The Branching, Self Reproducing Galactic Model (BSR)

Introduction

Extracting the essential properties of a simple branching system, and applying the same characteristics to a large-scale cosmic form, revolutionary alternate models of galactic evolution and structure can be proposed. A branching, self-reproducing galactic model might show how invisible and poorly understood dark matter, and its resultant visible components (dust, stars, and galaxies) organize and evolve in a fashion similar to their branching, self-reproducing worldly counterparts.

The authors couldn't imagine a more appealing conclusion than finding large scale cosmic form similar to their worldly counterparts, a kind of the large is similar to the small. There is already a movement underway that would describe the universe as an evolving, growing entity. It would appear a natural extension to find that this growing and evolving entity adopted the same form as the growth systems that dominate our planet. Just as exciting is the potential that some of the most challenging mysteries of the universe might find a context within the BSR model.

- Are elliptical and spiral galaxies aligned in a consistent orientation (similar to suns being aligned in the same dust cloud)?
- What of the relative orientation of clusters and superclusters?
- Are galactic jets aligned in a consistent orientation?
- Similar to worldly branching systems, are there any indications of a flow in the opposite direction of stellar or galactic jets?
- Are clusters just larger and older branches? Do they follow consistent or patterned lines/paths/organizations through space?
- What is science's explanation for the most intense concentrations of energy, mass, volatility, and organization occurring at the center of logarithmic spirals?
- Is there evidence to suggest the age of larger clusters is greater than smaller clusters?
- Are there indications individual galaxies move more quickly relative to their associated clusters?
- What are the odds of finding minority elliptical galaxies exclusively at the center of clusters? Are such odds at all compatible with current models?

Extracting the structural and philosophical components of a simple branching system, such as that displayed by a tree, and applying the same characteristics to a large-scale cosmic form, revolutionary alternate models of galactic evolution and structure can be proposed. A branching, self-reproducing galactic model might show how invisible and poorly understood dark matter, and its resultant visible components (dust, stars, and galaxies) organize and evolve in a fashion similar to their branching, self-reproducing worldly counterparts.

Pyramid of Mirrors

Fritz Zwicky's 1933 discovery that galactic motions were significantly greater than our expectations has turned the world of gravitational accounting on its head. Decades of scrutiny all confirm Zwicky's observation that 90-99% of the matter required to perpetuate the observed trajectory of galaxies remains stubbornly undetected by our high-tech instruments including Hubble. Clearly something out there is causing the rotational speed of galaxies, galactic motion about clusters, and the universe's expansion rate to vary overwhelmingly from our current understanding. If all this wasn't evil enough, this "ghost in the cosmos" appears to also organize in a profound and orderly fashion.

With exact quantification the very essence of scientific pursuit, a 900+% deficit in a fundamental physical quantity (matter) should justifiably cause a stir within the scientific community. Science has discarded countless theories on numerous subjects over the years for far less disparity. But in order to maintain our coveted celestial models the 'books' had to be balanced and thus the term 'dark matter' was created. For without dark matter, a precarious and unstable situation would exist similar to that of an inverted pyramid. For simple comparative purposes, if you turn a pyramid on to its apex it quickly collapses. Similarly if we balance current cosmological theory on its peak of 1% luminous (visible) matter, the pyramid should quickly topple. Now identify and hack away from the pyramid's peak another 9% of dark matter (through the use of dark matter in the form of theorized heavy neutrinos) and again stand the pyramid on its apex. In this condition, the pyramid is still susceptible to toppling, however, it now rests more steadily than before; awaiting the next further stabilizing advance in dark matter theory or perhaps a totally radical departure that debunks the pyramid altogether!

"What We Can't Create, We Can't Imagine" *Richard Feyman*

Matter who's electromagnetic radiation can be detected by light spectra instruments is labeled luminous or "visible" matter. The existence of its imperceptible counterpart, dark matter, has never been directly detected and is only surmised through means of deduction. Dark matter is the quantity required if we want our equations of gravity to add up to the observed motion of luminous matter. For example, the trajectories of galaxies within galactic clusters are so great they should literally tear apart from one another[1]. Why this does not happen means that 90-99% more matter[2] must be present than can be detected.

The visible and dark matter divide is just as wide when considering the relative motions within galaxies. Gravitational accounting demands a spiral's central "bulge" rotate much faster than its outer edges, however, our expectations are once again confounded by our observations which show the entire disc actually rotates at the same rate. Again a 90% boost from dark matter provides the solution to perpetuate the measured motion. Adding insult to cosmic injury, local observations within our own Milky Way galaxy offer no clues to the makeup of dark matter.

Feverish competition exists to prove the existence of the ever-elusive dark matter. 9% of dark matter can be accounted for via theorized, yet undetected heavy neutrinos. The remaining 90% of dark matter is believed to take the form of nonstandard "baryonic" matter, which is standard matter that adopts a less readily detectable state or form. Leading candidates for baryonic matter are black holes (large and small), brown dwarfs (stars too cold and faint to radiate), sun-size MACHO's, cold gas, dark galaxies, and dark clusters to name but a few. Now combine the dark matter deficiency with other gaping cosmic mysteries (galactic evolution, quasars, black holes, etc.) and we arrive, not at a dilemma as might be suspected, but a philosopher's paradise where "whatever can be imagined, can be created".

Where to Imagine?

A quick tour of your local bookstore is sufficient to conclude we live in a potent age of reason with a large number of complex and mind-bending theories attempt to explain astronomical and cosmological observations. Teaming our cerebral prowess with our powerful tools of measurement, and one has wonder what is keeping us from filling current cosmological disparities. Skeptics might point out that gaps in current models are perpetuated by, amongst other things burdensome models; institutions incapable of absorbing change, or a fundamental misunderstanding. If any of this is true, an exciting period lies just ahead because either the dark matter mystery will be solved, our equations of gravity will be modified, or revolutionary new models will evolve from man's imagination.

