Newton's Shell Theorem and the Deformation of Interacting Galaxies

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SUMMARY: On behalf of gravitational effects galaxies are usually considered as spheres. Is it correct to apply Newton's Shell Theorem to galaxies? Will interacting galaxies act like Newtonian spheres? There are exact astronomical observations to be compared with theoretic considerations. Newton's gravitation law is confirmed by a lot of observations of interacting galaxies, but there are severe objections against the validity of the Shell Theorem on behalf of galaxies.

INTRODUCTION.

The Shell Theorem: "A spherically symmetric body affects external objects gravitationally as though all of its mass were concentrated at a point at its centre." [1]
So any sphere will act like a point mass.

At first sight the shape of a spiral galaxy does not seem like a perfect bowle or a solid body. Most matter of any spiral galaxy is concentrated in the bulge and within the galactic disc. But nevertheless the galaxy is also extended in the third dimension. The matter of gas and dust and globular clusters is really distributed in the shape of a sphere, altough in diminishing concentration.
There is a general agreement that the spherically distributed matter of a galaxy will act gravitationally like a solid sphere. Usually the Shell Theorem is the basis for calculating the local gravitation within the galactic disc, resulting in the galactic rotation curve.
There are reasons for the supposition that any galaxy as a whole will act like a Newtonian sphere.

If any solid sphere will exert gravitation on an object outside of the sphere "as though all of its mass were concentrated at a point at its centre", the consequence is that two neighbouring spheres will exert gravitation on each other as if all mass was concentrated in their very centres.
For "actio est reactio". [2]
Therefore, any galaxy consisting of spherically distributed matter should act gravitationally like a solid sphere. A solid sphere will not change its shape. And so the shape of any interacting galaxy will also keep unchanged.

Is it correct to use Newton's Shell Theorem on behalf of galaxies?
Now we have to subject this supposition to an examination.

OBSERVATIONS. CONCLUSION.
Regarding approaching galaxies like **M51 (Whirlpool)** or **Stephan's Quintet** or **Arp 256**, we see deformed spiral arms, sometimes in the shape of handles. We recognize that the areas close to the neighbouring galaxy are pulled towards the other galaxy.

It is a matter of fact that approaching galaxies will deform each other by increasing degree the closer they approach. They get stretched towards each other.

Within a certain galaxy the masses of the areas close to the neighbouring galaxy are exposed to stronger gravitational force, according to the inverse square relation of gravitation. Whereas the areas in the rear of the first galaxy are least subject to the gravitation of the neighbouring galaxy. Thus the galaxy is stretched towards the neighbouring galaxy.
These observations are obvious and according to Newton's Gravitation Law.

If Newton's Gravitation Law is in force but not his Shell Theorem, approaching galaxies will act as if the mass in the area close to the neighbouring galaxy is more attracted by the external gravitational force than the mass of the centre or the area in the rear of the galaxy.
And that's exactly what we see in M51 and in all interacting galaxies.
Obviously masses of different areas within a galaxy do act and react according to the different distance of the gravitational force.

There is no evidence for the presupposition that masses of different areas would act “as though all of its mass were concentrated at a point at its centre.“

Conclusion: The Shell Theorem is not valid on behalf of a galaxy as a whole.

DISCUSSION.
On the one hand there are reasons for the supposition that any galaxy as a whole will exert gravitation on an object outside of the galaxy like a Newtonian sphere, and that also the gravitation within a galaxy will depend on Newton's Shell Theorem.

Regarding the local gravitation of a galaxy on any star within this galaxy at any distance to the centre, the current explanation is: all stars and other matter at less distance to the centre will exert gravitation on the regarded star as if all mass were concentrated in the very centre of the galaxy.
Thus the difference between the horizontal rotation curve of observation and the sloping rotation curve of theory is created. [3,4]

If the Shell Theorem is valid within a galaxy as supposed by current astrophysics, it must also be valid on behalf of the galaxy as a whole.
If the Shell Theorem is valid on behalf of a galaxy as a whole, the galaxy will act “as though all of its mass were concentrated at a point at its centre.“
And if all gravitation of a galaxy was united in its very centre, the galaxy would stay in the same stable shape, either moving along its way of inertia or being accelerated by an outside gravitational force.
If any galaxy acted like a solid sphere as predicted by the Shell Theorem, interacting galaxies would keep their shape conserved like solid spheres.

But on the other hand we see the deforming shape of each approaching galaxy. Interacting galaxies are not acting like predicted by Newton's Shell Theorem.
Astronomic observations do not bear out the shell assumption. On contrary, we see areas of stars within merging galaxies, acting and reacting according to gravitational forces, as predicted by the gravitation law.
These observations are incompatible with the Shell Theorem.

Another question is raising: Is the Shell Theorem valid within a galaxy?
If the Shell Theorem is not valid on behalf of a galaxy as a whole, it is reasonable to suppose that it cannot be valid within galaxies. And there are further convincing arguments against the presupposition of the Shell Theorem within galaxies. [5, 6]
This concerns the basis of the dark matter assumption.

Is the Shell Theorem valid on behalf of the Moon's solid sphere?
The GRAIL satellite experiments of 2012 disproved the validity of the Shell Theorem on behalf of the Moon. [7, 8]

Interacting galaxies, local gravitation within galaxies, and the globe of the Moon are just examples where the Shell Theorem is not applicable.
Is the Shell Theorem in Newton's words valid in general? See extended considerations. [9, 10]

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