Gravity and Revolution Rates within Galaxies

Paul Schroeder
8244 Anna Avenue, Wind Lake, WI 53185
e-mail: pshrodr8@aol.com

Mankind did not understand the motions of planets and moons until Copernicus, Kepler, and Newton defined the structure and workings of the solar system. Our understanding of galaxy motions is in that early stage today. There is a mystery surrounding the constant rotation rates observed for stars orbiting within galaxies unlike the solar system where more distant planets orbiting the sun do so more slowly than inner planets. Some suggest there something different about gravity in galaxies and they invented dark matter, dark energy and MOND to explain it. But proper analysis of gravity finds it is constant though its environment may vary. So the answer is otherwise.

1. Introduction

Galaxies consists of stars that are somewhat similar to each other in size, while in the solar system we have the large central body sun and small planets. Though galaxies have a dense central dome, it is not a central body. Our challenge is to investigate galaxy revolution at its circumference vs. internally. My External Gravitation model helps by concluding 'the rotation of central bodies pushes other bodies gravitationally'. Two rotating bodies drive each other in their orbits. You can arrive at similar perspectives by applying the inertia and centrifugal force terms to suggest that two adjacent bodies in space must orbit relative to each other or they will crash together due to gravitation.

Our discussions of gravity are about the physical mechanism, not the 'net' amount which is commonly identified as 'attraction'.

2. Direction

Communicating here requires a common perspective about directions in space. Revolution and rotation are two angular motions and for ease of communication here, they will always be assumed counterclockwise. When considering revolution/rotation it matters whether you view the event from the top or the bottom as they give opposite results. Using the three dimensional coordinate system with three axes, those viewing the event from the north Z axis, which defines up and down, can relate to clockwise direction. But not all observations are from the due north point and viewers with different positions have different perspectives and even assign different coordinate systems. We inherently draw the solar system as viewed from the solar north because we define earth's North Pole as north, the top for our top down view. If the galaxy plane was tipped more than 90 degrees relative to the ecliptic, then we would naturally draw it upside down and the arms would flare out in the opposite direction. As it is, there is a significant tipping of the galaxy plane relative to ours but it can never be greater than 90 degrees or we would just call its bottom north without thinking about all this perspective business. So it is valid to make references to counterclockwise revolutions in this analysis.

There is a preponderance of curvature in space. All motions in space are curved rather than linear. Things launched from earth are subject to, and acquire, some of the original motions of their launch site. Those motions are the rotation and the revolution motions of earth. The interchanges between bodies such as light/appearance, and gravity also must be somewhat curved. The curvature of light is sometimes referred to as aberration. That is where the direction from which images arrive is offset by motion of the observer. To consider the motion of the source, my 'pushing' gravity particles called Paeps penetrate a body such as the sun and leave the other side acquiring an angular component of motion due to the rotation of the sun. They don't go straight up. At an orbital, such as the planet earth, there is then an excess of paeps to the right of the planet pushing it counterclockwise in its orbit and also causing its rotation.

3. Motion Geometry

Rotation and revolution are interchangeable in any two body system where you exclude external considerations. Consider 2 equal sized bodies, call them stars. For them to coexist near each other they must be moving or revolving relative to each other. The bodies orbit each other. The speed of revolution is necessarily constant, so an outside observer sees their joint orbiting as having a continuous velocity. As we expand this view we see many interacting sources in galaxies. Note that the center of revolution, called the barycenter, is between not inside the two bodies participating in mutual revolutions.

Consider next 3 equal sized bodies along a line with 1 and 3 equidistant from 2. So, 1 and 2 would try to orbit each other and while 1 would pretty much succeed, 2 would be affected by the outside influence of 3. Similarly 2 and 3 try to orbit each other, and while number 3 pretty much succeeds, 2 is interfered with by 1. Essentially 1 and 3 motivate 2 to orbit in exactly opposite directions. So, 2 becomes stationary while 1 and 3 revolve around it. The lesser influence of 1 and 3 on each other additionally motivates them to revolve around each other essentially increasing the velocity of their joint revolutions around 2. Bodies cause both revolution and rotation in others via pushing gravitation. Body 2 gains rotation and now spins at twice speed of the other two bodies. The rotation increases the mass by increasing the density for body 2. Conveniently, body 2 acts a bit like a central body. The appearance of this system to an outside observer is like the 2 body system above except the barycenter now has mass.