Since the search for dark matter is crowded with complexity and protocol, this paper will focus on their opposite; imagination and fundamentals. However unorthodox the branching, self-reproducing galactic model may appear, its strength resides in one of science's most uncomplicated theorems, Occam's Razor.

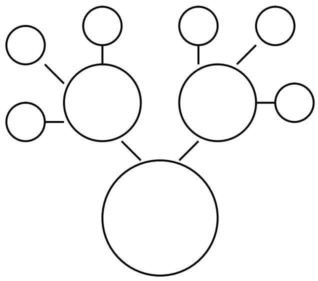
Where to Create?

"The simplest answer is usually the best". Occam's Razor, a reliable and time-tested scientific axiom states that when two or more competing explanations exist, the best answer is usually the simplest answer. Not only does this maxim imply strength in plainness, but a broader interpretation allows the term best to translate as 'most likely', which in evolutionary terms translates into most abundant. Hence via the virtues of simplicity and being the most likely, we might find the best answer in the most abundant quantity

Branching Systems Permeate Our World

Hence the first step in imagining an alternate cosmic model is searching out simple and abundant quantities. Looking no further than our natural world, simplistic and highly abundant branching systems offer an excellent basis from which to imagine alternative cosmic models. Consider that roots, branches, leaves, arteries, rivers, deltas, valleys, family trees, specietal trees, skeletal structures, circulatory systems, lungs, nervous systems, retina, neurons, and the brain are all examples of natural branching systems. Mankind and its inventions have simply followed nature's lead by creating numerous branching and arterial systems as witnessed by our roads and highways, electrical distribution systems, and the internet to name but a few highly illustrative examples.

In a similar context to natural branching systems, but on a universal (super-galactic) scale, Linde has ingeniously demonstrated that our entire universe may just be a small branch of a much larger (super-universal scale) "cosmic tree, whereby our part of the universe grows indefinitely away from the trunk of the tree"[3]. In Linde's world, our massive and extraordinary universe is but a sub-branch of a colossal branching super-universe.



Bracketed by Linde' s super-galactic branching system and our sub-galactic branching experience, the prospect of a galactic scale branching system appears plausible indeed.

A Branching Galactic System

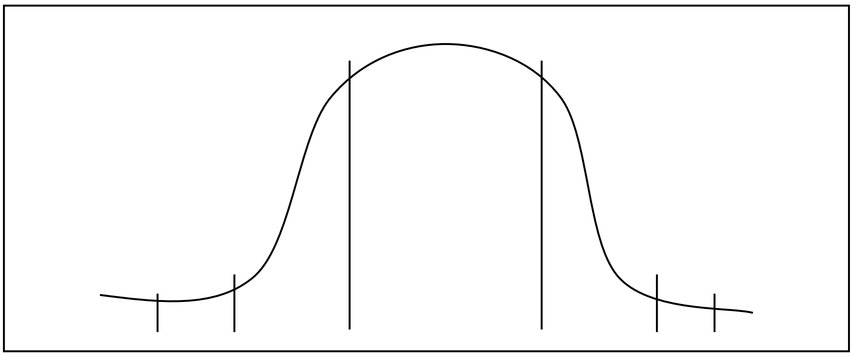
If the cosmos organizes in a branching configuration, a survey of the heavens should produce visual and qualitative evidence of a growth and branching system. Such indications might include branching component forms (such as straight lengths, nodes, terminal points, and spirals), common form, hierarchical or fractal-like organizations, efficiency, distinct visual characteristics including perpendicular and consistent orientations in space and consistent proportioning.

Commonality in Form

Though divided by continental distances, the large numbers of plant and flowering species on earth exhibit a large degree of commonality in shape and form. However, where one might expect meaningless and random galactic shapes and forms to occur in the infinite expanse of space throughout the 100 billion galaxies spread over 20-30 million light-years, galactic shape is surprisingly regular and consistent with the following distribution of baseline characteristics[15].

70% Spiral Shaped Galaxies
27% Elliptical Galaxies
3% Irregular Galaxies

Moreover, the regularity of galactic shapes is also distributed in roughly the same proportion as bell curves (which are employed to describe the distribution of traits of a single entity).



Common form and bell curve distributions are telltale signs of growth and branching systems.

The Form of Growth Systems

As a ubiquitous symbol of growth and decay systems, the shape of the logarithmic spiral is fundamental to the progression of budding (as well as decaying) leaves and flowers[16]. In the context of a BSR galactic system, it is therefore no surprise that the predominant galactic shape is that of the log spiral. These elegant structures grace Hubble images no matter where we look, however, the developmental stages of galactic spirals still baffle evolutionary cosmologists. Notwithstanding, the very components that define a spiral, its arms, are hotbeds of stellar reproduction.

"Rose and Spiral Image (side by side or overlaid?)"

Pre-budding flowers often appear as buds or pods similar in shape to an ellipse. Is it coincidental that the second most abundant galactic shape (ellipsoidal) is similarly shaped to a common worldly life form?

"Pod and Ellipsoid Image"

Branching Systems are Efficient

Tree and plant leaves are distributed evenly and proportionally on their branches in order to optimize the absorption of resources. Galaxies also reflect this spatial optimization (and resource consumption?) being distributed throughout space with a variance of less that ten parts in one million as highlighted in the paradoxical smoothness problem[17]. The smoothness problem than finds a comfortable home in a BSR galactic model whose components would be spaced evenly and efficiently as is the case with common branching systems.

The Role of Branch Ends

Due to their juxtaposition with growth points, the smallest entities of plant and tree branching structures terminate in the most complex organizations. Leaves (food producers), flowers (reproductive organs), root apical meristems (region of actively dividing cells), and new branch growth are all located at the branch extremities, or branch ends[18]. These "ends" are host to the most intense action of growth and self-reproduction. Therefore if we identify the most active entities in the heavens, we should find the "ends" of our cosmic sized branches.

