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Aerosol nucleation induced by a high energy particle beam

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The effect of ions in aerosol nucleation is a subject where much remains to be discovered. That ions can enhance nucleation has been shown by theory, observations, and experiments. However, the exact mechanism still remains to be determined. One question is if the nature of the ionization affects the nucleation. This is an essential question since many experiments have been performed using radioactive sources that ionize differently than the cosmic rays which are responsible for the majority of atmospheric ionization.

Here we report on an experimental study of sulphuric acid aerosol nucleation under near atmospheric conditions using a 580 MeV electron beam to ionize the volume of the reaction chamber. We find a clear and significant contribution from ion induced nucleation and consider this to be an unambiguous observation of the ion-effect on aerosol nucleation using a particle beam under conditions not far from the Earth's atmosphere. By comparison with ionization using a gamma source we further show that the nature of the ionizing particles is not important for the ion component of the nucleation.