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Experimental investigation of aerosol composition and growth rates

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Atmospheric aerosol particles have relevant influence on human lives. Human health is affected, as by breathing in the aerosol particles, they deposit in the lungs causing various health problems. Also they interfere indirectly and directly with sunlight, which affects the climate on Earth.

Primary aerosol particles originate for example from anthropogenic sources, such as Diesel cars or natural sources such as dessert dust. Secondary aerosol particles are formed via condensation of low volatile gas phase compounds. First, small clusters consisting of a few gas molecules only are formed, which can then grow to bigger aerosol particles. These then form seeds for cloud droplets. The chemical composition of the cloud particles determines whether the cloud absorbs or scatters sunlight more. Intensive experimental and theoretical work has been put into understanding the details of the initial processes leading to the natural formation of these secondary aerosol particles. According to modelling studies, aerosol particles formed via the nucleation process are responsible for about 50% of the global cloud condensation nuclei concentration.

With currently used methods, the chemical composition of small molecular clusters (up to 2nm in diameter) can be resolved. Also standard methods to determine aerosol particle composition at sizes >10 nm are available. Within this project, the aerosol particle composition in the 2-4 nm size range will be investigated experimentally. The setup will consist of a combination of an electrical method that allows determine the electrical mobility of the particles which then can be converted to a diameter. By letting the charged particles travel through a changing electrical field, they travel at different speeds according to their mobility. That allows to particles with certain mobilities, which then can be converted to a diameter. After the size selection, the particles are counted by means of optical detection. Condensation particle counters (CPCs) grow the particles internally, after which they are detected optically. By changing the condensing liquid, depending on the aerosol particle composition, they are activated differently. By combining the electrical size selection with CPCs with different liquids, information about particle composition can be determined. The project includes laboratory studies and field measurements in different locations (one rural site and two urban sites).

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