On a sub-galactic scale, stars are the most probable candidates for growth system extremity as they are the most active entity. They have a well-documented life cycle, and are located primarily in the arms of spiral galaxies. In this context, a star is analogous to a budding leaf or flower.

Complimenting their smaller cosmic counterparts, quasars and black holes qualify as the most active and complex entities on the galactic scale with their mind-boggling features and incredible energy concentrations. Whilst popular models of quasars and black holes suggest they only are a result of high energy/matter concentrations, a BSR model would suggest they actually serve a *role*. One such function might be the location from which cosmic birth, growth, and reproduction likely originate. Again, the ends of these celestial bodies are similar in shape to the reproductive components of plants.

Nodes

A basic feature of newly leafing and flowering entities is they emanate from a central point or nodal location and then unfold outward. This nodal quality is also reflected in the heavens where infinitely dense black holes and quasars, which exhibit the most intense concentration of energy known on the galactic scale, are located at the geometric center of spiral galaxies (as well as ellipsoidal galaxies). Might the center of galaxies therefore be the node from which the galactic disk and/or halo is initially formed? As shall be demonstrated in the fractal section below, more than galactic level cosmic organizations form a central nodal location.

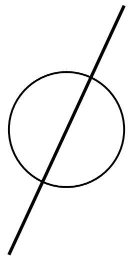
Galactic Branches?

Hubble images are providing incredible insights into galactic development. They have revealed that thin streams of gas and dust emanate from the center of younger "active" galaxies. These so-called jets[9] are not only perpendicular to their respective galactic discs, but they can extend for at least a *million light years* from their galactic source far into empty space prompting astronomers to suspect they are the largest coherent object in the universe[10]. Computer models also suggest jets progress in "fits and starts" which would account for the knotty structures seen on many jets[11]. The analogy of "fits and starts" is an appropriate description for the sequencing displayed in growth and decay systems as well as branch systems where bifurcations and nodes form at branching locations. Irrespective of the current theory to explain the nature of galactic jets (currently believed to be formed by galactic interaction with magnetic lines in space), jets are outright visual evidence that galaxies display natural branching characteristics.

"Image of Young Galaxy"

Stellar Branches?

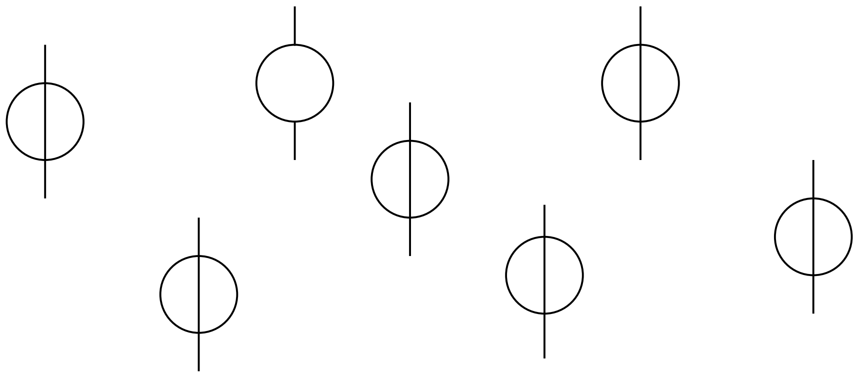
Individual stars also display evidence of branching systems during their formative years with visible jets emanating for tens of thousands of light years from the newly forming disc[12].



The highly analogous "jet" feature of both stellar and galactic bodies establishes that an underlying prime mover exists causing consistent form and function between bodies of vastly different proportion.

Eerily Parallel Orientations

Could this be circumstantial evidence why stellar nurseries exhibit a striking parallel orientation in the same dust cloud[13]? This is commonly attributed to the affect of the parent cloud's magnetic field, however, a BSR model suggests their common point of reference is a result of their common branching relationship.

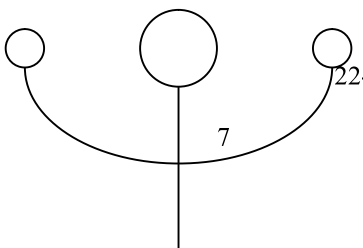


Stellar Nurseries

Through Hubble we have also viewed direct glimpses of stellar nurseries. Several such images, like the Eagle nebulae, indicate protostars remain hidden in "fingers" of nebulae material while new stars emanate from the tips of the finger columns[14]. This is analogous to the growth and budding of plant branch tips on earth, and to a BSR model it suggests stellar conception actually proceeds inside out (at a dark matter node), the opposite of current expectations.

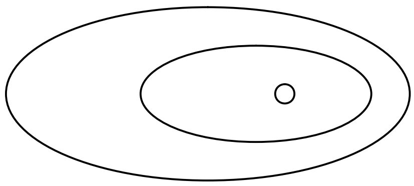
Stellar Proportion

Astronomers currently have no understanding why the ratio of large to small stars remains consistent across any given galaxy. The branching, self-reproducing model would suggest that since a local branching syndicate integrally links local star groups, the larger stars could represent a larger branch from which smaller branches (and smaller stars) originate.



Planetary and Lunar Similarity

A smaller branching element may be evident when picturing the cumulative elliptical path traced out by planetary bodies circling a sun. If a full-scale time lapsed photo could be taken from above the plane of the solar system, the concentric elliptical planetary paths would trace out the shape of a spiraling pattern similar to galactic spirals.



This observation is bolstered when considering the relative distances between the planets. As is the case with spiraling flowers and galaxies, the average proportion between adjacent planets approximates the Fibbonacci ratio (which is the mathematical sequence from which logarithmic spirals are constructed). As described by Robert Prechter, "while there is considerable latitude in the ratios, it is also the case the average mean ratios of the distances of adjacent planets among the first six planets from the sun, excluding the Mars/Jupiter relationship, is 0.615, the Fibonnacci ratio. The Mars/Jupiter separation is so great as to imply by this numerology that there is a missing planet between them. That is where the asteroids are located. The Titius-Bode law, developed in 1766, recognized these relationships and correctly predicted the position of the next planet, Uranus"[16]

With a preponderance of visual evidence suggesting the heavens organize in a branching manner, if we adjusted our focus to a fractal-branching basis, we might find additional branching or growth-like characteristics?

