

Summer School *Basic Aerosol Science* – Program

Sunday, 10 July 2022 – Saturday, 16 July 2022

University of Vienna, Faculty of Physics
Christian-Doppler Lecture Hall, 3rd floor
Strudlhofgasse 4, 1090 Wien

SUNDAY, 10 July 2022

(Room: Christian-Doppler Lecture Hall, 3rd floor)

- 16:00** **Registration**
- 16:30-17:00** **Welcome, presentation of participants, opening (Prof. Dr. Weinzierl)**
- 17:00-18:30** **Introduction to aerosol & the atmospheric aerosol (Prof. Dr. 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
- 19:00** **Heuriger**

MONDAY, 11 July 2022 – BASICS

(Room: Christian-Doppler Lecture Hall, 3rd floor)

- 08:30-09:00** **Registration & coffee**
- 09:00-10:30** **Aerosol mechanics (Dr. Burkart):** 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 (Prof. Dr. Horvath):** interaction of light with particles: scattering, absorption, extinction, Mie theory, phase function, mixed particles
- 12:30-14:00** **Lunch break**
- 14:00-15:30** **Particle statistics (Prof. Dr. 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
- 15:30-16:00** **Coffee break**
- Walk to Sky Lounge of the University of Vienna (11th floor, Oskar-Morgenstern-Platz 1, 1090 Wien)**
- 17:15** **Plenary lecture: Aerosol & Covid-19 (Dr. Gerhard Scheuch)**
- 18:30** **Ice Breaker, Sky Lounge University of Vienna**

TUESDAY, 12 July 2022 - BASICS

(Room: Christian-Doppler Lecture Hall, 3rd floor)

- 09:00-10:30 Nucleation and condensation – basics (Prof. Dr. Wagner):** formation of aerosol particles, homogeneous nucleation, Kelvin relation, heterogeneous nucleation, cluster geometry, (microscopic) contact angle, line tension, nucleation theorem
- 10:30-11:00 Coffee break**
- 11:00-12:30 Electrical properties of aerosols (Prof. Dr. Mäkelä):** ions, electrical mobility, particle charging mechanisms and charge limits, mobility distribution, Fuchs' charging theory; diffusion chargers as aerosol monitors"
- 12:30-14:00 Lunch break**
- 14:00-15:30 Aerosol sampling and measurement (Prof. Dr. 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
- 15:30-16:00 Coffee break**
- 16:00-17:30 Aerosol generation (Dr. Steiner):** collision atomizer, electrospray, hot wire generator, spark generator, tube furnace, La Mer generator, fluidized bed generator, generation of calibration aerosols with a DMA

WEDNESDAY, 13 July 2022 - MEASUREMENT METHODS

(Christian-Doppler LH)

- 09:00-10:30 Nucleation and condensation - measurements (Prof. Dr. Winkler):** homogeneous and heterogeneous nucleation: experiments, condensation nuclei counters
- 10:30-11:00 Coffee break**
- 11:00-12:30 Electrical aerosol measurement (Prof. Dr. Mäkelä):** 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 Optical particle measurements (Prof. Dr. Szymanski):** single vs. multiple particle detection, single particle optical counters and spectrometers, different designs of OPCs, multivalued response, low-cost optical particle sensors, resolution, detection limits, coincidence errors, calibration
- 15:30-16:00 Coffee break**
- 16:00-17:30 Aerosol remote sensing (Dr. Gasteiger):** remote sensing techniques and platforms, forward modeling of measurements, inverse problem, retrieval procedures, examples of columnar extinction and vertically-resolved lidar measurements

THURSDAY, 14 July 2022 - AEROSOL CHEMISTRY, MEASUREMENT METHODS

(Christian-Doppler LH)

- 09:00-10:30 Particle deposition: particle impaction, diffusion and filtration (Dr. Christoph 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; maybe: aerosol filtration & Covid-19 (masks etc.)
- 10:30-11:00 Coffee break**
- 11:00-12:30 Aerosol chemistry (Prof. Dr. Kasper-Giebl):** Chemistry basics, chemical composition (major and minor constituents, traces), composition and size, source identification, cloud processing, analytical methods (carbonaceous components TC/EC/OC/CC Sum parameters (HULIS), organic compounds, ionic compounds, main elements (mineral compounds))
- 12:30-14:00 Lunch break**
- 14:00-15:30 Aerosol mass spectrometry (Dr. J. 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
- 15:30-16:00 Coffee break**
- 16:00-17:30 Modern spectroscopy as a tool for aerosol characterization (Prof. Dr. Niessner):** 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

FRIDAY, 15 July 2022 – ATMOSPHERIC AEROSOLS, HEALTH ISSUES

(Christian-Doppler LH)

- 09:00-10:30 Measurement methods for black and brown carbon (PD Dr. Petzold):** 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 Primary biological aerosol in the atmosphere (Prof. Dr. Grothe):** introduction to biological aerosol particles, biosphere – atmosphere interaction, bioaerosol – cloud interaction, effects in the atmosphere (water uptake, freezing efficiency), measuring strategies
- 12:30-14:00 Lunch break**
- 14:00-15:30 Aerosol & respiratory system (Prof. Dr. Hofmann):** 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
- 15:30-16:00 Coffee break**
- 16:00-17:30 PM & health effects (Prof. Dr. Riediker):** additional health effects, e.g. heart diseases etc.

SATURDAY, 16 July 2022 - FIELD EXPERIMENT

- 08:30-10:30** **Short introduction to field experiment (Prof. Dr. 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**
- 16:30** Departure from Hohe Wand
- 17:00** **Presentation of results, general discussion**
- 17:30** **Heuriger**
- 20:00** Departure from Möllersdorf
- 21:00** Arrival at Boltzmannngasse 5, Vienna