Motions of observable structures ruled by hierarchical two-body gravitation in the universe

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Abstract

Over the past various scenarios had been presented to account for the formation of the solar system and galaxy, but ever-increasing observations prove these conceptions to be incomplete. Here I propose, all objects in the universe are orderly organized in a series of hierarchical two-body systems with gravitation. Within these systems, the two components of each two-body system are orbiting around the barycenter of this system, and at the same time each two-body system is orbiting around the barycenter of a superior two-body system. Based on this hierarchical two-body model, an approximate uniform velocity feature for all stars (galaxies) in a galaxy (cluster) is determined. Under the effect of gravitation, a successive hierarchical orbital shrinkage results in high redshifts of distant galaxies and planar (disc) rotational profile of large-scale structures like the solar system and galaxy.

"… if redshift are not primarily due to velocity shift … the velocity-distance relation is linear, the distribution of the nebula is uniform, there is no evidence of expansion, no trace of curvature, no restriction of the time scale … and we find ourselves in the presence of one of the principles of nature that is still unknown to us today … whereas, if redshifts are velocity shifts which measure the rate of expansion, the expanding models are definitely inconsistent with the observations that have been made … expanding models are a forced interpretation of the observational results ."

E. Hubble [1]

1 Introduction

For the last 260 years a number of models had been proposed by cosmologists to describe the formation of the solar system, these models include the Protoplanet Theory, the Modern Laplacian Model, the Capture Theory, the Accretion Theory, and the Solar Nebula Disk Model that is currently widely-accepted. Woolfson in 1992 reviewed their successes and failures [2]. So far, Solar Nebula Disk Model is still surrounded by a series of problems [3-7]. The earlier conceptions of galaxies were derived from Wright [8] and Kant [9], the later theories of galaxy formation include top-down modes that think proto-galaxies form in a large-scale simultaneous collapse lasting about one hundred million years [10] and bottom-up models that think small structures such as globular clusters form first, and then a number of such bodies accrete to form a larger galaxy [11], the current galaxy formation theories focus on larger scale cold dark matter cosmological model [12], and more extensive reviews of this kind of model can be seen in the publications [13-15]. Even so, the detailed process of the formation of galaxy is still an open question in cosmology. Many observations in 20st century revealed that both stars in the galaxy and galaxies in the clusters revolve much faster than would be expected from Newtonian and Einstein theories [16-20]. This discrepancy is currently thought to betray the presence of dark matter that permeates the galaxy and extends into the galaxy's halo. But no candidate particles so far have been detected to act as this non-baryonic matter, even though ever-increasing searches are being carried. This thereby inspires one to consider alternative gravity theory to explain galaxy dynamics. Edwin Hubble's discovery of the redshifts of disttant galaxies [21] was thought by other scientists to be a suggestion that the universe is expanding, but the majority of astronomers had forgotten Hubble's hint at the beginning of this paper. In this present paper, I would like to propose a model to demonstrate the formation of observable structures and their motions, and further account for galaxy rotation curve and high redshifts of distant galaxies.

2 Proposition

Because of an unknown significant event (assumed it were the Big Bang), small units like ordinary particles were evenly distributed in the universe; because of the impulse from another unknown matter (assumed it were dark matter), ordinary particles obtained a kind of random movement in space; once two ordinary particles due to random movement approach one another close enough, gravitation between them captures each other to form a clump. As the distribution of ordinary particles is extensive, countless clumps of particles are simultaneously created. And then the clumps due to random movement continue to capture each other to form larger clumps, and eventually a very large lump of particles is created to form a rotational proto-celestial object (Fig.1); As the distribution of larger clumps is also extensive, many proto-celestial objects are simultaneously formed; and then these proto-celestial objects due to random movement continue to capture each other to form some systems, on large-scale, these systems due to random movement continue to capture each other to form larger systems (Fig.2). By order, all celestial objects were eventually organized in a very gigantic final system. The solar system is one of the countless families of these systems. As all objects are fixed together through a pattern of one-capture-one, a series of hierarchical two-body systems are determined (Fig3). Within these systems, the two components of each two-body system are orbiting around the barycenter of this system, and at the same time each two-body system is also orbiting around the barycenter of a superior two-body system.