For relating to a four equal sized bodies system, interactions get much more complex. With 2 bodies there was 1 interaction. With 3 bodies there are 3 interactions. With 4 bodies there are 6 interactions. For analysis, place the 4 bodies along a line at distance marks 1,2,3, and 4 with 1 at the top end of the line. Consider their line to suggest 2 clocks, where 1 is 12 o'clock and 2 is 6 o'clock on clock 1, while 3 is 12 o'clock and 4 is 6 o'clock on clock 2. Then 1 is being pushed left by 2 while 4 is pushed right by 3. When 1 reaches 11 o'clock, 4 reaches 5 o'clock on his clock. Because 2 and 3 influence each other, while being influenced by their clock mates, they move less on their clock. Now 2 might be at 5:50 while 3 is at 11:50. The lesser revolution of 2 and 3 relative to each other might cause gravity to pull them together a bit. Pushing gravity stabilizes systems containing multiple bodies. If we allow random collapses, the galaxy would never have existed in the first place.

Following the revolutions onward, I suggest next time locations might be 10 o'clock, 5:30, 11:30, and 4 o'clock. Then come 9, 5, 11, and 3 o'clock. Given approximately another time period and the 4 spheres now serve as the corners of a rectangle. Note, there is always an equal balance relative to the original barycenter point. However, upon assigning one of the stars as a center, the system revolves counterclockwise relative to it. Also the system shows a relatively consistent velocity along its circumference to outside observers.

The 5 body system has 10 interactions. Much net attraction between each suggests cluster formation. Any odd number linear system has a central body around which all other bodies rotate. The 6 body system has 15 interactions and more complications. In the solar system, planets essentially do not coincidentally orbit each other, unlike stars in galaxies. The concern that stars far from the center of galaxies have much higher velocities than predicted, indicates current theory assumes the center provides the velocity source and ignores the velocity sources spread across the galaxy. As we add more bodies, the back and forth motions are less distinguishable than is the overall forward orbiting of all the bodies around the center. This forward motion helps picture the creation of galaxy arms.

If all bodies are the same, every body/star over the long term achieves the same 'average' distance from the galaxy center. Most will move in and out and back and forth in suborbits, but their average distance will be the same. Thus over the long term they will all take the same average time to orbit the center. Kepler's law, where velocity depends on distance, suggests that objects at the same 'average' distance take the same average time to orbit. The time for revolving around the galaxy center must account for the sub-orbiting. The average orbit time for all Milky Way galaxy stars may take many cycles for all revolutions to equal out. Our sun is orbiting around other star groups within the galaxy besides the center itself.

4. Spiral Arms, Domes and Other Features of Galaxies

As you keep adding bodies, you can choose to view any one as a center. In reality they are all orbital centers while all orbiting the galaxy center. Given 100 bodies in line on the north and on the south of center, something like body 7 from center on the north line has a line of bodies both to the north and to the south that wish to orbit it and also wish to push it into orbit. The north line bodies push body 7 to an outside observer's right, the southern line bodies push it left. The difference is that there are more total bodies to the south so they will win in the long term. They will force body 7 to revolve counterclockwise around center. By comparison, they will force body 14 north to revolve even faster because of the greater south vs north imbalance it experiences. Likewise body 1 north will revolve slower than any other northern body.

The actual rotation of the line depends on the separation of the bodies along the line. With bodies equally spaced, the farther from center the body, the more its proper motion will exceed the inner bodies. The greater proper motion causes more bending so galaxies form arms.

Consider a body # 0 as center. Then consider a Y axis line of many stars numbered 1 - 100 equally spaced north of center. Say the innermost star in a line is gravitationally caused to rotate 1 degree counterclockwise relative to the Y axis. There is a sequence of counterclockwise forces by it and by each star further out upon the next star in line. In that single time period further out stars are multi-shifted causing higher angular motions. That creates the arm in this single shift. The further out the star the faster it moves to its new position relative to the original line. Each star orbits its predecessor so all move/orbit at the same speed and the same 1 degree of angular shift relative to their prior star.

As we continue out the line of bodies, the degree of angular offset increases and may reach 90 degrees. Those star's motions have become perpendicular to the original line. They suggest the spiral arm of the galaxy. Note that the arm extends leftward in a direction that appears to an outside observer as the direction opposite presumed the galaxy rotation. This motion occurs naturally from the counterclockwise pushing of all gravitating bodies within the system.

The reorientations relative to the line discussed thus far occur within a single time unit. Additional time units lead to higher angles of the revolutions relative to the original line. A star may cycle back and cross between the two stars prior in the line or perhaps the whole line spiral in on itself like octopus arms. If star 100 wraps back around and cross between stars 99 and 98, then each will intersect its next lower body in a cascading effect. Extend the revolution sequence so the outer arm stars motion perpendicular to the Y axis give or take. As stars continue to revolve beyond that perpendicular direction, they start heading more toward the galaxy center. Do they continue their orbit of their adjacent star, or is the galaxy center gravity strong enough to pull them downward and gradually roll up the whole arm? Or do the stars from the arm end begin to slide back along the underside of the arm more like a chain saw blade?