Fractal Branching Systems

Fractal systems are defined as "a rough or fragmented geometric shapes that can be subdivided into parts, each of which is (approximately) a reduced size copy of the whole. Fractals are generally self similar and independent of scale"[4]. In simple terms a fractal's smaller and larger parts are similar in shape regardless of any difference in scale. Branching systems with their similar shaped components are examples of fractal systems whereby the smallest sections (branches and twigs) are similar to the largest sections (trunks and larger branches). This arrangement of components suggests a hierarchical relationship in both size and age.

This similarity in the form and hierarchy of branching is reflected throughout the cosmos as demonstrated in the following list of known organizations.

Celestial Organization	**Typical Diameter[5] (Meters)**
Super Universal (Linde)	Infinite
Universal (Observable)	10^{27}
Grand SuperCluster	Alleged But Unconfirmed
Superclusters	10^{23}
Cluster Groups	10^{22}
Clusters	10^{21}
Galactic Groupings	10^{20}
Galaxies	10^{19}
Stellar Groupings	10^{16}
Planetary	10^{12}
Lunar	10^{8}

Here matter organizes in discreet groupings of similar form across the vast scale of space. Several of these groupings also include an element of 'filamentary' form and a central dominating mass which further supports their resemblance to their counterpart worldly branching systems.

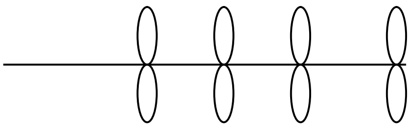
These observations suggest that the basic components of branching fractal systems are readily apparent in our heavens. The following description of multi-scalar cosmic organizations strengthens the fractal link and reveals additional visual and philosophical evidence of a branching system in the cosmos.

Grand Superclusters

The deeper we delve into space the more layers of celestial organization are discovered. The continuous search for larger and more complex organizational structures has been a traditional and much coveted carrot of astronomical pursuit since man first started exploring the skies. Once believed to be limited to supercluster level great walls, astronomers now suspect a higher level of organization (what the authors propose to label as Grand Superclusters). The discovery of further levels of hierarchical cosmic groups is a defining hallmark feature of fractal systems.

Superclusters

Superclusters are comprised of galactic cluster groupings that cumulatively form enormous 'great walls' or 'filamentary sheets' in space some 15x200x500 million light years across[6]. Similar to soap suds in a sink, the galaxies are dispersed along the film surface. This filamentary sheet-like arrangement of galaxies is no different in principle to a worldly leaf branching system whereby leaves are orientated along a tree branch. The efficient distribution of branching systems is not, however, coincidental as the filamentary arrangement of the branches allows for the optimum absorption of available resources. Viewed as a whole, a leafing branch and its neighboring branches adopt a layered and sheet like appearance. Might we dare to suggest that superclusters are also spaced for optimal resource absorption?



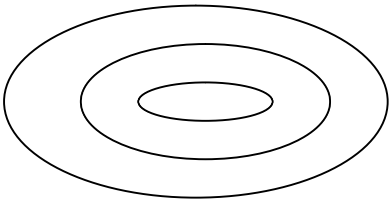
Cluster Groupings

The branch-like appearance of superclusters is directly reflected in their source elements. Not only bough-like in there 'lacy' and 'filamentary' forms[7], but they also display the fractal quality of similarity by sharing the same form as an adjacent organization.

Cluster groupings contain a disproportionate central mass which dominates the surrounding clusters. As shall be seen with increasing examples, cosmic organizations tend to perpetuate about a concentrated central mass

Clusters

Clusters are spherically shaped and are comprised of several galactic groupings, which rotate about the clusters' center. The violent rotations that occur about the common center are sufficient to rip cosmic neighbors apart, however this does not happen (dark matter provides sufficient gravitational bonding to hold the system together). It is not only curious that galactic groups strive for a common and concentrated center, but temperature and x-ray maps reveal clusters appear similar to the cross-section of a branch[8].



Galactic Groupings

The spherical shape of galactic groupings is formed by 'satellite' galaxies orbiting about a controlling central mass. The similarity in form and function of galactic groupings to other celestial groupings (clusters, galaxies, and planetary systems) is highly indicative of a fractal system at work.

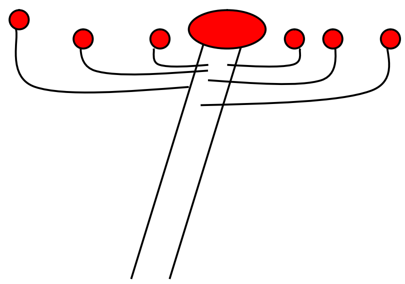
Galaxies, Stellar, and Planetary

The similarity galaxies, suns, planets, and lunar systems is even more striking than their relationship to higher degree cosmic organizations. These intergalactic bodies all exhibit strikingly analogous spherical, spiral, central mass, and branching components.

Dark Matters Role

Abundant visual and philosophical evidence suggests cosmic bodies possess features and organize themselves in a similar manner to worldly branching and growth systems. When superclusters branch to form clusters, clusters branch to form groupings, groupings branch to form galaxies, galaxies branch to form stellar groupings, and stars branch to form planetary bodies. The existence of a naturally unfolding, hierarchical branching cosmic structure appears to be very likely indeed. With the distribution of cosmic form adopting the shape of worldly branch and growth systems, coupled with the association of branch extremities with intense activity, we have additional evidence to support a dynamic branching system is operative within the universe.