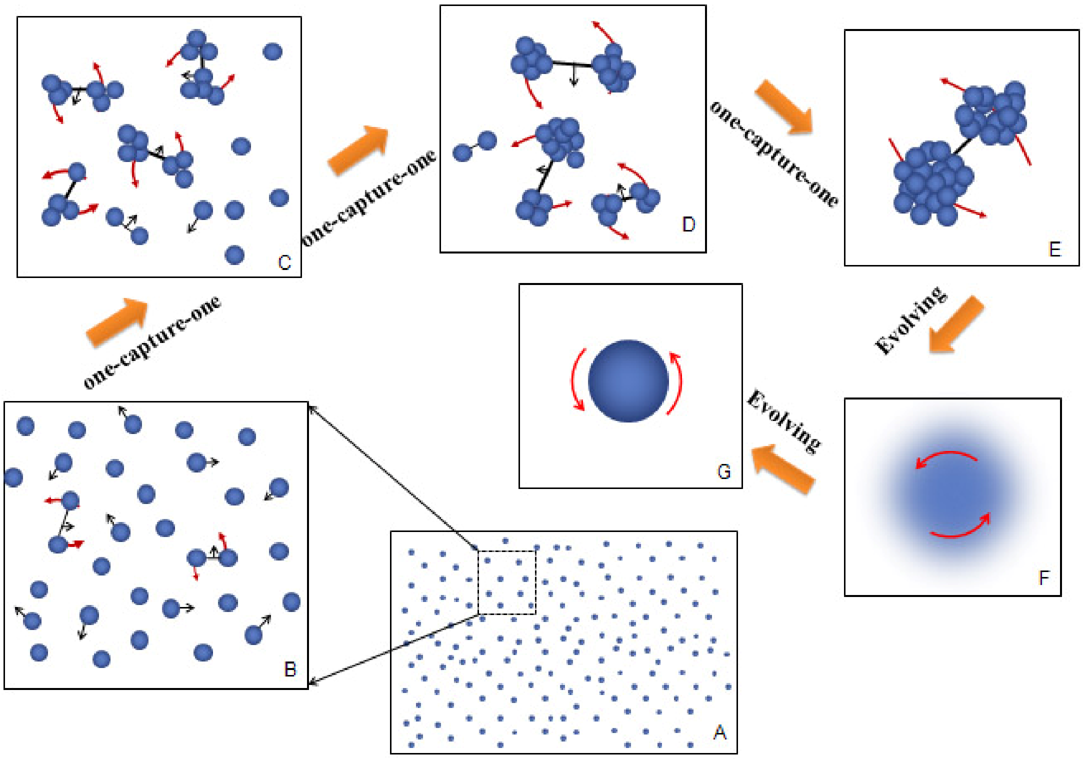

Fig. 1. The building-up of a primordial celestial object from small units (ordinary particles). Some particles are evenly distributed in a scene (A). They due to random movements approach and capture each other to form larger lumps through a pattern of one-capture-one (B, C, D, E) until a primordial rotational celestial object is formed (F). The primordial celestial object finally evolves into a mature celestial object (G). Little black arrows in diagram denote the movements of particles and their lumps. Line between two lumps (particles) denotes gravitation. Red arrows in diagram (B, C, D, E) represent the motions of the two components of each two-body system, thereby determining a rotational celestial object.

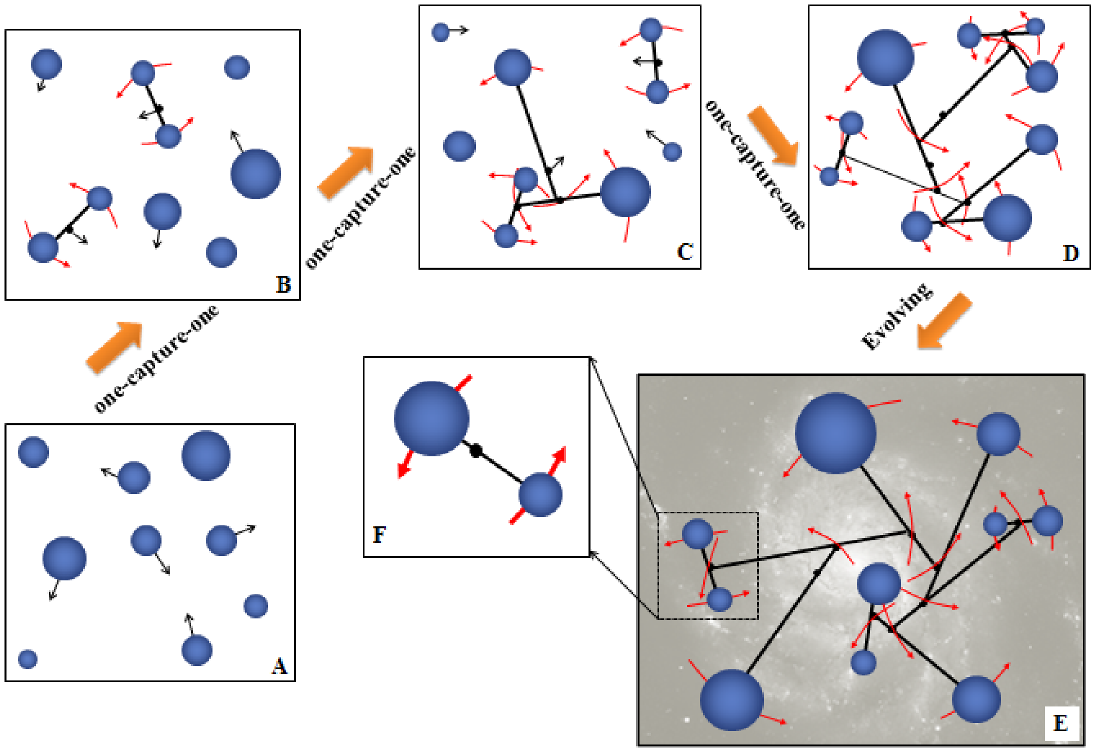

Fig. 2. The building-up of a large system from primordial celestial objects. Some primordial celestial objects are evenly distributed in a scene (A). They due to random movements approach and capture each other to form a series of two-body systems until a final association is formed (B, C, D). The association further evolves into a large planar rotational structure (E). Note that background is set by a spiral galaxy (Photo provided courtesy of NASA). The two components of each two-body system are orbiting around the barycenter of this system (F). Little black arrows in diagram denote the random movements of primordial celestial objects and their associations, while red arrows denote the motions of the two-components of each two-body system. Lines between objects denote gravitations. Little black dot represents the barycenter of each two-body system.

