Droplet Nucleation In a Rapid Expansion Aerosol Chamber

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We present a new experimental facility to investigate the nucleation and growth of liquid droplets and ice particles under controlled conditions and characterize processes relevant to cloud microphysics : the rapid expansion aerosol chamber (REACh), cf. Fig. 1. REACh is an intermediate size chamber ($\sim 0.14\ \mathrm{m}^3$) combining the principle of an expansion chamber with the ability to probe the influence of turbulent flows. Nucleation is achieved via a sudden pressure drop accompanied by a temperature drop, which can cause humid air to condense into a cloud of droplets under the appropriate thermodynamic conditions. REACh features tight control and monitoring of the initial saturation ratio of water vapor, identity and concentration of seeding aerosol particles, temperature, pressure, and air flow mixing, together with high speed real time measurements of aerosol and droplet size and number.

The total droplet concentration scales linearly with the seeding aerosol concentration, suggesting that all injected aerosol particles serve as condensation nuclei. While the total number of droplets formed increases with aerosol concentration, the mean droplet size decreases with the concentration of seeding aerosols as a result of competition for the available water vapor. The high repetition rate of experiments that we can perform in REACh will permit extensive characterization of aerosol-nucleation including nucleation onset, droplet and ice growth and the importance of turbulence fluctuations. More details in the related article [1].

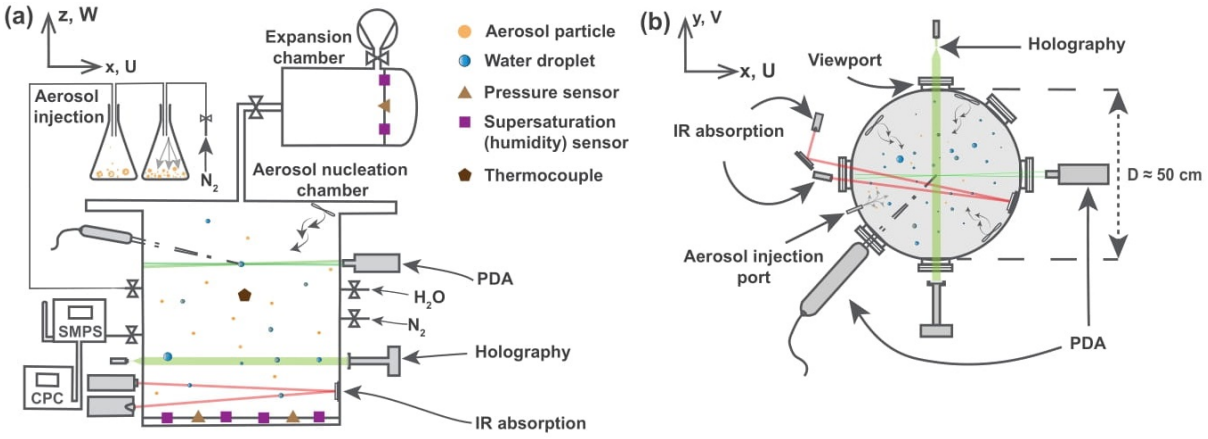

Figure 1. Schematics of the rapid expansion aerosol chamber (REACh). (a) Side view. (b) Top view.

Références

1. M. A. Erinin et al, Droplet Nucleation In a Rapid Expansion Aerosol Chamber, *arXiv preprint*, arXiv :2501.01467 (2024).