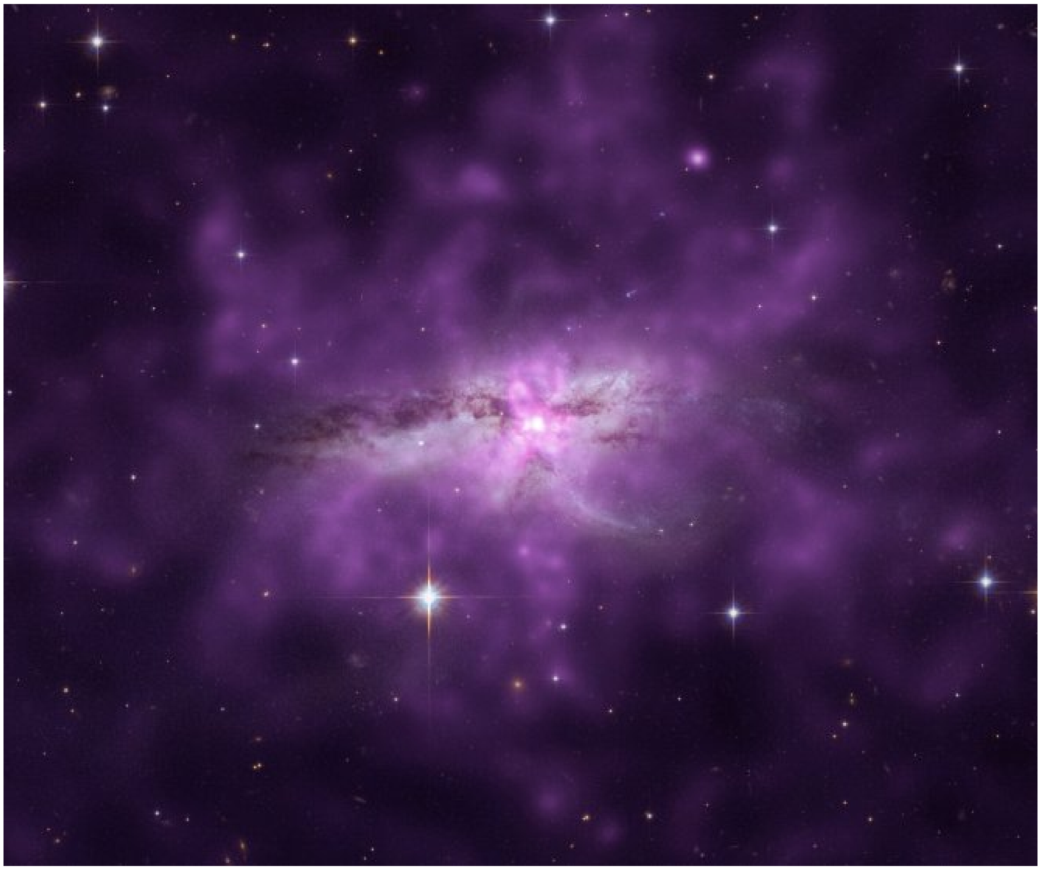
Giant Gas Cloud in System NGC 6240



Scientists have used Chandra to make a detailed study of an enormous cloud of hot gas enveloping two large, colliding galaxies. This unusually large reservoir of gas contains as much mass as 10 billion Suns, spans about 300,000 light years, and radiates at a temperature of more than 7 million degrees.

This giant gas cloud, which scientists call a "halo," is located in the system called NGC 6240. Astronomers have long known that NGC 6240 is the site of the merger of two large spiral galaxies similar in size to our own Milky Way. Each galaxy contains a supermassive black hole at its center. The black holes are spiraling toward one another, and may eventually merge to form a larger black hole.

Problem 1 - If 1 light year equals 9.5×10^{15} meters, and the cloud is in the shape of a sphere with a diameter of 300,000 light years, what is the volume of this cloud in cubic meters? ($\pi = 3.141$)

Problem 2 - The mass of the sun is 2.0×10^{30} kilograms. What is the density of this cloud in kilograms/m^3?

Problem 3 - If a single hydrogen atom has a mass of 1.7×10^{-27} kilograms, how many hydrogen atoms per cubic meter does the gas density represent?

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http://www.nasa.gov/mission_pages/chandra/multimedia/ngc6240.html

Problem 1 - If 1 light year equals 9.5 x 10^{15} meters, and the cloud is in the shape of a sphere with a diameter of 300,000 light years, what is the volume of this cloud in cubic meters? (π = 3.141)

Answer: V = 4/3 π R^3 so
V = 1.333 (3.141) (150,000 x 9.5x1015 meters)^3
= **1.2 x 10^{64} meters^3**

Problem 2 - The mass of the sun is 2.0 x 10^{30} kilograms. What is the density of this cloud in kilograms/m^3?

Answer: Mass of cloud = 10 billion suns = 10^{10} x 2.0x10^{30} kg = 2.0x10^{40} kg.

Density = mass/volume
= 2.0x10^{40} kg / 1.2x10^{64} m^3
= **1.7x10^{-24} kg/m^3**

Problem 3 - If a single hydrogen atom has a mass of 1.7x10^{-27} kilograms, how many hydrogen atoms per cubic meter does the gas density represent?

Answer: Density = 1.7x10^{-24} kg/m^3 x (1 atom/1.7x10^{-27} kg)
= **1000 atoms/meter^3**