

Summer School *Basic Aerosol Science* – Program

Wednesday, 8 July – Wednesday, 15 July 2026

University of Vienna, Faculty of Physics
Ludwig-Boltzmann Lecture Hall, ground floor, Strudlhofgasse 4, 1090 Wien

WEDNESDAY, 8 July 2026

(Room: Ludwig-Boltzmann Lecture Hall, ground floor)

- 14:00** **Registration & coffee**
- 14:30-15:00** **Welcome, presentation of participants, opening (Bernadett Weinzierl)**
- 15:00-16:30** **Introduction to aerosol & the atmospheric aerosol (Bernadett Weinzierl):** atmospheric aerosol system, size range, main constituents, sources and sinks of atmospheric particles, vertical distribution, residence time, natural and anthropogenic greenhouse effect, role of aerosols in the climate system, temporal trends, aircraft measurements
- 16:30-17:00** **Coffee break**
- 17:15** **Transfer to Heuriger**
- 18:30** **Get-Together at a “Heuriger”** (traditional Viennese tavern, where winemakers serve their own new wine (Heuriger = "this year's wine") alongside rustic food)

THURSDAY, 9 July 2026 – BASICS

(Room: Ludwig-Boltzmann Lecture Hall, ground floor)

- 08:30-09:00** **Registration & coffee**
- 09:00-10:30** **Aerosol mechanics (Agnieszka Straus):** shape of aerosol particles, equivalent diameters, Knudsen number, Stokes' law, settling velocity, slip correction, stopping distance, Stokes number, diffusion, Maxwell-Boltzmann distribution of molecular velocities, Fick's diffusion laws, Brownian motion, diffusion coefficient, coagulation
- 10:30-11:00** **Coffee break**
- 11:00-12:30** **Aerosol optics (Carlos Toledano):** interaction of light with particles: scattering, absorption, extinction, Mie theory, phase function, mixed particles
- 12:30-14:00** **Lunch break**
- 14:00-15:30** **Electrical properties of aerosols (Gerhard Steiner):** ions, electrical mobility, particle charging mechanisms and charge limits, mobility distribution, Fuchs' charging theory, diffusion chargers as aerosol monitors
- 15:30-16:00** **Coffee break**
- 16:00-17:30** **Nucleation and condensation – basics (Paul Wagner):** formation of aerosol particles, homogeneous nucleation, Kelvin relation, heterogeneous nucleation, cluster geometry, (microscopic) contact angle, line tension, nucleation theorem
- 17:30** **Optional Lab Tours** to the new Aerosol Observatory and future ACTRIS site of the Vienna Aerosol Group at the roof of the physics building (number of participants limited)

FRIDAY, 10 July 2025 - BASICS

(Room: Ludwig-Boltzmann Lecture Hall, ground floor)

- 09:00-10:30 Particle statistics (Imre Salma):** particle number, surface and mass size distributions, lognormal distribution function, modes of size distributions, important size intervals, average diameters, moments of size distributions, inversion problem, applications
- 10:30-11:00 Coffee break**
- 11:00-12:30 Electrical aerosol measurement (Gerhard Steiner):** electrical mobility analysers, differential mobility analyser - DMA: particle sizing, measurement procedure, response with various sensors, data acquisition and data reduction, SMPS versus DMPS; other instruments based on electrical properties of aerosols
- 12:30-14:00 Lunch break**
- 14:00-15:30 Aerosol generation (Paul Winkler):** dispersions of powders, atomization of liquids, electrospray atomization, condensation methods, generation of ion clusters, generation of calibration aerosols with a DMA
- 15:30-16:00 Coffee break**
- 16:00-16:45 Demonstration of selected aerosol generation methods (Maximilian Dollner)**
- 16:45-18:15 Particle deposition: particle impaction, diffusion and filtration (Christof Asbach):** impactor, flow through nozzle, efficiency curve of impacting jet, design criteria for impactors, virtual impactors, cyclone, aerodynamic particles sizer, deposition by diffusion, deposition in ducts, diffusion batteries, diffusion denuders, filters: types of and artifacts, filtration theory, selection of filter media, EU PM standard, sampling for analysis

