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Astrophysical ZeV acceleration in the relativistic jet from an accreting supermassive blackhole

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An accreting supermassive blackhole, the central engine of active galactic nucleus (AGN), is capable of exciting extreme amplitude Alfven waves whose wavelength (wave packet) size is characterized by its clumpiness. The ponderomotive force is driven by these Alfven waves propagating along the AGN (blazar) jet, and is capable of accelerating protons/nuclei to extreme energies beyond Zetta-electron volt (ZeV $=10^{21}$ eV). Such acceleration is prompt, localized, and does not suffer from the multiple scattering/bending enveloped in the Fermi acceleration that causes excessive synchrotron radiation loss beyond 10^{19} eV. The ponderomotive accerelation was confirmed one-dimentional particle-in-cell simulations. The production rate of ZeV cosmic rays is found to be consistent with the observed gamma-ray luminosity function of blazars and their time variabilities, while the episodic phase of the acceleration and the spectral index may be explainable by the present theory. General relativisitic Magneto-hydrodynamics simulations show the intermittent eruptions of electromagnetic waves from the innermost region of the accretiond disk around a black hole.

Biography

Toshikazu Ebisuzaki has completed his PhD from Graduate School of Physics, Univeristy of Tokyo. Since then, he has actively worked in the Astrophysics, Computational Science and Earth Sciences and published more than 170 papers in reputed journals. He is the Chief Scientist of Computational Astrophysics Laboratory at RIKEN.

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