[초IT-03] How the Sun generates "killer electrons" in near-Earth space

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A fundamental problem in space physics is to explain the origin of energetic charged particles in space close to the Earth and the significant temporal variations of their flux. The particles are primarily electrons and protons although energetic heavy ions such as O+ are sometimes non-negligible. By "energetic" we mean a rather broad energy range of particles from a few tens of keV to well above MeV. Drastic variations of the particle fluxes (by >3 orders of magnitude) occur over both a short time scale like a few minutes and a long time scale like the 11-year sunspot cycle. In this talk I will focus on relativistic energy electrons (~MeV) trapped within the Earth's magnetosphere. They are a primary element of the space weather since they can cause damage to satellites, so often called "killer electrons". Considering that the source particles in both the solar wind and the ionosphere are relatively cold (~eV), the quasi-permanent existence of these very energetic particles close to the Earth has been a surprise to space physicists for decades. Complex electromagnetic processes such as wave-particle interactions within the magnetosphere are believed to play a major role in generating these killer electrons. While detailed physics remains an active research area, for this lecture I will introduce a synthesized picture of how solar activities are related to wave-particle interaction physics inside the magnetosphere. This can be applied to other astrophysical systems.