What lessons do we learn from the first-ever image of a black hole?

Back in 1873, John Michell came up with the idea of a black hole. He defined it as a massive object in a small volume of space which would allow nothing to escape from it – even if it's light. Karl Schwarzschild discovered a solution for General Relativity proposed by Einstein which would result in a black hole. However, this prediction wasn't tested for a really long period of time until the 10th of April, 2019. It was on this day that the scientists revealed the first-ever picture of an event horizon of the black hole. The black that we have finally been able to capture – thanks to the Event Horizon Telescope collaboration – it hails from the galaxy Messier 87. This galaxy is the most massive amongst the galaxies which lie in the neighbourhood of our galaxy. The diameter of the event horizon was 42 micro-arc-seconds. Thus, it means if we were to fill the entire sky black holes of the same size, we would require 23 quadrillion similar black holes.

We do acknowledge the fact there were plenty of unanswered questions pertaining to black holes but have we garnered any solutions to them? Yes, we have. Here's what we get to learn from a black hole.

1. A black hole if a definite: In the past, there were a lot of questions thrown at the credibility of the existence of a black hole. Scientists often tend to create unconventional theories. However, the General Relativity theory has passed each test of time and has proven that there are not possible replacements to the theory – especially with the recent evidence that we had laid our hands on.

There were some important observations that erupted from the evidence that we have got ahold. What the scientists witnessed was not a wormhole. We, for sure, know that there is a real event horizon and it is not a hard surface. Had it been a hard surface, the infalling matter would have radiated an infrared signature.

2. The black hole so discovered is a rotating black hole: With the observations that have been made, it can easily be figured that the radio emissions surrounding the event horizon of the newly discovered black hole point at it to be a rotating black hole rather than a non-rotating one.

The new discovery is a complex one; thus, in order to become certain of the nature of the black hole – scientists cannot rely upon one simple feature. Rather, they have to construct various models to understand the same. Once they gauge all the signals that emanate from the numerous prototypes, then only it can be understood whether the results are in consistency with the anticipated.

3. The radiation emitted from a black hole changes: It takes a day for the light to travel across the event horizon of the black hole. Despite having observed the black hole for a few days, it has been confirmed that the structure of the radiation being emitted changes over a period of time. After you go through the images that have been surfaced, you can witness that the pictures have a change in the structure that is visible. Thus, the logical conclusion of the observation is that the black hole is changing over time.

4. Magnetic field or not?: A new image is on its way and is going to clarify the polarization of the light coming from the black hole. The electromagnetic nature of light, when combined with a magnetic field, would allow us to get ahold of the polarization signature. Once this has been done, it would enable us to lay hands on the magnetic field of a black hole and we would be able to predict how that field is going to change over time. We have all the data in hand; however, once we analyse the situation – we would be able to understand it better.

5. Increased scope: If we have been able to gather images of a particular black hole located in a particular galaxy, it allows us the scope of accessing pictures of other black holes as well. The requirement of resolving a black hole is to better the telescope array's resolving power in comparison with the size of the object that you are having a look at. There is a possibility that we can increase the Event Horizon Telescope's power by launching telescopes into the orbit.

Also, we increase the frequency of our observations, the telescope's resolution is bound to see an upward trajectory. This is because wavelengths of higher-frequency would adjust in the same telescope. Thus, if we work on these improvements – not only can we tap into two or more galaxies but hundreds of them in order to reveal black holes. This proves that the future prospects for collecting black hole images look good.

6. Improved technology would lead to the revelation of various black holes: A planet does not orbit the sun only because the sun applies a gravitational pull on the former, but the planet also has a similar reaction towards the sun – the planet pulls back on the sun. On similar lines, when an object revolves around a black hole – it exerts a gravitational pull on the black hole, too.

Similar is the case of a black hole. There are innumerable objects in the galaxies and theory suggests that there are a number of small – and concealed – black holes in the galaxies, apart from the central one. Thus, the black hole is expected to experience a jitter.

However, it is difficult to measure the same and that is you require a reference point in order to calibrate your position with respect to that of the black hole. The stipulated technique to do so is to look at your calibrator, then the source and stay indulged in this back and forth procedure. However, the atmosphere changes rapidly and it gives you little time to look away from your target. Since technology is improving by the minute, there is the scope that we may be able to make progress in this aspect.

Nonetheless, now we have stepped into the era wherein we are to encounter black hole astronomy and we owe it to the network of scientists who made it possible.