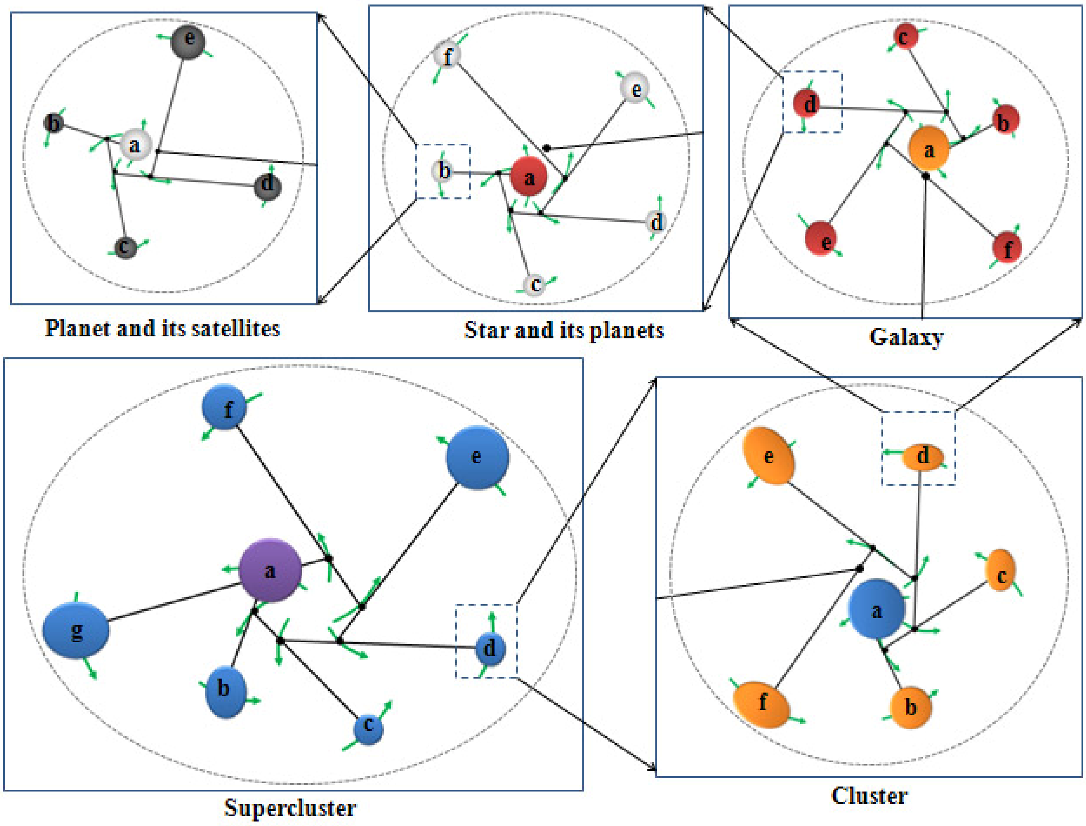

Fig. 3. A model of the association of celestial objects and their motions in a supercluster based on hierarchical gravitation. A subordinate two-body system is always connected to a superior two-body system with gravitation. Black line denotes gravitation between objects. Green arrows represent the motional directions of the two components of each two-body system, and little black dot represents the barycenter of each two-body system. Dashed circle represents the ideal scope of a hierarchical level system.

3 Explanation to astronomical phenomenon

3.1 Galaxy rotation curve

Assumptions: the star **a**, **b**, **c**, **d**, **e**, **f**, **g**, and **h** in a sample galaxy form a series of hierarchical two-body systems, in which object **a** and **b** form first two-body system, and at the same time the first two-body system and object **c** form second two-body system, by order, the sixth two-body system and object **h** form the final two-body system. The masses of these objects are defined as $100m$, $10m$, $20m$, $10m$, $30m$, $10m$, $25m$, and $15m$, respectively, and their distances from the center of galxy are defined as $0.2r$, $0.4r$, $0.6r$, $0.8r$, $1.0r$, $1.2r$, $1.4r$, and $1.6r$, respectively. To derive the coordinate of each celestial object, we treat the barycenter of a final two-body system as the center of this galaxy, and the center is further used as an origin to set a Cartsian coordinate system (Fig.4).

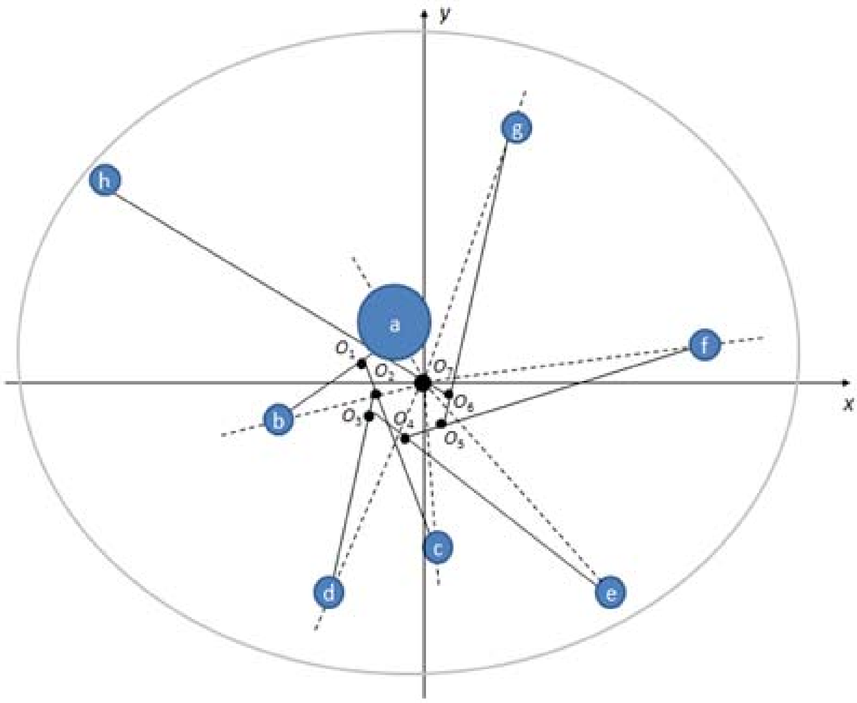

Fig. 4. A Cartesian coordinate system is set for all sample stars in the galaxy. Point O_1, O_2, O_3, O_4, O_5, O_6, and O_7 are the barycenters of related two-body systems, respectively, and point O_7 is the origin of the system. Black line between the two components of each two-body system represents gravitation. Ellipse denotes the boundary of the galaxy.

