

Ground-based high-energy radiation measurement of photonuclear reaction triggered by lightning discharge

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There is an increasing number of observations of high-energy atmospheric phenomena in Japanese winter thundercloud and lightning. Since 2015, the Gamma-Ray Observation of Winter THundercloud (GROWTH) collaboration started multi-point ground-based radiation measurements along the Japan sea aiming to study the gamma-ray radiation during winter thunderstorms. On 6 February 2017, an intense gamma-ray flash was detected simultaneously with a lightning discharge occurred 0.5-1.7 kilometres away from our monitoring stations. A subsequent gamma-ray afterglow exponentially decays with 40-60 millisecond constant, followed by prolonged 0.511 megaelectronvolts line emission about 35 seconds after the lightning (Enoto, Wada et al. Nature 2017, Vol 551, 481). The series of detected radiation is well explained by signals of neutrons and positrons produced via photonuclear reaction triggered by the lightning discharge. We will report this lightning-induced nuclear reaction and current status of our radiation measurement project.

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