Black holes essay

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IV. How are they discovered? A. X-ray EmissionsB. Exotic Energy SourcesC. Star speedsD. MasersE. The Baseline ArrayF. Hubble TelescopeG. SatellitesV. Quasi-Stellar RelationsVI. LocationsA. M87B. Milky WayC. AndromedaD. ?????? E. NGC 6240F. A0620-00What are black holes? Black holes are the remains of a massive star that has collapsed and shrunkto a tiny point in space. They have all of the gravity of the star concentrated into that point. Black holesare difficult to see because they cannot be seen. They cannot be seen because they are spinning faster thanthe speed of light and light cannot escape from them. They can be compared to a giant vacuum cleaner, they suck in anything that gets near them. Where do black holes come from? Black holes are formed when giant stars run out of fuel and areoverwhelmed by their own gravity. When this happens they cannot keep from collapsing. After starscollapse, they start rotating and as they arespinning, their gravity becomes stronger causing them to shrink. As the object becomes smaller, it startsspinning faster and faster.

Using a small black marble as an example of the size that Earth would become if it collapsed andbecame a black hole, Todd R. Lauer, of the National Optical Astronomy Observatories said, ” Black holesare very messy eaters. If you took that marble to an ‘ all-you-can-eat buffet’ allowing it to consume all thematter around it, the feeding frenzy would produce as much radiation as the Sun.” Research indicates thatblack holes may have existed at the beginning of time. Black holes are so dense that not even light canescape. Looking towards a black hole, the stars behind it would appear

out of place because black holesdistort light. The immense gravitational pull of black holes is thought to be responsible for the swirlingmasses of stars in spiral galaxies throughout the universe. Gravity in a black hole should be able to packstars in so tight that the intensity of the stars' light would drastically increase towards the center of gravity. Everything falling into a bla! ck hole loses its identity, you couldn't tell if it were a satellite or a T. V. set that fell in. Dr. Fred Chromeyof Vassar College in New York said, " Black holes are the easiest way to explain some of the strange thingsthat are going on in some of the galaxies." Research indicates that if a black hole formed, it wouldeventually evaporate but it would take millions of years.

Earth's escape velocity, the speed it takes to escape the pull of gravity, is 11 kilometers per second. The escape velocity of a black hole is 300, 000 kilometers per second, which is faster than the speed oflight. If Earth's diameter shrank to less than 1 centimeter, the escape velocity would exceed the sped oflight, the escape velocity of a black hole. Anything can become a black hole if you compress it enough.

How are black holes located? Black holes technically can't be seen, but they give off many cluesto their location. Signs of many black holes have been located during normal observation of other spaceobjects. Abnormally high levels of X-rays and gamma rays are the most common clues, but other exoticenergy sources are also good clues. Astronomers have also located black holes by studying the speeds ofswirling galaxies. If large objects are moving at very high speeds astronomers usually try to track theirorbits and try to locate a central object that could be the source of the gravity. Another clue to the locationof black holes are masers. Masers are the cosmic

relatives of lasers. They are water molecules orbitingblack holes that capture and amplify radiation and send it back out into space. Masers are usually locatedin the accretion disk, the swirling cloud of gases above a black hole. Some masers have been clockedtraveling over 650 miles per second.

Many types of equipment are used to locate black holes. One type of equipment is called theBaseline Array. The Baseline Array consists of 10 radio dishes, each 82 feet across, spaced across a 5, 000mile area. It acts as one 5, 000 mile wide telescope. The Baseline Array is so accurate the a user in LosAngeles can read a newspaper in New York. Other pieces of equipment used are ‘ orbiting observatories’like the Hubble Telescope, which provided the first conclusive proof of black holes. Orbiting satellites arealso used to detect radio waves usually given off by black holes. The British satellite Ariel V discoveredthe black hole A0620-00 this way.

Black holes may be related to the most exotic space phenomenon, quasi-stellar objects, mostcommonly called quasars. Quasars shine so brightly that astrophysicists think the light must come fromsuperheated matter falling into a black hole. The leading theory about quasars says they may represent theearliest period of evolution of galaxies. Quasars, so far, are the most distant objects known, some as far as10 billion light years away. Black holes are usually found in or near companion star pairs. One of the stars is sometimes adark star, a star that is hard to see or can’t be seen. Bruce Margon from the University of Washington-Seattle says, ” We are finding that black holes come in a large number of sizes. Nature makes them like 50-and 100-watt light bulbs.” Astronomers are finding that for reason, closer black holes are smaller than themore distant ones. Black holes can be located by

