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White holes: The extreme objects of particle astrophysics

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Abstract. The name 'white hole' is intended to exploit a lively interest by the lay public in black holes, the extreme objects of gravitational astrophysics. Black holes are understood as openings into which entering matter disappears from observation. White holes are openings out of which matter emerges, often with properties that have been given intriguing names: 'strangeness', 'charm' and the like. These are properties that are unknowable by ordinary observations, but they are absolutely necessary for a deep understanding of the laws that govern the universe. White holes open up briefly in events where energy is made available for creating of particle-antiparticle pairs. The first observed events of this kind were encounters of cosmic rays with nuclei. A series of Nobel Prize-winning discoveries made by observing such events led to the development of giant particle accelerators for generating controlled beams of artificial cosmic rays. The name 'white hole' also fits decay events. White holes are ranked by the amount of energy that is made available. In case of ordinary cosmic ray collisions, this is about 10^{10} eV. A milestone in accelerator physics was the discovery of W and Z bosons. Decays of these exotic particles liberates more than 10^{11} eV. But the cosmic ray energy spectrum extends beyond 10^{20} eV. Where do such cosmic rays come from? Do they emerge from white holes that liberate even greater amounts of energy? The decay of X-particles with energy of order 10^{24} eV has been suggested. Why stop there? I'm intrigued by the notion of an 'ur-particle' so massive–energy equivalent 10^{90} eV–that its decay opened the ultimate white hole from which the universe emerged. This way of accounting for the 'big bang' implies that the fundamental laws already existed; they weren't violated at the first instant. One can imagine that the ur-particle decays into other extreme -mass particles in a chain that accounts for structure (clustering and voids) in an alternative manner than by inflation. At a certain stage, of course, downward cascading must kick in so as to account for the microwave cosmic background. Finally, is it possible that gamma ray bursts are white holes (with somewhat lower energy, about 10^{64} eV) resulting from decay of sufficiently long-lived supermassive particles belonging to the same hierarchy?

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