The branching tendencies described thus far are based solely on the observations of a mere 1-9% of available luminous matter. With the predominance of 'dark matter' molding and sculpting the shape and organization of luminous matter, it is logical to assume, therefore, that the aggregate form of 'dark matter' should also organize in the form of a branching system. Furthermore the 'ends' of these dark matter branches (galaxies) are highly likely to be involved in activities such as reproduction, growth, or energy production similar to their worldly counterpart branching systems. A spiral galaxy is therefore nothing more than the visual outgrowth of the dark matter branch from which it emanates. In cross-section it would appear as follows:



In the context of a BSR model, the following alternative interpretations of universal form and activity can be proposed:

1) Cosmologists are miffed at the degree of advanced organization the further they look (allegedly earlier in time). Based on current models, clusters are believed to have started forming only in the last 3 billion years, however, a recent survey[19] of distant galaxy clusters discovered a large cluster population over 5 billion light years from earth. To a BSR model, large scale 'cluster branches' are therefore likely to exist at any distance.
2) In accordance with the conclusion noted in item 1, this is also the case with ancient galactic forms, which are strikingly similar to today's galaxies. This severely counters big bang models which suggest galaxies only began forming during the last few billion years.
3) A BSR model suggests all celestial entities and organizations are formed from within and grow outwards. In simple terms visible organizations sprout from their parent dark matter structure. Hence dust clouds and stars are not a random collapse of matter in space but actually emanate from the body of their governing dark matter.
4) A recent article in the February 2001 Astronomy[20] considered an alternate scenario for galactic evolution. Where classic theory models galactic evolution in an 'outside-in' sequence (where material trickles into forming galaxies from which black holes ultimately form), the Astronomy article suggests an 'inside-out' sequence where "seed black holes" establish themselves during the very early development of a universe from which in-falling material later forms the balance structure of the resultant galaxy. The

distinction is significant and is a result of the confounding and precise relationship recently discovered between the mass of a black hole and the size of its associated central bulge. Thus the inversion of a classic cosmological 'outside-in' theory to suit new findings furthers the BSR cause and its 'inside-out' basis.

5) Recent close-ups of spiral galaxy arms by the Hubble Space Telescope reveal that "along the spiral arm, dust spurs are seen branching out almost perpendicular to the main spiral arms. The regularity and large numbers of these features suggests to astronomers that previous models of the two-arm spiral galaxies may need to be revistied"[21]. The perpendicular orientation and branching nature of these dust spurs is a splendid reflection of branching characteristics exemplified elsewhere in the universe.
6) An October Astronomy 2000[22] describes "one of the simplest ways to study a globular cluster system of a single galaxy is to count the number of clusters and sort them according to brightness. This produces what's called a globular cluster luminosity curve, and it' shape can be approximated by a bell curve. Intriguingly, the shape is reproduced in all galaxies studied to date. Despite enormous variations in the size, brightness, structure, and location of the host galaxy, the bell-shaped curve is always there". Here again, a fundamental (and ancient) component of the universe displays highly consistent form and function across enormous scales offering further evidence an underlying mechanism may be at work in our universe.
7) Might evidence of an underlying architect, sculpting the form of galaxies come from the pages of the July 2001 Astronomy which reports "star formation seems to occur in the large regions of ionized hydrogen distributed in the mighty 2,000 light-year-wide ring around the center of the galaxy". The University of Herfordshire (United Kingdom) team continues "we see similar rings around the cores of other galaxies and think they represent interstellar gas falling in toward the galaxy's center". Hence intense star formation occurs in a highly specific region of the galaxy fueled by in-flowing matter from outside the galaxy. Both of these phenomena imply yet another fixed structural component of galaxies and may expose the form of the surrounding undetectable medium.
8) Using the above descriptions, the many mysteries of galactic and stellar phenomena (growth-like and filamentary structure, proportion, etc) are naturally described by a BSR model.

Strong analytical evidence exists to suggest the above proposals may operate on a grand scale. The German Virgo Consortium performed supercomputer simulations of the universe's large-scale structure as noted in the following extract from the February 2001 Astronomy[23]:

"From observational evidence, they assume most of the matter in the universe consists of a mysterious dark matter. Tiny density fluctuations, seen in the cosmic microwave background, cause the dark matter to start clumping. Inside the computer models many eons tick away and what results over time is a sponge-like structure. Through the work of gravity, *the dark matter comes to be concentrated in fat threads that weave through the universe* (emphasis added), with vast voids situated in between"

"Add Images from Page 42 of the Feb 2001 Astronomy"

The left image indicates the outline of resultant dark matter threads. The right image superimposes the agglomerations of super-galactic sized matter accumulations, which appear to the BSR eye as nothing more than buds from dark matter branches.

The idea that such mechanisms are at work is not incomprehensible. The same mechanisms of growth and reproduction are well documented on the stellar scale, and their extrapolation to the galactic scale is natural. With these simple principles in mind, dark matter assumes the role as 'prime mover' in the universe and visible matter takes on a minority function as dark matter's highly organized or "rarified" form.

Is their additional and perhaps complimentary evidence supporting the assertion that our universe may be nothing more extraordinary than a common, growing, branching system?

Self Reproducing Systems (SR)

The pattern of self-reproduction (SR) pervades worldly entities, systems, and organizations much the same as branching systems. Otherwise known as the life cycle, the rhythm of growth and decay affects more than cells, plants, and animals. The self-reproduction sequence also shapes the evolution of obscure objects such as atoms, ocean waves, atomic particles, the atmosphere's evaporative cycle, thunderstorms, moods, civilizations, seasons and suns, etc. This rhythm follows a consistent sequence of birth, growth, procreation, decay, and death.

Since the rules of growth and decay are the underlying core mechanisms for the development of plant and tree branch systems, it would be highly complimentary to the galactic branching model if celestial bodies possessed similar characteristics. In this instance, the heavens would display evidence of the SR cycle in both form and function. Our heavens should manifest galactic sized birthings, growth, procreation, decay and dissolution. To assist us in this search, we first need to study the highly documented life cycle of stellar bodies.