SATURDAY, 11 July 2025 - MEASUREMENT METHODS

(Room: Ludwig-Boltzmann Lecture Hall)

- 09:00-10:30 Aerosol sampling and measurement (Imre Salma):** principles and major methods for off-line and on-line measurements, collection of samples: inlets, sampling devices, sampling artifacts and their correction; overview of major types of instruments
- 10:30-11:00 Coffee break**
- 11:00-12:30 Nucleation and condensation - measurements (Paul Winkler):** homogeneous and heterogeneous nucleation: experiments, condensation nuclei counters
- 12:30-14:00 Lunch break**
- 14:00-15:30 Cloud condensation nuclei and clouds (Maximilian Dollner):** Hygroscopicity and cloud condensation nuclei (CCN); Köhler theory (Raoult + Kelvin); κ -Köhler formulation; microphysical processes in warm clouds; ice nucleating particles (INP); modes of freezing; microphysical processes in cold clouds, ice crystal formation
- 15:30-16:00 Coffee break**
- 16:00-17:30 Optical particle measurements (Wladyslaw Szymanski):** elastic light scattering domains, single vs. multiple particle detection, optical particle counters and spectrometers, impact of scattering geometry on particle sizing, multivalued response, resolution, detection limits, coincidence errors, calibration rules, low-cost optical particle sensors, configurations and measurement related issues

17:30 **Optional Lab Tours** (number of participants limited) to the new Aerosol Observatory and future ACTRIS site of the Vienna Aerosol Group at the roof of the physics building

SUNDAY, 12 July 2026 - FIELD EXPERIMENT

08:30-10:30 **Short introduction to field experiment (Bernadett Weinzierl)**

10:30-11:00 **Coffee break**

11:00 Departure by bus from Boltzmannngasse 5, Vienna, to mount **Hohe Wand**

13:00 **Field experiment at Hohe Wand (Bernadett Weinzierl and Maximilian Dollner)**

16:30 Departure from Hohe Wand

17:00-17:39 **Presentation of results, general discussion**

17:30 **Heuriger**

20:00 Departure to Vienna

21:00 Arrival at Boltzmannngasse 5, Vienna

MONDAY, 13 July 2025 - AEROSOL CHEMISTRY, MEASUREMENT METHODS (Room: Ludwig-Boltzmann LH)

09:00-10:30 **Aerosol chemistry (Anne Kasper-Giebl):** Chemistry basics, chemical composition (major and minor constituents, traces), chemical composition and size, organic tracers/marker compounds and their use for source identification, identifying markers and aiming at a chemical mass balance

10:30-11:00 **Coffee break**

11:00-12:30 **Aerosol mass spectrometry (Johannes Schneider):** introduction to mass spectrometry, overview of on-line aerosol mass spectrometry techniques, single particle mass spectrometry vs bulk, data analysis strategies, positive matrix factorization

12:30-14:00 **Lunch break**

14:00-15:30 **Modern spectroscopy as a tool for aerosol characterization (Frank Keutsch):** analytes of interest in modern aerosol science: nanostructured particles, bioaerosol, micro-encapsulated particles, chemical surface characterization: electron spectroscopy for chemical analysis (ESCA), bulk characterization: total reflection X-ray fluorescence, FT-IR spectroscopy, Raman spectroscopy

15:30-16:00 **Coffee break**

Walk to Sky Lounge of the University of Vienna (12th floor, Oskar-Morgenstern-Platz 1, 1090 Wien)

17:15 **Keynote Lecture**

18:30 **Get-Together, Sky Lounge University of Vienna**

TUESDAY, 14 July 2026 – ATMOSPHERIC AEROSOLS, HEALTH ISSUES (Room: Ludwig-Boltzmann Lecture Hall)

