

# Drifting away from us

Jonathan Freundlich

The milky white glow you can see across the sky during dark moonless nights is our Galaxy, the Milky Way. It is made of a myriad of stars held together by the gravitational force, our Sun being only one of them. Although philosophers and scientists had imagined the possibility of a multitude of island worlds like our Milky Way far away from us, it is only in the beginning of the 20th century that this possibility became a scientific fact. All at once, the Universe appeared much wider than initially thought.

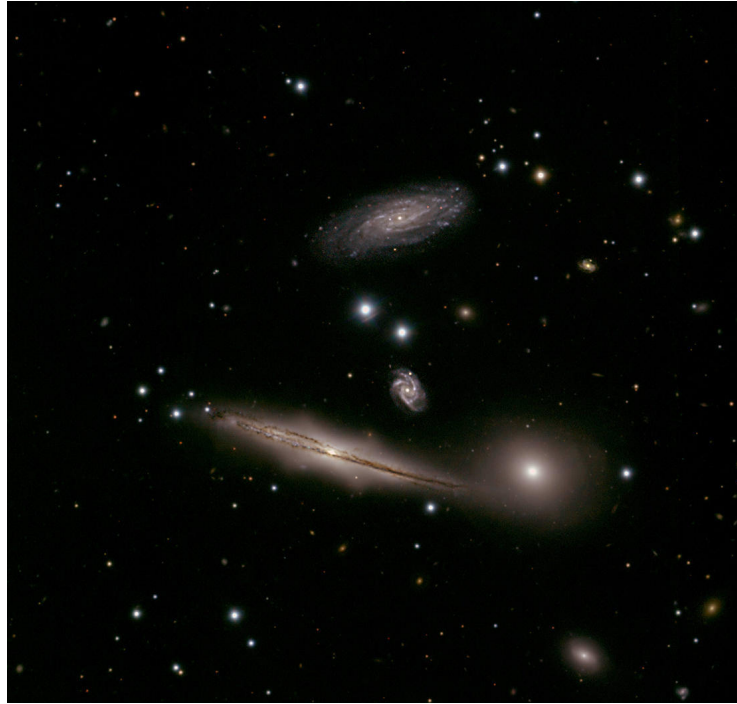
## An expanding Universe

Galaxies outside of the Milky Way have in common the fact that the farther they are, the redder they appear. This is because they are all drifting away from us.

Have you ever noticed the shift in the sound of a motorcycle or in the siren of a fire-fighter truck as it passes you? If you pay attention, you would notice that the pitch of these sounds is higher when they come towards you, and lower when they go away from you. This is called the Doppler Effect. In a similar way, galaxies that come towards us would appear bluer than if they were standing still, while galaxies that are moving away from us would appear redder. Distant galaxies appear redder than they should, so they are moving away from us. And the farther they are, the faster they are moving away!

## Space itself is expanding

This phenomenon concerns all galaxies and they are all moving away from each other. There is a global expansion of the Universe. As strange as it may seem, space itself is expanding! Imagine the Universe as a dotted balloon where each dot represents a galaxy: when the balloon is blown up,



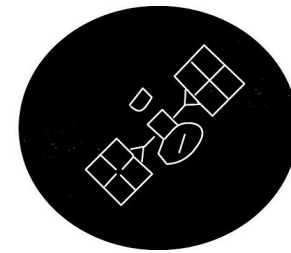
*The galaxy group HCG 87 with more distant background galaxies.* CREDIT: GMOS-S COMMISSIONING TEAM, GEMINI OBSERVATORY

the distance between the dots increase in the same way as the distance between galaxies. Current models state that such distances have increased by a factor higher than thousand since the epoch of the Cosmic Microwave Background! However, galaxies themselves are held by gravity and are thus able to retain their shapes.

## Observable galaxies are slowly disappearing

Recent observations have shown that the expansion of the Universe is actually accelerating: galaxies are moving away from each other faster and faster!

If the receding velocity of a galaxy keeps increasing, there will be a time when it will reach the speed of light. After that, light from this galaxy will never be able to reach us and the galaxy will totally dis-



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appear from our sight. Indeed, you can imagine the light coming from this galaxy as a runner on an expanding track whose finishing line is our galaxy: if the track expands faster than the runner can run, the runner will never reach the end of the track! Consequently, in an accelerated expanding Universe and according to our current models, we are doomed to

## Did you know?

- \* The earliest known observation of a galaxy outside of the Milky Way was made by the Persian astronomer Abd al-Rahman al-Sufi in the 10th century A.D., when he noted the fuzzy appearance of the Andromeda Galaxy.
- \* Hubble's law states that the receding velocity of a galaxy is proportional to its distance from Earth. It is named after the American astronomer Edwin Hubble, who published it in 1929.
- \* The velocity associated with the expansion of the Universe can be higher than the speed of light. However, this does not mean that objects can move through space faster than light, since the expansion of the Universe is an expansion of space itself.
- \* Since farther galaxies are redder than they should because of the expansion of the Universe, their "redshift" is a measure of their distance from us.

see less and less galaxies.

In hundred billion years, there would ultimately be only one single visible galaxy: ours. Not exactly the Milky Way, because it would have merged with Andromeda Galaxy, but the galaxy resulting from the merger. If there are still humans around, they won't be able to see as much of the Universe as we can see now. Do you think they would trust our observations and theories about the Universe and galaxies they wouldn't be able to see?

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