Abstract of the lecture:

Atmospheric aerosol particles affect the quality of our life in many different ways. First of all, they influence the Earth's radiation balance directly by scattering and absorbing solar radiation, and indirectly by acting as cloud condensation nuclei (CCN). The interaction between atmospheric aerosols and climate system is the dominant uncertainty in predicting the radiative forcing and future climate. Secondly, aerosol particles deteriorate both human health and visibility in urban areas. The interactions between air quality and climate are largely unknown, although some links have been identified. Thirdly, aerosol particles modify the intensity and distribution of radiation that reaches the earth surface, having direct influences on the terrestrial carbon sink. Better understanding and quantifying of the above aerosol effects in the atmosphere requires detailed information on how different sources (such as atmospheric nucleation) and atmospheric transformation processes modify the properties of atmospheric particles and the concentrations of trace gases.

Formation and growth of aerosol particles have been observed all around the world, and its contribution to total aerosol concentration is dominating (50−90%) and to CCN production is significant (30−50%). The detailed understanding of the initial process requires knowledge on the concentrations of neutral and charged clusters, on their chemical composition and on the gas phase precursor data. We have shown that the atmospheric nucleation occurs in size around 1.5 nm (mobility diameter). Already in 2000, we predicted theoretically the existence of thermodynamically stable atmospheric clusters, and nowadays there is growing number of observations of sub 3 nm and even sub 2 nm clusters. Recently, we have been able to perform the size segregated measurements of concentration and dynamics of atmospheric clusters down to 0.9 nm.