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An experimental verification of the relativity of galactic cosmic rays and aerosol nucleation

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It is well known that the galactic cosmic ray (GCR) flux is modulated by the change of solar magnetic activity. It has been pointed out that there is a strong correlation between the GCR flux and the amount of the cloud in the lower atmosphere (altitude < 3.2km) by the recent studies(Svensmark et al ; 1997,2000). There is a hypothesis to explain this correlation that the aerosols are created by the effect of ions that were produced through the ionization by the GCR, then grow up to the cloud condensation nuclei and finally form seeds of the cloud. However, the mechanism has not been well understood quantitatively. An experiment called SKY-experiment(Svensmark et al; 2007)was conducted to reproduce a part of this physical process, but some questions were still left uncertainly.

With the aim to obtain a decisive mechanism connecting to the correlation of the GCR and aerosol nucleation, we have conducted an experiment with the gas chamber in which the reaction of the atmosphere by the irradiation of beta rays as the GCR and of the ultraviolet of 253.7 nm is reproduced. For the experiment, we have arranged a gas supply system to control concentration of SO₂, H₂O and ozone in air, a chamber for reaction and an ion detector to measure the ion density in the chamber. Then we have measured a change in the aerosol density in the mixed gas with the irradiation of beta rays and the ultraviolet of 253.7 nm.

In this presentation, we report our recent results of the experiments.

Keywords: galactic cosmic rays, aerosol, ion, clouds