We further assumed that all stars are located in the same plane and the angles of star **a**, **b**, **c**, **d**, **e**, **f**, **g**, and **h** to the positive x axis are 120°, 200°, 280°, 240°, 310°, 25°, 75°, and 150°, respectively. And then the coordinates of these objects may be worked out as follows:

Object **a**: $x_a = Lo_7a \times \cos 120° = -0.10000r$ $y_a = Lo_7a \times \sin 120° = +0.17321r$

Object **b**: $x_b = Lo_7b \times \cos 200° = -0.37588r$ $y_b = Lo_7b \times \sin 200° = -0.13681r$

Object **c**: $x_c = Lo_7c \times \cos 280° = +0.10419r$ $y_c = Lo_7c \times \sin 280° = -0.59088r$

Object **d**: $x_d = Lo_7d \times \cos 240° = -0.40000r$ $y_d = Lo_7d \times \sin 240° = -0.69282r$

Object **e**: $x_e = Lo_7e \times \cos 310° = +0.64279r$ $y_e = Lo_7e \times \sin 310° = -0.76604r$

Object **f**: $x_f = Lo_7f \times \cos 25° = +1.08757r$ $y_f = Lo_7f \times \sin 25° = +0.50714r$

Object **g**: $x_g = Lo_7g \times \cos 75° = +0.36235r$ $y_g = Lo_7g \times \sin 75° = +1.35230r$

Object **h**: $x_h = Lo_7h \times \cos 150° = -1.38564r$ $y_h = Lo_7h \times \sin 150° = +0.80000r$

Where $Lo_7a = 0.2r$, $Lo_7b = 0.4r$, $Lo_7c = 0.6r$, $Lo_7d = 0.8r$, $Lo_7e = 1.0r$, $Lo_7f = 1.2r$, $Lo_7g = 1.4r$, $Lo_7h = 1.6r$.

As the momentums of the two components of each two-body sysytem are conservative, according to the property of algebra and geometry, the coordinates of point O_1, O_2, O_3, O_4, O_5, and O_6 may be worked out as follows:

$x_{O6} = -\ 0.10139r$, $y_{O6} = +\ 0.05850r$;

$x_{O5} = -\ 0.06514r$, $y_{O5} = +\ 0.25450r$;

$x_{O4} = -\ 0.00500r$, $y_{O4} = +\ 0.29930r$;

$x_{O3} = +\ 0.13167r$, $y_{O3} = +\ 0.19930r$;

$x_{O2} = +\ 0.11103r$, $y_{O2} = +\ 0.16130r$;

x_{O1} = + 0.15016r, y_{O1} = + 0.08320r;

In the calculation, as the masses of both star **a** and **b** are given, to maintain a dynamical stablity for the system, the presumed position of star **a** need to be corrected, namely,

$x_{a1} = x_{O1} + m_b(x_{O1} + x_b)/(m_a) = + 0.12758r$; $y_{a1} = y_{O1} + m_b(y_{O1} + y_b)/(m_a) = + 0.07780r$;

$L_{O7}a_1 = 0.14945r$

And then the distance between the two components of each two-body system and the orbital radius of each component may be worked out. In each two-body system the motion of each component is determined by the mass of another component and the distance between them, this fits to a dynamical equation

$G\frac{M_1M_1}{r_1^2} = G\frac{M_2{v_2}^2}{r_2}$ (the left hand is the gravitational force undergone by one component from another component, the right hand is the centrifugal force that is due to the motion of this component around a centre position), where M_1 and M_2 respectively reprsent the mass of the two components of a two-body system, G is the gravitational constant, r_1 represents the distance between the two components, and r_2 represents orbital radius that M_2 revolves around the barycenter of this system. After a simplification, there will be $v_2 = \sqrt{\frac{GM_1r_2}{r_1^2}}$. It is significant to keep in mind that if another component of this two-body system is composed of a series of subordinate hierarchical two-body systems, the gravitational force undergone by this component should be the summation of the attractions from all components in the subordinate two-body system. For instance, star **e** is one component of the fourth two-body system, and another component of this system is composed of a series of subordinate two-body systems that include star **a**, **b**, **c**, and **d**, thus, the total gravitational force undergone by object **e** in fouth two-body system is the summation of the attractions from object **a**, **b**, **c**, and **d,** namely

$$F = \frac{Gm_am_e}{(L_{ao_1} + L_{o_1o_2} + L_{o_2o_3} + L_{o_3e})^2} + \frac{Gm_bm_e}{(L_{bo_1} + L_{o_1o_2} + L_{o_2o_3} + L_{o_3e})^2} + \frac{Gm_cm_e}{(L_{co_2} + L_{o_2o_3} + L_{o_3e})^2} + \frac{Gm_dm_e}{(L_{do_3} + L_{o_3e})^2}$$

As object **e** is revolving around O_4 and its orbital radius is L_{O4}e, therefore the centrifugal force aroused by its motion may be written as $\frac{m_e{v_e}^2}{L_{o_4e}}$. And then,

$$v_e = \sqrt{GL_{o_4e}\left[\frac{m_a}{(L_{ao_1} + L_{o_1o_2} + L_{o_2o_3} + L_{o_3e})^2} + \frac{m_b}{(L_{bo_1} + L_{o_1o_2} + L_{o_2o_3} + L_{o_3e})^2} + \frac{m_c}{(L_{co_2} + L_{o_2o_3} + L_{o_3e})^2} + \frac{m_d}{(L_{do_3} + L_{o_3e})^2}\right]}$$

By this method, all parameters are worked out (Tab.1). Also note that a corrected distance for star **a** to the center of galaxy is 0.15r. According to these parameters, a velocity curve without scale may be yielded (Fig.5).

Object	R_1	M	F	R_2	V
	(r)	(m)	(Gm^2r^{-2})	(r)	($(Gmr^{-1})^{-1/2}$)
a	0.2(0.15)	100	3338	0.02	0.88
b	0.4	10	3338	0.57	13.80
c	0.6	20	1745	0.75	8.10
d	0.8	10	938	1.04	9.87
e	1	30	2260	1.25	9.69
f	1.2	10	630	1.18	8.62
g	1.4	25	1370	1.37	8.68
h	1.6	15	540	1.60	7.59

Tab.1. Parameters of related objects used in the model. Where R_1 denotes the distance of the object to the center of the galaxy; M denotes the mass of each object; F denotes the total gravitation encountered by each object; R_2 denotes orbital radius of each object; V denotes the orbital velocity.

