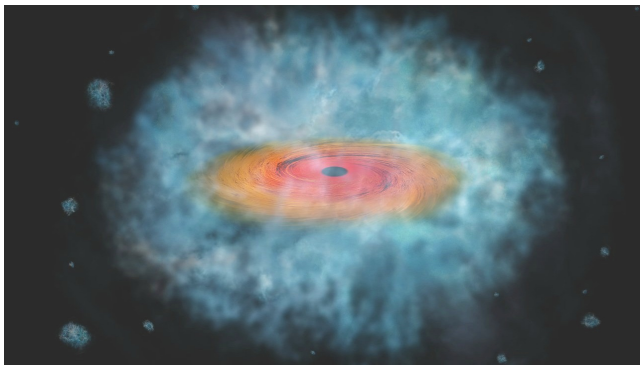
**UNDERSTANDING MASSIVE BLACK HOLES**

For years astronomers have debated how the earliest generation of supermassive black holes formed very quickly, relatively speaking, after the Big Bang. Now, an Italian team has identified two objects in the early universe that seem to be the origin of these early supermassive black holes. The two objects represent the most promising black hole seed candidates found so far.

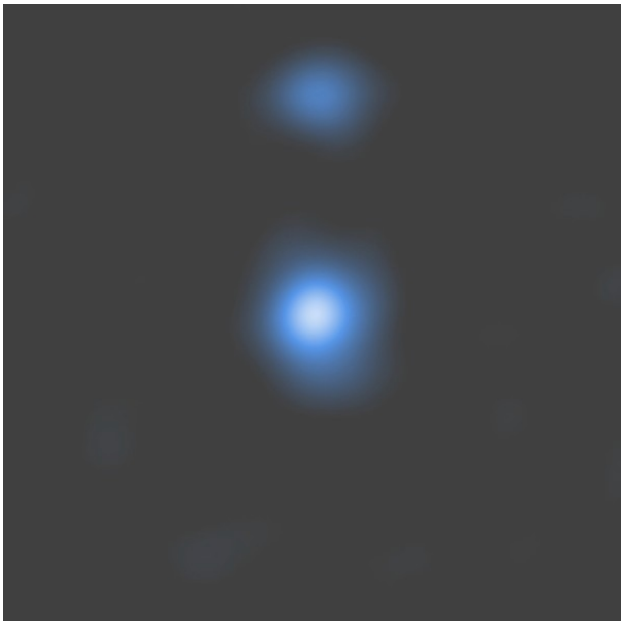
**NASA announced yesterday (May 24, 2016) that astrophysicists have taken a major step forward in understanding how supermassive black holes formed.** Using data from three different telescopes, researchers have found the best evidence yet to suggest that supermassive black holes in the early universe **were produced by the direct collapse of a massive gas cloud**.



This artist's impression shows a possible seed for the formation of a supermassive black hole. Two of these possible seeds were discovered by an Italian team, using three space telescopes

Supermassive black holes contain millions or even billions of times the mass of the sun. In the modern universe they can be found in the centre of nearly all large galaxies, including the Milky Way. **The supermassive black hole in the center of the Milky Way has a mass of four million solar masses**. The two black hole seed candidates would also be the progenitors of two of the modern supermassive black holes, say the researchers.

The group used computer models and applied a new analysis method to data from the NASA Chandra X-ray Observatory, the NASA/ESA Hubble Space Telescope, and the NASA Spitzer Space Telescope to find and identify the two objects. **Both of these newly discovered black hole seed candidates are seen less than a billion years after the Big Bang and have an initial mass of about 100,000 times the sun.**



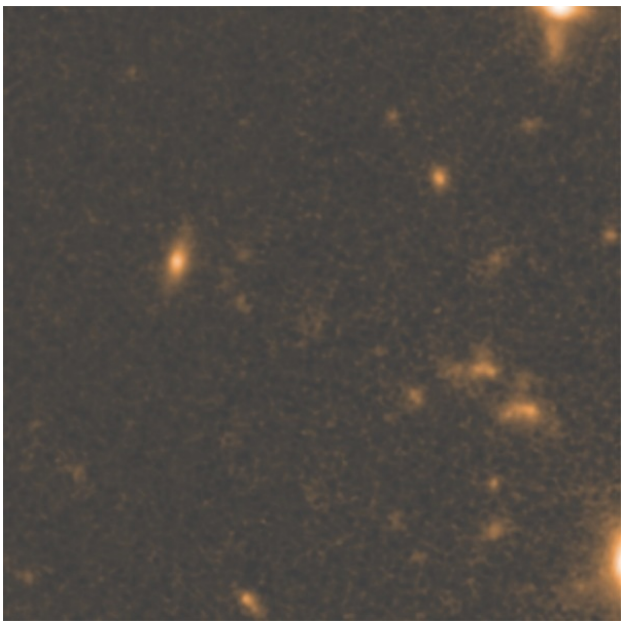
This image shows one of two detected supermassive black hole seeds, OBJ29323, as it is seen by the NASA Chandra Space Telescope. The properties of the X-ray data match those predicted by models produced by the Italian research team.

**Fabio Pacucci,** of Scuola Normale Superiore in Pisa, Italy is lead author of the study. Pacucci said in a statement:

*Our discovery, if confirmed, would explain how these monster black holes were born.*

This new result helps to explain why we see supermassive black holes less than one billion years after the Big Bang. There are two main theories to explain the formation of supermassive black holes in the early universe. One assumes that the seeds grow out of black holes with a mass about ten to a hundred times greater than our sun, as expected for the collapse of a massive star. The black hole seeds then grew through mergers with other small black holes and by pulling in gas from their surroundings. However, they would have to grow at an unusually high rate to reach the mass of supermassive black holes already discovered in the billion years young universe.

**The new findings support the scenario that some early massive black holes formed directly when a massive cloud of gas collapsed**. In this case the growth of the black holes would proceed more quickly.



This image shows one of two detected supermassive black hole seeds, OBJ29323, as it is seen by the NASA/ESA Hubble Space Telescope

**Andrea Ferrara**, a co-author,.said:

*Our work suggests black holes start big and grow at the normal rate, rather than starting small and growing at a very fast rate*. AK with EarthSky Notes