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Cosmic Rays Come from Active Galaxies. Maybe...

Cosmic ray source still a subject of debate

Not long ago, scientists tracked down the origin of cosmic rays to supermassive black holes located in the cores of active galactic nuclei. Cosmic rays are streams of high energy subatomic particles coming from intergalactic space. Ultra-high-energy cosmic rays, however, are far more energetic than usual cosmic rays, capable of reaching energies of 10^{20} (1 followed by 20 zeros) electron volts per subatomic particle. Such energies can't be reached even in the most powerful particle accelerators in the world today. As they travel through space, cosmic rays and ultra-high-energy cosmic rays, UHECRs, eventually hit the Earth's atmosphere determining a shower of other subatomic particles. By observing the latter, Pierre Auger Observatory researchers have been able to establish, in late 2007, a pattern of 27 of the most energetic cosmic rays. According to these observations, most of them came from directions less than 3 degrees of the cores of active galaxies, believed to contain supermassive black holes. This means that galaxies not only emit cosmic rays, but UHECR as well. Stanford University researcher Igor Moskalenko believes otherwise. In fact, the UHECR emissions corroborated by researchers from the Pierre Auger Observatory with active galaxies are by no means special nor associated to any pattern. "The sample consists mainly of low-power active galaxies. The correlation found by the Auger group is likely to be a chance coincidence", Maskalenko explains. The problem is, Moskalenko says, that these active galaxies are simply too weak to determine such high energy cosmic rays and they don't present evidence of the high-energy gamma-ray emissions that are associated with subatomic particle acceleration. He believes that the ultra-high-energy cosmic rays are probably created by quasars and radio galaxies, which are known to eject high-speed jets of material and gamma-ray. For example, more than four of these UHECRs could have been emitted by the Centaurus A radio galaxy, located only 12 million light years away from us. The fact that most of the ultra-high-energy cosmic rays do not match the direction of the active galaxies that emitted them is probably because cosmic rays are most likely made up of heavy, charged subatomic particles, such as protons, whose path through intergalactic space can be easily altered by magnetic fields. Jim Hinton from the Leeds University, part of the Pierre Auger Observatory team, says that if the galaxies are indeed weak they should not produce even a single ultra-high energy cosmic ray emission that would reach Earth. This would also explain why only 27 UHECRs were ever detected. "Which ones are seen is largely a matter of chance. This also implies that UHECR-accelerating active galaxies are common in nature - i.e., they are not just the powerful radio galaxies. This implication is something that has surprised many authors - but nature may just be like that!", said Hinton.