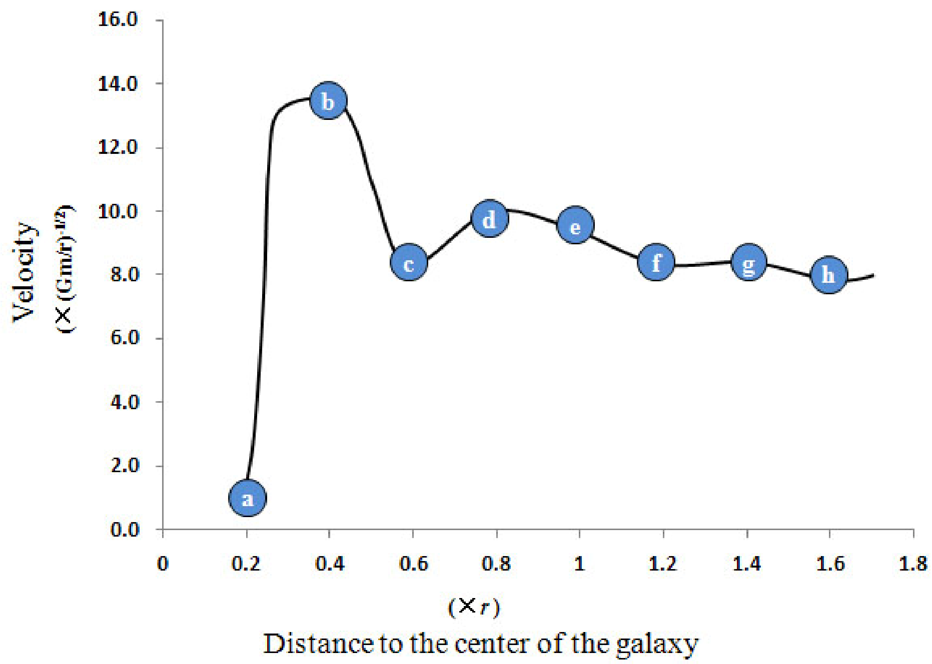

Fig. 5. A modelling galaxy rotation curve based on hierarchical two-body gravitation.

It is clear that, regardless of star **a**, the circular velocities of all other objects generally exhibit a flat profile. From the distance of 0.2r to 0.4r the velocity rises steeply, but it soon takes place a decrease from 0.4r to 0.6r. On the whole, the velocity keeps approximately uniform from 0.6r to 1.6r, which fits to the observed rotation curves of galaxies and clusters. In the simulation the mass of star **a** is setted as 100m, which accounts for 45.45% the total mass of all sample objects. In addition, the distance of the barycenter of each two-body system to the center of galaxy is less than 0.184r, and the distance of star **a** to the center of galaxy after a correction is 0.15r, this suggests that, if the radius of star **a** is long enough, the barycenters of all two-body systems may always locate in the body of star **a**. As star **a** has a huge mass and the barycenter of each two-body system is invisible, it is feasible to treat the position of star **a** as the center of that galaxy. Also note that because all sample stars are organized in a series of hierarchical two-body systems, the motion of a superior two-body system necessarily arouses the objects in the surbordinate two-body systems to move, this partly moderates the motions of all the stars in the galaxy. The simulation here indicates that, due to the association of a series of hierarchical two-body systems, the motion of a star (galaxy) in the galaxy (cluster) is determined by all the mass that is interior to the region of this star (galaxy), thereby yielding a flat velocity curve for all stars (galaxies) in the galaxy (cluster).

3.2 The high redshifts of distant galaxies

The orbital energy of celestial object is apparently derived from the contribution of gravitation, and the effect of gravitation is to drag objects to approach each other, as a result, the two components of each two-body system are approaching mutually, this result in their orbital shrinkage. As all galaxies belong to different clusters, and the galaxies in the same cluster are organized in a series of hierarchical two-body systems, a successive hierarchical approach between the galaxies in the same cluster determines that all clusters in size are shrinking increasingly. As a result, the distant galaxies that are in other clusters are observed by us to be with common redshifts. As shown in Figure 6, the galaxies in cluster **a**(**b**) are approaching the center of their father cluster, this results in the cluster's shrinkage, at the same time the galaxies in local group are also approaching the center of local group, this also results in the local group's shrinkage. In this point, when we from the view of the Milky Way observe these distant galaxies, all of them look like receding from us, and thereby results in redshifts of their spectrum lines. In addition to this, the simultaneous approach further increases gravitation between galaxies, this in turn promotes a further shrinkage of cluster to accelerate redshifts.

