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Until recently most astronomers believed that the space between the galaxies in our universe was a near perfect vacuum. This orthodox view of the universe is now being challenged by astronomers who believe that a heavy “rain” of gas is falling into many galaxies from the supposedly empty space around them. The gas apparently condenses into a collection of small stars, each a little larger than the planet Jupiter. These stars vastly outnumber the other stars in a given galaxy. The amount of “intergalactic rainfall” into some of these galaxies has been enough to double their mass in the time since they formed. Scientists have begun to suspect that this intergalactic gas is probably a mixture of gases left over from the “big bang” when the galaxies were formed and gas was forced out of galaxies by supernova explosions. It is well known that when gas is cooled at a constant pressure its volume decreases. Thus, the physicist Fabian reasoned that as intergalactic gas cools, the cooler gas shrinks inward toward the center of the galaxy. Meanwhile its place is taken by hotter intergalactic gas from farther out on the edge of the galaxy, which cools as it is compressed and flows into the galaxy. The net result is a continuous flow of gas, starting as hot gases in intergalactic space and ending as a drizzle of cool gas called a “cooling flow,” falling into the central galaxy. A fairly heretical idea in the 1970’s, the cooling-flow theory gained support when Fabian observed a cluster of galaxies in the

constellation Perseus and found the(30) central galaxy, NGC 1275, to be a strange-looking object with irregular, thin strands of gas radiating from it. According to previous speculation, these strands were gases that had been blown out by an explosion in the galaxy. Fabian, however, disagreed. Because the strands(35) of gas radiating from NGC 1275 are visible in optical photographs, Fabian suggested that such strands consisted not of gas blown out of the galaxy but of cooling flows of gas streaming inward. He noted that the wavelengths of the radiation emitted by a gas would changes as the(40) gas cooled, so that as the gas flowed into the galaxy and became cooler, it would emit not x-rays, but visible light, like that which was captured in the photographs. Fabian ' s hypothesis was supported by Canizares ' determination in1982 that most of the gas in the Perseus cluster was at a(45) temperature of 80 million degrees Kelvin, whereas the gas immediately surrounding NGC 1275 (the subject of the photographs) was at one-tenth this temperature. 1. The primary purpose of the passage is to (A) illustrate a hypothesis about the origin of galaxies (B) provide evidence to dispute an accepted theory about the evolution of galaxies (C) summarize the state of and prospects for research in intergalactic astronomy (D) report new data on the origins of intergalactic gas (E) reconcile opposing views on the formation of intergalactic gas 2. The author uses the phrase " orthodox view of the universe " (line 3) to refer to the belief that (A) the space between the galaxies is devoid of matter (B) the space between galaxies is occupied by stars that cannot be detected by optical photographs (C) galaxies have decreased in mass by half

since their formation (D) galaxies contain stars, each the size of Jupiter, which form clusters (E) galaxies are being penetrated by gas forced out of other galaxies by supernova explosions. 3. It can be inferred from the passage that, if Fabian is correct, gas in the peripheral regions of a galaxy cluster (A) streams outward into intergalactic space (B) is hotter than gas in the central regions of the galaxy (C) is composed primarily of gas left over from the big bang (D) results in the creation of unusually large stars (E) expands to increase the size of the galaxy 4. The author of the passage probably mentions Canizares' determination in order to (A) clarify an ambiguity in Fabian's research findings (B) illustrate a generalization about the temperature of gas in a galaxy cluster (C) introduce a new argument in support of the orthodox view of galaxies (D) provide support for Fabian's assertions about the Perseus galaxies (E) provide an alternate point of view concerning the movement of gas within a galaxy cluster 5. According to the passage, Fabian believes that gas flowing into a central galaxy has which of the following characteristics? (A) It is one-tenth hotter than it was in the outer regions of the galaxy cluster. (B) It emits radiation with wavelengths that change as the gas moves toward the center of the galaxy. (C) The total amount of radiation emitted diminishes as the gas cools. (D) It loses 90 percent of its energy as it moves to the center of the galaxy. (E) It condenses at a rate much slower than the rate of decrease in temperature as the gas flows inward. 6. According to the passage, Fabian's theory makes use of which of the following principles? (A) Gas emanating from an explosion will be hotter the

more distant it is from the origin. (B) The wavelength of radiation emitted by a gas as it cools remains constant. (C) If pressure remains constant, the volume of a gas will decrease as it is cooled. (D) The volume of a gas will increase as the pressure increases. (E) As gas cools, its density decreases.

7. It can be inferred from the passage that which of the following is true of Fabian ' s theory? (A) It did not receive approval until Canizares ' work was published. (B) It was not widely accepted in the 1970 ' s. (C) It did not receive support initially because technology was not available to confirm its tenets. (D) It supports earlier speculation that intergalactic gas was largely the result of explosions outside the galaxy. (E) It was widely challenged until x-ray evidence of gas temperatures in NGC 1275 had been presented.

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