A Window to Galactic Life Cycles?

Within the context of current cosmological theory, massive interstellar dust and gas clouds occupy portions of the ever-expanding environment of space. Due to some triggering event like a colossal supernova explosion, a protostar is conceived when a cloud begins to contract under gravity's influence (this might suggest the conception of a protostar from the shock wave of a supernova explosion is not much unlike the string of events that proceeds our own notion of conception). After 100,000 years or so, the protostar begins to radiate sufficient heat (via friction from collapsing matter), the outward pressure of which prevents the further inflow of matter, and the protostar passes in to its pre-main sequence star phase. Depending on the mass of the developing star, it steadily contracts for 500,000 to tens of millions of years until its temperature is sufficient to ignite a perpetual fusion reaction, and a star is born. The main sequence star now burns for 100's of millions (to billions) of years balanced only by fusion's outward explosive and gravity's implosive forces. During this tenor, the star radiates immense amounts of energy, which can serve to facilitate and maintain various life forms (as in the case of the planet earth). As the star ages, its fuel supply depletes (decays) the star swells to enormous proportions and is then followed by a dramatic reversal (implosion). Depending on the star' s size, it either settles to become either a brown dwarf, a neutron star, or explodes violently in a massive supernova expansion. In the latter case the cycle is thus completed as the violent demise radiates shock waves that serve to seed adjacent dust and gas clouds initiating a new generation of star formations. The remnants of such an explosion form new clouds of dust and gas that in time will also contract into another generation of stars.

The recurrent pattern of birth, growth, procreation, and decay is deeply ingrained into the life cycle of stars. It is here that key clues for galactic life cycles are likely reflected. As we purvey the cosmic landscape for signs of SR, prudence would search for traces of life cycle traits such as explosive events; large volume swings, temperature variations, light spectra and intensity shifts, seeding, conception, triggering events, transitions, reproductive form, fixed mass or volume relations, growth, decay, dissolution, and generational evidence.

Galactic Generations

The vital statistics of globular clusters are as interesting as they are significant. Globular clusters are large, clumpy agglomerations of ancient stars that inhabit the circular halo that envelops a spiral galaxy. They each traverse independent elliptical orbits about a spiral' s central bulge and are some 13-15 billion years in age (this age is extremely troublesome to cosmologists as their age exceeds some estimates of the age of the universe!). They also inhabit the same space as the dark matter that causes galactic rotational rates to vary wildly from what we are familiar with.

Though the developmental relationship between a globular cluster and a galactic disc is still a hot topic of debate, there is little to deny the generational implications of globular clusters. By engulfing the younger spiral but also independently revolving about the common galactic center, globular clusters maintain autonomy with the disc. They do, however, come from an earlier stage of the galaxy's life cycle. Might clusters therefore be the remnants of the galaxy's first generation?

Birthings

Birthings are one of the most intense events in the life cycle of species, systems, and organizations. The intensity of a birth in earthly life forms is just as dramatic as that of stars and universes (the big bang). As with branch systems, births are than present at both the sub-galactic and super-galactic scale (remember Linde and our worldly branching experience). As such, galactic births should be the norm, not the exception. Do we therefore see evidence of dramatic birthing events on the galactic scale?

Quasars currently defy plausible explanation. They contain incredible amounts of energy in impossibly small spaces[24] even dwarfing their heir apparent black holes. By virtue of possessing the most intense and largest mass/energy concentrations on the galactic scale, quasars are possible candidates for evidence of galactic birth. Quasars become increasingly predominant the further we look into space[25] (the further back in time), which is precisely the era one would expect to find the formation of young or first-generation galaxies. The quasar link to galactic birth is further strengthened by the coincidental high rate of stellar reproduction.

Gamma ray bursts are one of the most incredible, dramatic and least understood phenomena of the heavens. Their vital statistics are staggering. These energy bursts are located evenly across the celestial sky and are over ½ the distance from the edge of the observable universe (also some 9 billion light-years away). They *emit more energy in less than 100 seconds than our sun will over its entire 10-billion-year lifespan.* Curiously gamma ray bursts occur in the same era as high rates of stellar and quasar activity[26]. This evidence suggests gamma ray bursts may somehow be associated with explosive galactic conception or birthing activity. Scientists believe gamma ray bursts may be the result of collisions between neutron stars and black holes (analogous to dust clouds collapsing to form suns), which is another indication they may be associated with colossal sized conception.

The Work of Dark Matter?

A recent Scientific American article[27] states "current understanding of the formation of light elements suggests most, if not all, of the deuterium in the universe was created just minutes after the big bang". The article continues "*in the absence of local processes capable of producing deuterium in the galactic center* (emphasis added), chemical evolution models predict that the ratio of deuterium to normal hydrogen should be very low – less than one atom of deuterium per one trillion hydrogen atoms. But this latest radio survey of the galactic center has detected nearly one million times the expected amount of deuterium."

With the manufacture of deuterium supposedly occurring 'only' in the moments following the big bang its presence should have decreased through time due to chemical interactions in space. Finding such large amounts of deuterium suggest "there probably has to be an external source of deuterium". The large quantity of a matter-type created in the moments surrounding the birth of the universe implies to the BSR model that either a similar process is on-going in a SR universe, or an external undetected source can be attributed with unknown galactic or dark matter activity.

Self Reproduction

We have already commented on the similarity of galactic shapes to common plants and to their reproducing flower components. The reproductive nature of galaxies can be observed in the spiral arms (analogous to a flower petal), which host the most active stellar seeding and birthing in the galaxy. Not only does the overall shape of galaxies resemble reproductive parts, but their main components also contain hotbeds of stellar reproductive activity.