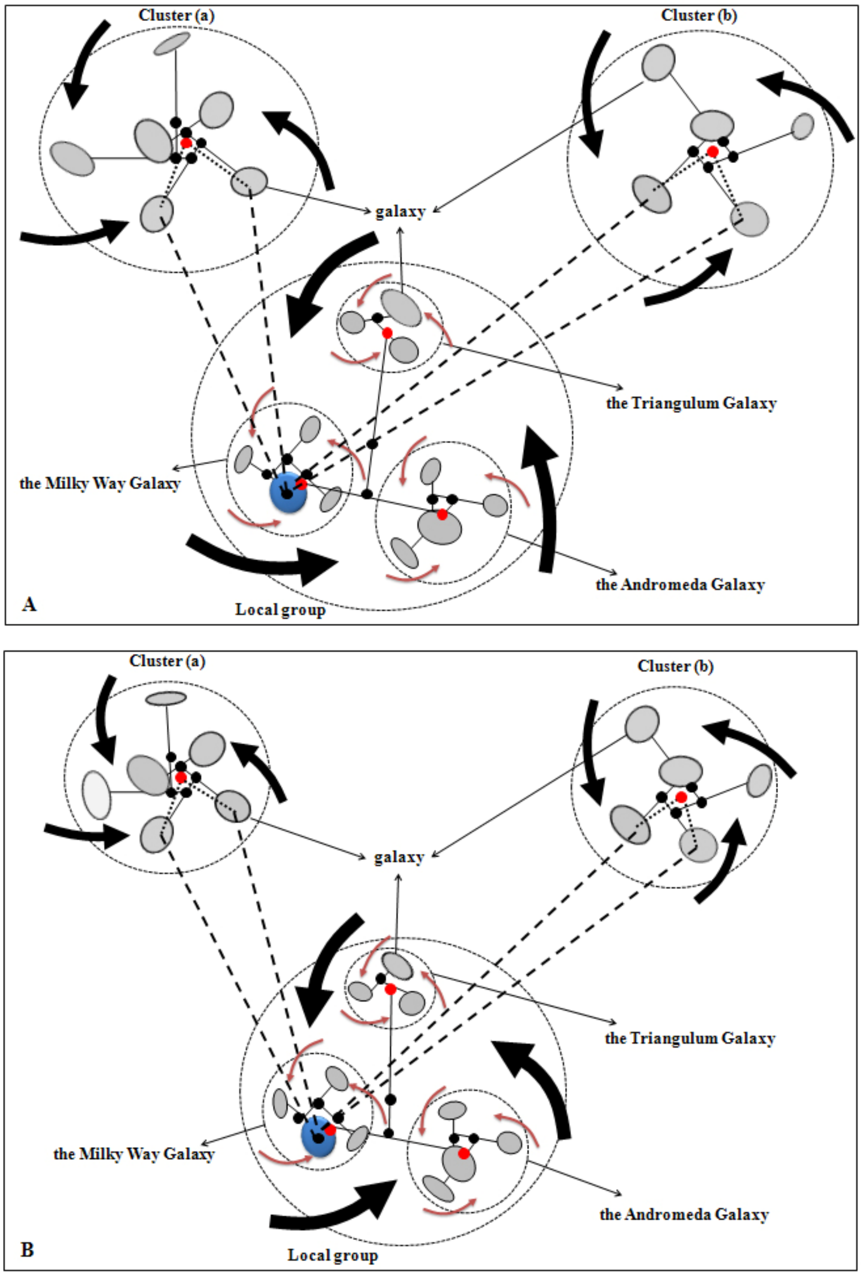

Fig. 6. Simultaneous hierarchical shrinkages of all galaxies. A: the initial positions of all galaxies at the moment. B: the final positions of all galaxies after a time of dynamical evolution. Black dots in the cluster denote the barycenters of related two-body systems, while red dot denotes the barycenter of the cluster. Large black arrow represents the shrinkage of a cluster, while small red arrow represents the shrinkage of galaxy and its satellites in local group. Blue patch is the primary of the Milky Way Galaxy. Large dashed circle represent the range of a cluster, while small dashed circle denotes the range of both primary galaxy and their satellites.

The redshifts of the galaxies in local group and the nebulae from Hubble's observation have fitted to this expectation (Tab.2). For the 26 satellite galaxies of local group, they are gravitationally bounded by the Milky Way, the Andromeda, and the Triangulum, respectively. The 12 satellite galaxies of the Milky Way have both redshifts and blueshifts. In contrast, NGC 598 of the Triangulum and almost all satellite galaxies (excluding Andromeda IV) of the Andromeda perform only buleshifts. And for 24 nebulae from Hubble's observation, except for 6 nebulae that reside in local group, nearly all nebulae in other clusters generally display redshifts.

26 galaxies in local group				24 nebulae from Hubble's observation [21]			
Primary galaxy	Satellite	Distance (mly)	Redshift (km s^{-1})	Primary cluster	Object	r	v
The Milky Way	Small Magellanic	1.97	+158	Local group	S.Mag.	0.032	+170
	Large Magellanic	1.57	+278		L.Mag.	0.034	+290
	NGC 6822	1.63	-57		N.G.C.6822	0.214	-130
	Ursa Minor Dwarf	2	-247		598	0.263	-70
	Draco Dwarf	2.6	-292		221	0.275	-185
	Carina Dwarf	3.3	+230		224	0.275	-220
	Sextans Dwarf	2.9	+224	Other cluster	5457	0.45	+200
	Sculptor Dwarf	2.9	+110		4736	0.5	+290
	Fornax Dwarf	4.6	+53		5194	0.5	+270
	Leo I	8.2	+285		4449	0.63	+200
	Leo II	6.9	-87		4214	0.8	+300
	Ursa Major Dwarf	2	-247		3031	0.9	-30
The Triangulum	NGC 598	2.81	-179		3627	0.9	+650
The Andromeda	NGC 221	2.49	-200		4826	0.9	+150
	NGC 224	2.52	-301		5236	0.9	+500
	NGC 205	2.69	-241		1068	1	+920
	NGC 147	2.53	-193		5055	1.1	+450
	NGC 185	2.05	-202		7331	1.1	+500
	Andromeda I	2.4	-368		4258	1.4	+500
	Andromeda II	2.22	-188		4151	1.7	+960
	Andromeda III	2.44	-351		4382	2	+500
	Andromeda IV	…	+256		4472	2	+850
	Andromeda V	2.52	-403		4486	2	+800
	Pegasus Dwarf	2.7	-354		4649	2	+1090
	Cassiopeia Dwarf	2.58	-307	r = distance in unit of 10^6 parsecs.			
	Andromeda IX	2.5	-216	v = measured velocity in km./sec.			

Tab.2. Redshift distribution of both the most galaxies of local group and the nebulae from Hubble's observation.