studying how they affect their surroundings. A super-massive black hole has been located at the heart of Galaxy M87. It is between 2. 5 and 3. 5billion times the size of our sun. The accretion disk at M87 is rotating at at least 1. 2 million miles per hour. Some people think that it might be a cluster of neutron stars, but it would take more than 2 billion stars toget something that big. Anything that big in that small of an area would eventually collapse into a blackhole anyway. Superluminal jets, groups of high speed electrons which are flung out of galaxies thought tocontain black holes, have been detected coming out of M87. Superluminal jets can travel close to thespeed, but the fastest one has ever been found was going 93% of the speed of light. The frontier of theM87 black hole is roughly the same distance that Uranus is from the Sun. Superluminal jets in the Milky Way indicates a black hole is lurking nearby. Astronomers havelocated something strange, near Sagittarius A* that is less than 1 million times the size of our sun, in theMilky Way. This object doesn’t give off enough radiation to be a normal black hole. Scientists havedevised a model that would explain the lower radiation levels. The object is superheating the gases beforethey enter. The heated gases move faster so less energy escapes. The model shows that the object canconsume 99. 9% of the energy that is given off leaving . 1% to escape, which would account for the lowenergy levels.

A black hole smaller than the one in Galaxy M87 has been located near the center of theAndromeda Galaxy, with a mass of only a few million solar masses. Near the center of the galaxy, thereare two star clusters, one bright the other faint. The bright cluster may be the nucleus of a dwarf galaxythat Andromeda may have captured. The faint cluster is moving at a speed of

over 850, 000 miles per hour, which is good evidence of a black hole. If Andromeda holds a black hole it would mean that there is ablack hole 50 times closer than the one in M87.

Another black hole was discovered in a galaxy less than 21 million light years from Earth. Thisblack hole has a mass of more than 40 million suns.

In Galaxy NGC 6240, almost 300 million light years from Earth, astronomers believe to havefound a black hole during observations of two colliding galaxies. The black hole is caught between the twogalaxies and is expected to merge with them in the next few hundred million years. It has a mass 10 to 100times larger than any black hole ever found. It has the mass of the Milky Way in 1/10, 000th the area. Itmay have been left over from an early universe, or a quasar that has burned itself out. Its finding suggeststhe presence of a lot of unobserved matter and it may be the first step in explaining dark matter or missingmass. The object itself may be a form of dark matter, which makes up 90% of the mass of the universe.

In 1975 an X-ray burst and an optical nova lead to the discovery of a black hole. The black holeA0620-00 is located in the constellation Monoceros. It is a dark object with a mass exceeding 3 solarmasses. It is part of a binary system, a pair of stars that orbit each other, consisting of an orange dwarf anditself. Orange dwarfs are very common, in fact they make up more than 15% of star masses. The star isorbiting the black hole. Astronomers have found that only half of the light comes from the star, the otherhalf comes from the accretion disk circling the black hole.

Black holes are much more common than astronomers once thought. Future research may locatemany more exotic phenomenon. Astronomers believe there may be thousands of black holes and othermysteries of space, and they hope to learn more about them in the future. ReferencesCowen, Ron. “ Repaired Hubble Finds Giant Black Hole” Science News, 145 (June 4, 1994) p. 356Croswell, Ken. “ The Best Black Hole in the Galaxy” Astronomy, (March, 1992) pp. 30-37Dye, Lee. “ Evidence of Massive Black Hole Discovered by Astronomers” Los Angeles Times, (January12, 1995)p. A3+Flamsteed, Sam. “ 99. 9 Percent Sure” Discover, 16 (January, 1995) p. 32Kaiser, Jocelyn. “ Does the Milky Way Hide its Black Hole?” Science News, 147 (April 15, 1995) p. 230Majeski, Tom. “ Evidence of Second Black Hole Detailed” Knight-Ridder/Tribune News Service, (May 31, 1994)p. 0531K6533Naeye, Robert. “ Faster Than Light?” Discover, 16 (January, 1995) p. 33Sawyer, Kathy. Monstrous, Dark Stranger Seen in Neighborhood of Galaxy” Washington Post,(April 10, 1991) p. A2Sawyer, Kathy. “ Scientists Detect 12 Black Holes” Las Vegas Review-Journal+ Sun, (August 2, 1992) p. 21EShipman, Harry L. Black Holes, Quasars, and the UniverseBoston, Houghton Mifflin Company, 1980Taylor, Ronald A. “ Astronomers Spot Massive Mystery” Washington Times, (April 10, 1991) p. A4Black HolesbyTable of ContentsI. What are black holes? II. Where do they come from? III. Interesting facts about black holes.

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