Cosmologists believe the merging of galaxies was commonplace in the early stages of the development of the universe. Such interactions are reminiscent of stellar formation where the merging of dust and atoms ultimately produces a star. The production of a larger galaxy from merging galaxies is a possible link to a reproductive phase similar to their stellar counterparts.

It may be more than coincidence that ancient globular clusters share the same space as dark matter. From a BSR perspective, that dark matter shares the same space as ancient globular clusters (and there is every reason to believe that dark matter has been around just as long), might lend further evidence that dark matter perpetuates the course of visible matter.

Can we find a comfortable comparison between the reproductive components of flowers (anthers, stigmas, and pollen) and galactic components such as the central bulge, jet lobes, or dust clouds? One clue might be furnished by the exclusive presence of elliptical galaxies at the center of clusters (and accompanying dearth of spiral galaxies)[28]. The exclusive presence of the minority galaxy type at the center of clusters (and thereby high concentrations of dark matter) supports the idea of a larger mechanism molding the distribution of matter in our universe.

Growth

A recent finding indicates there may be an inextricable link between black holes and galactic bulges from the very early stages of a galaxy' s life cycle[29]. These findings can be summarized as follows:

1) The mass of a black hole is directly related to the average velocity of the stars within its ellipsoidal host (almost exactly), even in areas beyond the hole's direct influence.
2) The mass of each hole is roughly proportional to the mass of the ellipsoidal host (as estimated from its brightness).
3) The only requirement for super massive black holes seems to be the existence of a surrounding ellipsoidal shape.

These findings have led two teams of researchers to conclude "black holes are tailor made for galaxies" and "neither hole nor bulge (ellipsoidal shape) came first; they developed together" and "the new correlation thus supports theories that quasars are black holes and bulges in the throes of growth". These findings conclude that galactic centers grow and evolve as part of a galactic life cycle. The uncannily accurate proportions between black holes and central bulges strongly reflects the natural proportion of branching growth systems and strongly supports the assertion of an underlying structure shaping galactic form and proportion.

An interesting philosophical analogy between the propagation of cell growth along a branch and galactic form is furnished from the paper "Asymptotic Resolution"[30] which examines the incredible activities associated with a spiral's center.

"A branch's growth can actually be described in AR terms by imagining a branch as a linearized spiral. A branch traverses' space and hence 'forms' by cell division at the branches' end. At some point, branches inexplicably bifurcate (split into separate branches) or form 'rarified' organs such as leaves and reproductive flowers.

Now visualize the cell division, not along the path of a linear branch, but instead as traversing a path along a spiral's arm towards a spiral's center. In this instance, the growth eventually runs into the spiral's center and encounters a shock or discontinuity (an asymptotic event), which in a branching system results in bifurcation or a specialized growth form. The parallels between a branches bifurcation and the discontinuity experienced at the eye of a spiral furthers the casual link between spirals and branching systems". The authors continue, "the event of cell division at a branches' ends could also be considered a minute asymptotic event. This growth, taken as a whole with the branch of which it comprises, is interestingly analogous to the distribution of stars in the arms of spiral galaxies and their relationship with the galactic center. In spiral galaxies, the arms contain high densities of stellar activity which could be considered analogous to cell growth or cell division in a branch. The galaxies arms also spiral inward toward the galactic center which includes no less than the extraordinary black holes (a possible asymptotic event)."

Thus if a spiral galaxy was 'unwound' and made linear, might it appear as nothing more than a branch whose cellular activities are stellar bodies and whose bifurcation is the galaxy' s central black hole?

Transition, Evolution, and Seedlings

Edwin Hubble developed a "tuning fork" shaped galactic family tree where elliptical galaxies ultimately evolve into spiral and irregular shapes. Though this theory has been 'in' and 'out' of favor for decades (and discarded by modern models), the branching self-reproducing galactic model breaths new life into Hubble' s idea.

Evidence supporting Hubble's contention that ellipsoids evolve into spirals lies in the consistent nature of globular clusters and the contents of elliptical galaxies. Not only is there a fractal-like similarity in shape between globular clusters, haloes, central bulges, and elliptical galaxies; but more strikingly the contents of elliptical galaxies and ancient globular clusters orbit the galaxy' s center in independent elliptical orbits! Could the ellipsoids of our earlier universe, comprised of a massive quasar and elliptically orbiting stars, now be the same globular clusters that encircle the quasar's central remnants (black holes)?

Supporting these observations are recent findings indicating "the mass of a (black) hole is determined *by whatever* (emphasis added) fixes the size of the bulge" and "the new correlation supports theories that quasars are black holes and bulges in the throes of growth"[31]. The article further concludes, "some galaxies then acquire a flattened disk, such as the one the sun lives in. Other galaxies begin as a disk and later develop a bulge with a black hole". These observations are not only consistent with Hubble's beliefs and support several aspects of the BSR model, but they clearly indicate an unseen mechanism that affects and is integral with the most dramatic and intensely populated areas of galactic bodies.

Decay

Decaying plant life often retraces the same path traversed during its growth path. Leaves and flowers primarily enter and exit the world in a spiral unfolding or collapsing pattern. These remains, however, can hardly be classified as dead as they provide a source of food for following generations. Current cosmological wisdom suggests that galaxies will just burn out and ultimately become dark and lifeless. A branching self-reproducing galactic model, however, suggests galactic demise traverses a reverse path to the previous ellipsoidal or spiral unfolding and therefore becomes a precursor to further procreation.

If stellar activity provides any clues, might we find that first generation galaxies age or pass through a specific structural change? Do galaxies dramatically expand and contract (quasar pulsing?), experience temperature variations, light spectra and intensity shifts, or decay (diminishing energy)?