As the Milky Way and its satellite galaxies form a series of hierarchical two-body systems, which is similar to our solar system, the Milky Way is like the Sun, the satellite galaxies are like the planets, hence, every satellite galaxy looks like orbiting around its primary galaxy- the Milky Way, because planets in their motions can periodically approach and depart from the Sun, thus the satellite galaxies in their motions can also periodically approach and depart from the Milky Way, this determines the coexistence of the redshifts and blueshifts of their satellite galaxies. At the same time, as the Milky Way, the Andromeda, and the Triangulum also form two hierarchical two-body systems, and the two components of each two-body system are also approaching each other, therefore both the Andromeda and the Triangulum on the whole are approaching the Milky Way, thereby arousing the blueshifts of their satellite galaxies to be observed. The redshifts is currently thought to be a consequence of spatial expansion, but to support such a physical expansion, there needs two requirements: 1) the expansion is initially launched from some special position; and 2) the expansion is running from the position to some direction. So far, we know nothing of them, moreover, the redshifts of distant galaxies may ascribe to other factors such as light refraction by intermediate dust and gas, and the shrinkage of large-scale structure in size that we propose here, etc., it is therefore safe to infer that the conception of expanding universe is still premature.

4 Discussion

Historically, two theories had been presented to explain the structure of the universe and the motion of celestial object. The first one is the geocentric model that believes the Earth is the center of the universe and all objects like the Sun, planets, and distant stars are orbiting around it. The other is the heliocentric model that believes the Sun is the center of the universe and planets are orbiting around it, and distant stars are motionless. The long-term ground and spacecraft-based observations show that the Earth and Moon are orbiting around the common center of their masses, and at the same time the Earth-Moon system is also orbiting around the center of the solar system, the solar system is orbiting around the centre of the Milky Way Galaxy, the Milky Way Galaxy is orbiting around the centre of local group, and local group is orbiting around the centre of a supercluster. A large number of investigations reveal that most multiple stars are organized in a hierarchical two-body manner. For instance, Alpha Centauri is composed of a main binary yellow dwarf pair (Alpha Centauri A and Alpha Centauri B), and an outlying red dwarf, Proxima Centauri. Both A and B form a physical binary star, and Proxima C and this binary star form a superior two-body system whose orbit is much larger than that of this binary stars system [22]. Recent observation confirms that many multiple stars are organized in a young trapezia, and the centre of gravity is not fixed at some point but moves as the stars change their mutual positions [23]. All these observations indicate that they do not fit to the heliocentric model, this forces us to redefine the structure of the universe and the motion of celestial object. Figure 7 compares three models. It is obvious that hierarchical two-body model is more accordant with observable universe than both of heliocentric and geocentric models. In hierarchical two-body model, the Sun and planets are organized in a series of hierarchical two-body systems to orbit, and at the same time the solar system and other stars are organized in a series of superior hierarchical two-body systems to orbit, and Milky Way Galaxy and other galaxies are also organized in series of even superior hierarchical two-body systems to orbit, and local group and other clusters are also organized in a series of gigantic hierarchical two-body systems to orbit. As the two components of each two-body system are orbiting around the common center of their mass, the orbit of each two-body system can always nest inside the orbit of a superior two-body system, this arrangement enables all curving movements in space well-regulated.

