between specific polynomial coefficients and the morphological characteristics of the galaxies. For instance, galaxies with more pronounced bars tend to exhibit distinct angular velocity profiles compared to those with weaker bar structures.
- Mass Distribution Influence: Variations in mass distribution, particularly in the central regions of the galaxies, significantly affect the shape of the rotational curves. The sixth polynomial effectively captures these non-linear relationships.
- Implications for Galactic Evolution: The results suggest that the structural features of spiral-barred galaxies play a critical role in their rotational dynamics, providing insights into the processes of galaxy formation and evolution.

It can be noted that in group A, there was a slight correlation between rotational angular velocity and mass at degree one polynomial. In group B, there was a retrogression in the plot of rotational angular velocity and mass, meaning that a decrease in rotational angular velocity increases the mass of a spiral-barred galaxy at degree one polynomial, and later terminated at the middle of the graph plot. At the degree, one polynomial of group C spiral barred galaxy, there was a slight progressive increase in both rotational angular velocity and mass, indicating a slight correction between angular velocity and mass. Observing group D gaudily, it can be pointed out that there was a retrogressive plot from the middle of the rotational angular velocity axis at degree one polynomial, showing some level of correlation between rotational angular velocity and mass, though these did not occur from the beginning of the plot, which could mean that some barred galaxies correlated at degree one polynomial while some didn't correlate at the same level.

VI. CONCLUSION

This modification study underscores the significance of the sixth polynomial in analyzing the rotational dynamics of spiral-barred galaxies. By exploring the relationship between rotational angular velocity and mass, we gain valuable insights into the complexities of galactic structures. The findings, as summarized, pave the way for future research, aiming to deepen our understanding of the processes that govern galaxy formation and evolution. It can be conclusively stated that at degree one polynomial, some spiral barred galaxies exhibited some element of correlation, while at another polynomial, there exists no correlation between rotational angular velocity and mass at various groups of reclassifications.

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