Do orbiting stars complete orbits around their original partners or are they passed along. Stars get to the underside of an arm either by sliding back down or via some giant midway orbit. Either our sun is part of the upper line extending and growing outward or it is part of the series of stars sliding back toward center, being forced there by the upper arm stars. Sol is core side (underneath) on its spiral arm - Orion. Per my geometry, that means sol should perform in one of two ways. It is core side because 1. It is orbiting something central on the arm so that its local orbital radius is the distance to the arm center, or 2. Sol is rolling back toward the galaxy center underneath its arm. In either case we are orbiting backward relative to the rest of the arm. Questionable theory says we are currently orbiting the galaxy center clockwise at 226 million years per revolution. Thus most of the rest of the outer galaxy orbits slower or oppositely - counterclockwise. My construction suggests a counterclockwise motion. Only a base picture of most all local motions can yield an overall motion. How do we define a stationary, non rotating observer who can make these judgments?

Given its rapid relative motions, is Barnard's star one that is wrapping back downward? To successfully pursue analysis of motions requires data, sort of like what Tycho Brahe provided for Kepler. A lot of data has been collected by a Danish study.

5. Proximity: System Stability Concerns

Stars balance their local environment by both 'attracting' nearby bodies and guiding them into orbital motions. Otherwise, with all the stars in the galaxy 'gravitationally pulling' on each other, some would ultimately collide. We could try saying the original speeds, distances, and sizes are just right to prohibit collapse. But there is more to it.

Gravity tidal ripples form in the gravitation field between two stars. The ripples interfere with the passage of star X between them. That star is forced to, travel above or below the tidal action, bringing the 3rd dimension into consideration for the motions within the galaxy.

Gravitation revolution support is greatest along the extension of the central body's equator and is less as the latitude angle increases. So star X drifts up or down when passing between and it does so sufficiently to decrease the attraction effects of each. Its orbit around either body is therefore inclined. This reveals that galaxial orbitals must follow paths inclined relative to the galaxial plane during their orbit. Similar reasoning extends to moons crossing equatorial planes.

Galaxies are sometimes described as domed pinwheels. Essentially the inclinations must increase as bodies are closer in to the galaxy center. The higher the orbit latitude relative to the center body, the less net gravitational push is applied to it. Bodies in inclined orbits experience less of the central spin due to latitude. In a galaxy, stars, ever closer to the central body, must travel in planes increasing in latitude relative to the center. As more and more bodies are visualized near the center of the galaxy, there is increasing inclination to the orbits to avoid the tidal action of many bodies passing through the region, and to minimize the pull of the center. The closer in toward the center the body is, the greater the angle of inclination that is required. There becomes a 3rd dimensional build up called a dome around the center, and to a lesser extent near other suborbital centers within the galaxy.

For another perspective about the necessity of domes, picture a line of stars from the center. Angle the line above or below the galactic plane. The length of the line must be shorter. The length of the line is dependent upon the angle of inclination because the central body provides less revolution support as the latitude angle increases. Also less spin is applied to revolve the orbitals.

Regarding potential system collapse, gravitation as the medium provides the potential of system self adjustment to compensate for local disturbing events. There must be attraction variations due to the role spin plays in determining density and therefore in determining mass. Expected circuar orbits within systems are affected by pulling of a nearby system which causes the internal orbits to become oblong/elliptical, rather than circular. Such interaction mathematically defines the second focus of an ellipse as being a virtual center. Then the reason the orbital motion is slower in the vicinity of the second focus is that its source provides 'attraction' but none of the orbital push that the central body provides.

The sun's rotation also provides more gravitational support to orbitals along its equator than it does in other directions. The greater the latitude, the less the revolution support. Solar system orbits can be inclined and may be elliptical rather than circular. We may fully understand both solar system planetary inclinations and their elliptical second (virtual) focus if we can determine the location and motion of secondary centers of gravitation outside our solar system.

6. Conclusion

Images of the geometry above suggest nearby interactions. In reality separations are in light years. Regardless of distance, some of the counterclockwise push remains if only as a whiff of a breeze. If it takes eons of acceleration by the whiff, the constant seeking of equilibrium will occur as the recipient star motion gradually offsets the push. To understand the motion of any one star requires application of ever diminishing rotation disks for every nearby star which provide the motion source.

References

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