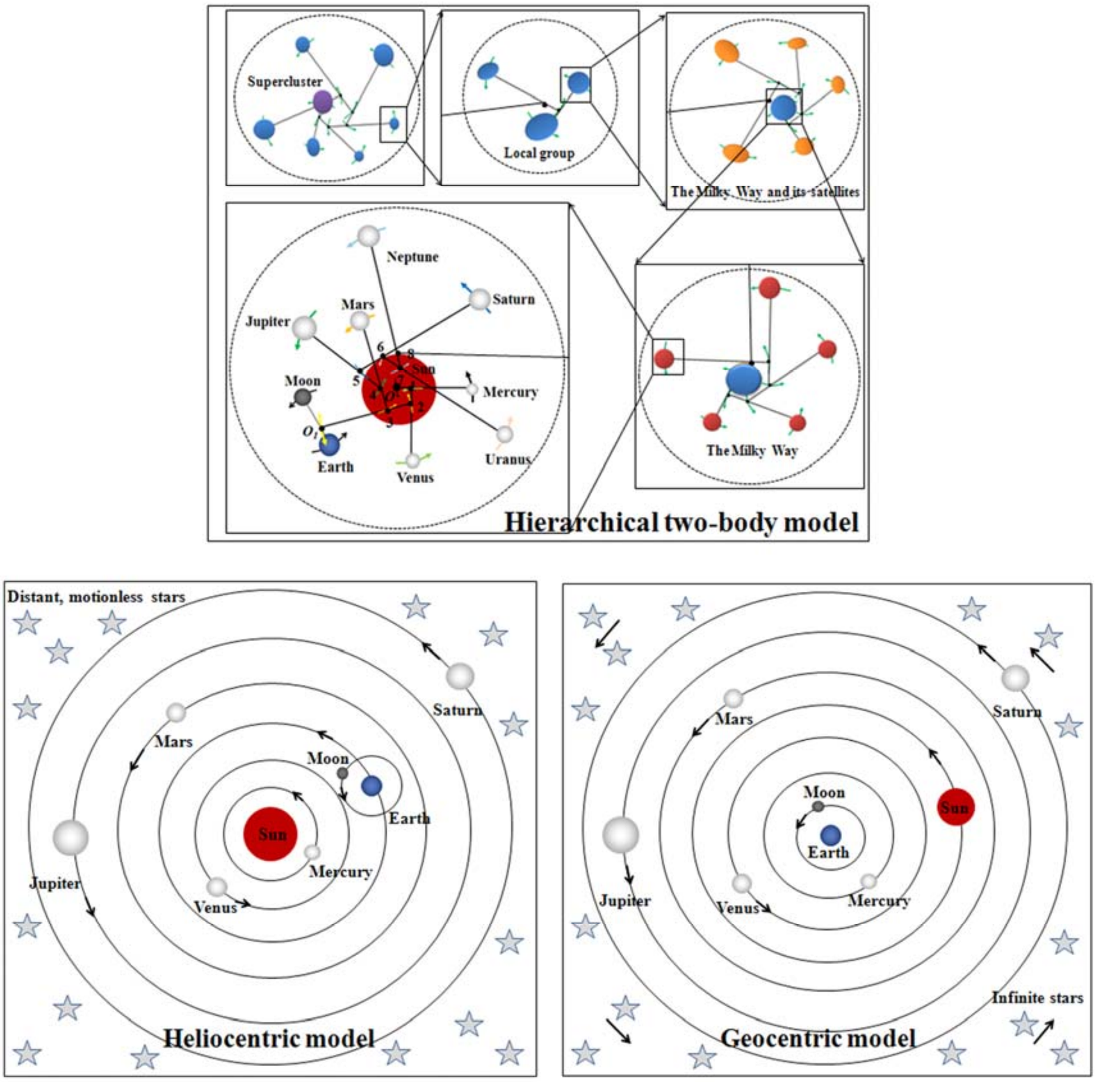

Fig. 7. A comparison of three models that account for the frame of the universe and the motion of celestial object. In hierarchical two-body model, a subordinate two-body system is always connected to a superior two-body system with gravitation, dashed circle denotes the boundary of each level hierarchy. Arrow in the circle denotes the motion of a component. Black dot denotes the barycenter of each two-body system. Black line denotes gravitation. In the diagram of the solar system, the Sun and the Mercury form first two-body system, and at the same time this two-body system and the Venus form second two-body system, etc., and dot 1, 2, 3, etc. respectively denote the barycenter of related two-body system, while O and O_1 denote the barycenters of both the Sun and Earth-Moon system, respectively. In both the heliocentric and geocentric models, arrows denote the motions of planets, the Sun, and stars.

As all objects before be captured are with random movements in space, this determines that after capture they hold various inclination-orbits (for star, planet, and satellite) and various poses (like stand, lie, and leaning) (for galaxies). As every large-scale structure is composed of a series of hierarchical two-body systems, under the effect of gravitation the successive hierarchical approaches between the components of all two-body systems can result in a planar (disc) rotational profile. For instance, as shown in hierarchical two-body model (reference to Figure 7), the Sun and the Mercury are approaching the common center of their mass (point 1), and at the same time both of them through barycenters (point 1 and 2) are exerting gravitation to the Venus, this enables point 1 and the Venus at the same time approach point 2, similarly, point 2 and the barycenter of the Earth-Moon system (point O_1) are also approaching point 3, point 3 and the Mars are also approaching point 4, etc.. It is clear that under the effect of this successive hierarchical approach, all planets are constrained to fall on a plane. This dynamical process is the same for planet's satellites and galaxy. Observation shows that the satellites of Jupiter (Saturn) approximately lie in the same plane. The nearest 23 satellites of the Saturn have inclinations of generally less than 1.6 degrees, while the nearest 8 satellites of the Jupiter have inclinations of generally no more than 1.1 degrees [24, 25]. Recent observation reveals that all classical satellites of the Milky Way Galaxy – the eleven brightest dwarf galaxies – lie more or less in the same plane, they are forming some sort of a disc in the sky [26]. In the solar system, each of the four giant planets (Jupiter, Saturn, Uranus, and Neptune) holds a lot of satellites, this makes it look like a small solar system, especially the Uranus's equatorial plane has a high inclination to the ecliptic, it is very difficult for the solar nebula disc model to account for this feature. It may infer that each giant planet had firstly captured satellites to form a series of hierarchical two-systems, and then four giant planet systems were successively captured by the Sun to form the present solar system. It can also infer (reference to Figure 7) that, as the Sun has a very massive mass, the barycenters of related two-body systems are generally located in the body of the Sun, this makes all planets look like orbiting around the Sun. Due to this hierarchical two-body arrangement, the planets (excluding the Mercury) in the movements can repeatedly approach and depart from the Sun, this determines them to be with ellipse-like orbits with aspect to the Sun.

It is well accepted that force is the reason of motion, and motion is the aftermath of force. Hence, by means of the motion of celestial object to seek for the force that is responsible for this motion is a proper method. Newton follows the heliocentric mode. To explain the stability of the fixed stars, he wrote: "*And lest the system of the fixed stars should, by their gravity, fall on each other, he [God] hath placed those systems at immense distances from one another.*" Newton further wrote that all stars in space are evenly distributed, and the mutual attractions between these stars at the same time are counteracted by their reverse attractions (see Proposition XIV in *Philosophiae Naturalis Principia Mathematica*). Here we see, the intention of Newton proposing universal gravitation is to employ this force to constrain all stars in the sky not to move. And now, it may infer that, because Copernicus's definition of the universe and the motion of celestial object is incomplete (even though it is advanced than the geocentric model), Newton's universal gravitation therefore becomes unwanted. We see, there are countless stars in the sky, and some of them also have their planets, and planets also have their satellites, all of them are not only movable, but also belong to some special hierarchical systems (for instance, stellar system, galaxy, cluster, etc.), such a gigantic number of objects and their hierarchical associations require a sapiential mode to run, a hierarchical two-body gravitation fits to this requirement.

The observable universe is currently thought to be derived from a Big Bang occurred about 14 billion years ago. If this proposition is tenable, an extrapolation is that when the explosion takes places, ordinary matters due to an explosive impulse would be instantaneously expelled way from a high-dense mass point. With the passage of time, the distances between ordinary matters are increasing increasingly, which automatically separate matter from each other in space. If gravitation at earlier time is not strong enough to counteract this separation, the expelling process will be endless, and the present celestial structures will be difficult to form. On the other hand, if ordinary matters rely on gravitational accretion to form larger lumps, this also separates matter in space. On the whole, to maintain a continuous accretion, there requires another matter to exist, it does not exert gravitation to ordinary matter, but it can provide an impulse effect like Brown random molecule movement to help separated ordinary matter have chance to approach each other. The demand is necessary, like what said by Newton in the principle, "*these bodies may, indeed, persevere in their orbits by the mere laws of gravity, yet they could by no means have at first derived the regular position of the orbits themselves from those laws*".

Under the effect of gravitation, planets will eventually swallow their satellites, soon after the star swallows its planets, the bulge of a galaxy swallows stars, the primary galaxy of a cluster swallows the satellite galaxies, etc., all mass are eventually collected to flow to a point where it perhaps conceives the next big bang.

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