Sagittarius A*

Sagittarius A* is the supermassive black hole at the Galactic Centre of the Milky Way. Viewed from Earth, it is located near the border of the constellations Sagittarius and Scorpius. The object is a bright and very compact astronomical radio source.

- ***Discovery***: -

In 1933, Karl Jansky, a physicist and Radio engineer, discovered that a radio signal was coming from a location in the direction of the constellation of Sagittarius, towards the centre of the Milky Way. The radio source later became known as Sagittarius A.

Sgr A*, was discovered in1974, by Balick and Robert L Brown using the baseline interferometer of the National Radio Astronomy Observatory. The name Sgr A* was coined by Brown in a 1982 paper because the radio source was "exciting", and excited states of atoms are denoted with asterisks.

- ***Observational evidence***: -

Conclusive evidence that the compact object Sagittarius A* is a supermassive black hole was delivered in 2018 when emissions caused by magnetic interactions from hot gas clumps close to the black hole moving at around 30% the speed of light were observed by astronomers using the European Southern Observatory (ESO)'s Very Large Telescope (VLT). These observations exactly matched theoretical predictions for hot spots orbiting close to a black hole.

- ***Physical Properties***: -

In 2008, astronomers Reinhard Genzel and Andrea Ghez determined Sagittarius A* to have a mass 4.3 million solar masses. Astronomers have also calculated that its diameter is around 14.6 million miles (23.5 million kilometres).

- ***Surrounding Environment***: -

Dwarfing Sagittarius A* is a disk of gas surrounding it that extends for between 5 and 30 light-years occasionally feeding matter to Sagittarius A* causing faint flashes of X-rays. This accretion disc is also connected with X-ray emissions (called as jets) caused by friction driving temperatures in the disc up as high as 18 million degrees Fahrenheit (10 million degrees Celsius).

- ***Significance in the Study of Galactic Dynamics and the Evolution of Galaxies***: -

The motion of stars and other objects near Sagittarius A* can be studied to understand the gravitational dynamics of our galaxy. By observing the orbits of stars around Sagittarius A*, scientists can measure the black hole's mass, confirm its existence, and test the predictions of Einstein's theory of general relativity.

Its gravitational influence affects the distribution of stars, gas, and dust throughout the Milky Way. Understanding Sagittarius A* helps us comprehend the formation and evolution of galaxies in general.

- ***<u>Ongoing Research and Future Observational Strategies</u>***: -

Scientists are still studying Sagittarius A* and want to understand how it works, like how it pulls in stuff and makes jets. They're using special telescopes to take pictures of it and looking for signs of black holes crashing into each other nearby. They're also watching how stars move around it to learn more about our galaxy.

Future observational strategies include enhancing the capabilities of existing telescopes and developing new instruments to probe different wavelengths of light and detect other cosmic messengers like neutrinos and gravitational waves. By combining data from multiple sources, researchers hope to gain a comprehensive understanding of Sgr A*'s properties, including its accretion processes, jet formation, and overall impact on galactic evolution. This collaborative effort will contribute to unravelling the mysteries surrounding supermassive black holes and their role in shaping the universe.