Death

Stellar death is a fantastic event. Stars swell to enormous volumes and then dramatically collapse to form dense burnt-out stars (neutron stars) or they explode and form the seeds for the next stellar generation. Have cosmologists found evidence of dramatic galactic volume shifts, pulsations, erratic shapes, chemical composition changes, or temperature changes followed by large-scale implosions and then explosions? Are there any transitional post elliptical or spiral galaxies (such as active galaxies) that might support a decay or dissolution phase of galaxies. Might such occurrences be in the future or outside our current astronomical range? Or might the massive energy of gamma ray bursts be one such indication?

A BSR Cosmos?

All of the above philosophically basic applications of branching system characteristics to large-scale cosmic forms provide profound alternate insights in the possible workings of our universe and the role of dark matter itself. If our cosmos were indeed a branching self-reproducing system, what would it look like and how would it traverse time?

Grand Branches

Imagine an enormous branch comprised of dark matter growing into the fabric of space. Of mind stretching size, it continues to increase its size via growth at its end points, along lateral branches, or circumferenctially as would a tree's cambium (how a trunk increases its girth). As with other arterial branching systems, a bi-directional flow is likely to occur within the grand branch where the equivalent(s) of energy are transferred to locations of growth, production, or reproduction.

At millions of locations along its length and ends, the grand branch or "great wall" bifurcates or germinates with lateral sub-branches and other forms of growth sprouting into the surrounding area. Where these supercluster sub-branches originate or congregate may illuminate the outline of the grand branch's path. Intense amounts of energy may also be associated with the arrival of these sub-branches into existence.

Supercluster Branches

In similar fashion to their elder grand branches, the supercluster branches also grow into space with millions of cluster-sized branches emanating from all ends of the supercluster. Superclusters are also "given away" by the assembly of clusters that grow from their surface. The form of supercluster sized branches may be straight, spherical, or sheet-like depending on the "push and pull" of the underlying dark matter and surrounding luminous matter.

Cluster Branches

Cluster sized branches fill the space between superclusters and display a branch-like "filamentary and lacy" appearance. Comprised mostly of galactic groupings and adopting a spherical form, the starting point of these clusters and their grouping should pinpoint their larger sized supercluster branches. During the events that produce cluster branches, there may be intense energy releases that are seen as gamma ray bursts (or possibly quasars?). Galactic groupings, of which clusters are comprised, may split from clusters to form galactic group-sized branches. Galactic group sized branches then subdivide into subcomponent galaxies.

Galactic Branches – Ends of Branches?

Galactic-sized branches can be likened to twigs (the smallest branch entity prior to a leaf and flower) because they contain the most active or 'rarified' form of the species. Branching from their parent galactic group branch, galactic sized branches may be partially illuminated by jet lobes that emanate from (or to) young galaxies. Further suggesting that galactic branch terminal points are also associated with some of the most active known components of the entire branching system.

Similar to branching components, galaxies are perhaps perpetuating some type of active growth, resource transferal, or reproduction. The fact that the most intense known concentrations of energy (on at least the cluster scale) are located at the heart of galaxies supports this assertion. These centrally located quasars and black holes are also surrounded by the magnificent, life structure of galaxies. It is here that dark matter adopts it's more readily evident (rarified) form.

Finally, the intensity of a galactic center is reflected in the intense stellar components that comprise the host ellipsoidal or log spiral galaxy. This 'whole is like the parts' phenomena finds a fitting analogy in the common sunflower. The sunflower is comprised of a mass of miniature flowers (florets) that when taken together, resemble a single larger flower. Applied to the cosmos, stellar body florets taken as a whole resemble the larger galactic structure.

Conclusion

By taking the essence of worldly branching and self reproducing systems and superimposing their persona on galactic structure and evolution, a new blueprint of large-scale cosmic form and function can be formulated. The branching, self-reproducing galactic model describes how galactic structure, organization, and evolution proceeds through space and time in a fashion similar to common branching growth systems. Moreover, the ever elusive and predominant quantity 'dark matter' is the prime mover and sculptor of galactic form and function.

Currently all tools used to detect the elements in our universe are limited to analyzing light spectra or gravitational effects. Would it therefore offend our sensibilities if something existed that is not subject to current detection capabilities? What if our missing dark matter was a less rarified state of matter or entirely beyond the reach of human imagination? What would an unrestrained scientific examination discover, one without the constraining bounds of exact quantification. Might it topple some of the existing pyramids and replace them with alternative, simpler, and more accessible models of universal interaction?

Do we dare imagine what can't be created?

Footnotes:

1) The comparison of galactic velocities about the Coma Cluster against the clusters' apparent gravitational field (based on the clusters' luminosity), led Fritz Zwicky to determine in 1933 the galaxies should literally tear away from the cluster.
2) Though figures vary, consensus estimates indicate the percentile of missing matter on the galactic scale is 90% and on the cluster scale 99%.
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8) Hubble Space Telescope. "Image of Virgo obtained in X-Ray." *NASA.*
9) Ray, T. (2000, August). "Fountains of youth, early days in the life of a star." *Scientific American.*
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13) Ray, T. (2000, August). "Fountains of youth, early days in the life of a star." *Scientific American.*
14) Comins, N. and Kaufmann, W. (2000). "Discovering the universe." *New York: W. H. Freeman.*
15) Though figures vary, consensus estimates indicate the distribution of galaxies is 70% spiral, 27% elliptical, and 3% irregular.
16) Prechter R. (1999). "The wave principle of human social behavior and the new science of socionomics." *New Classics Library.*
17) http://www.physics.iupui.edu/astro/lectures/RMPA105L14.pdf. (2001). "Fate of the universe."
18) As is the case with spiral shaped flower petals which occur at the termination points of plants, spirals also show up in the 'ends' of other systems as well. This is demonstrated by spirals in the form of curling waves, ear drums, and retina being associated with the termination of a crashing waves, a sound wave to our ears, and a light wave to our eyes respectively
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20) Nadis, S. (2001, February). "Here, there, and everywhere." *Astronomy.*
21) Scoville, N. (2001, April). "Image of Whirlpool Galaxy." *NASA.com.*
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