- 09:00-10:30** **Measurement methods for black and brown carbon (Andreas Petzold tbc):** carbonaceous species, "terminology", measurement methods (thermo-optical, thermal, optical, on-line, off-line), measurement intercomparisons
- 10:30-11:00** **Coffee break**
- 11:00-12:30** **Aerosol remote sensing (Josef Gasteiger):** remote sensing techniques and platforms, photometer, lidar, satellite, spectral ranges, measurement geometry, optical and radiative transfer modeling, retrieval approaches, sensitivity, instrument networks
- 12:30-14:00** **Lunch break**
- 14:00-15:30** **Aerosol transport modelling (Andreas Stohl):** types of models, in-cloud scavenging, below-cloud scavenging, dry deposition, gravitational settling, meteorological input data, aerosol lifetimes, long-range transport episodes
- 15:30-16:00** **Coffee break**
- 16:00-17:30** **Aerosol & respiratory system (Lea Ann Dailey):** structure of the human respiratory tract, physical deposition mechanisms, fluid dynamics in the lung, computational deposition models, experimental deposition methods, particle/vapor interaction, particle clearance and retention

WEDNESDAY, 15 July 2026 – OPTIONAL COURSE

(Room: Ludwig-Boltzmann Lecture Hall)

- 9:00-17:00** Optional: Course **"Tube Fittings and Sampling Systems: From Theory to Hands On Testing"** sponsored by AA-Solutions GmbH/Swagelok (limited number of participants)

Theoretical part:

Selection of suitable tubing and influencing factors; proper handling of tubing; correct tube installation; historical development of tube fittings; design, function, and assembly of the Swagelok tube fitting; comparison of different fitting systems; leaks; required safety precautions; failure analysis; theoretical exam

Practical part:

Construction of a stainless-steel example tubing system; optimal use of test gauges and auxiliary tools; handling of tube benders; identification of potential installation errors; practical exam

The test piece remains with the participant afterwards (following a subsequent burst test by Swagelok Austria on an internal high-pressure test stand)

List of Lecturers (in alphabetical order)

Name	Institution	Topic
Prof. Dr. Christof Asbach	Institut für Umwelt & Energie, Technik & Analytik e. V. (IUTA), Duisburg, Germany	Particle deposition: particle impaction, diffusion and filtration
Prof. Dr. Lea Ann Dailey	University of Vienna, Faculty of Life Sciences, Department of Pharmaceutical Sciences, Austria	Aerosol & respiratory system
Dr. Maximilian Dollner	Catalytic Instruments, Rosenheim, Germany Formerly: University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Cloud condensation nuclei & clouds; aerosol generation; field experiment
Dr. Josef Gasteiger	Hamtec Consulting GmbH / EUMETSAT, Darmstadt, Germany Formerly: University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Aerosol remote sensing
Prof. Dr. Anne Kasper-Giebl	TU Wien, Institute of Chemical Technologies and Analytics, Austria	Aerosol chemistry
Prof. Dr. Frank Keutsch	Harvard University, Department of Chemistry and Chemical Biology, USA	Modern spectroscopy
Prof. Dr. Andreas Petzold	Research Center Jülich, Institute for Energy and Climate Research, Germany	Measurement methods for black and brown carbon
Prof. Dr. Imre Salma	Etövös University, Institute of Chemistry, Budapest, Hungary	Particle statistics, aerosol sampling and measurement
Dr. Johannes Schneider	Max Planck Institute for Chemistry, Mainz, Germany	Aerosol mass spectrometry
Dr. Gerhard Steiner	GRIMM Aerosol Technik, Ainring, Germany Formerly: University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Electrical properties of aerosols, electrical aerosol measurement
Prof. Dr. Andreas Stohl	University of Vienna, Faculty of Earth Sciences, Geography and Astronomy, Department of Meteorology and Geophysics, Austria	Aerosol transport modelling
Dr. Agnieszka Straus (Kupc)	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Aerosol mechanics
Prof. Dr. Wladyslaw Szymanski	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Optical particle measurements

List of Lecturers (in alphabetical order) – continued

Name	Institution	Topic
Prof. Dr. Carlos Toledano	Universidad de Valladolid, Grupo de Óptica Atmosférica, Spain	Aerosol optics
Prof. Dr. Paul Wagner	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Nucleation and condensation – basics
Prof. Dr. Bernadett Weinzierl	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Organizer; the atmospheric aerosol; field experiment
Prof. Dr. Paul Winkler	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Nucleation and condensation - measurements; aerosol generation