

Summer School "Basic Aerosol Science" – Program

Sunday, 30 June 2019 – Saturday, 6 July 2019

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

SUNDAY, 30 June 2019

18:00 **Optional: City walking tour**
Meeting point: Strudlhofgasse 4 (in front of the main entrance of the physics building)

MONDAY, 1 July 2019 - BASICS

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

07:30-08:30 **Registration & coffee**

08:30-09:00 **Welcome, presentation of participants, opening (Prof. Dr. Weinzierl)**

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**

16:00-17:30 **Nucleation and condensation – basics (Prof. Dr. Wagner):** formation of aerosol particles, homomolecular homogeneous nucleation and heteromolecular homogeneous nucleation: models; heterogeneous nucleation: theory; nucleation theorem

19:00 **Heuriger** by invitation of Grimm Aerosol Technik

TUESDAY, 2 July 2019 - BASICS

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

- 09:00-10:30** **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"
- 10:30-11:00** **Coffee break**
- 11:00-12:30** **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
- 12:30-14:00** **Lunch break**
- 14:00-15:30** **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
- 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, 3 July 2019 – MEASUREMENT METHODS (Room: Christian-Doppler Lecture Hall, 3rd floor)

- 09:00-10:30** **Optical particle measurements (Prof. Dr. Szymanski):** single vs. multiple particle measurement, scattering and transmission measurements, single particle optical counters and spectrometers, multi-valued response, different designs of OPCs, accuracy, resolution and detection limits, coincidence errors, calibration
- 10:30-11:00** **Coffee break**
- 11:00-12:30** **Nucleation and condensation - measurements (Prof. Dr. Winkler):** homogeneous and heterogeneous nucleation: experiments, condensation nuclei counters
- 12:30-14:00** **Lunch break**
- 14:00-15:30** **Particle deposition: particle impaction, diffusion and filtration (Prof. Dr. Hitzemberger):** 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
- 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, 4 July 2019 – AEROSOL CHEMISTRY, MEASUREMENT METHODS

(Christian-Doppler LH)

- 09:00-10:30** **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))
- 10:30-11:00** **Coffee break**
- 11:00-12:30** **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
- 12:30-14:00** **Lunch break**
- 14:00-15:30** **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
- 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, 5 July 2019 – ATMOSPHERIC AEROSOLS, HEALTH ISSUES (Room: Christian-Doppler LH, 3rd floor)

- 09:00-10:30** **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
- 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, 6 July 2019 – FIELD EXPERIMENT

- 08:30-09:00** Short introduction to measurements with a mobile particle counter (Prof. Dr. Weinzierl)
- 09:00-10:30** Visibility and atmospheric optics (Prof. Dr. Horvath): relative air mass and attenuation, visibility theory, sky radiance, Angström formula, elements of radiative transfer, radiative forcing)
- 10:30-11:00** Coffee break
- 11:00** Departure by bus from Boltzmannngasse 5, Vienna, to mount **Hohe Wand**
- 13:00** **Field experiment (Prof. Dr. Horvath, Prof. Dr. Weinzierl):** Visual determination of visibility and extinction; determination of aerosol number concentration and comparison with measurements done before at Boltzmannngasse
- 16:30** Departure from Hohe Wand
- 17:00** **Presentation of results, general discussion**
- 17:30** **Heuriger** by invitation of the Association for Aerosol Research GAeF in Möllersdorf
- 20:00** Departure from Möllersdorf
- 21:00** Arrival at Boltzmannngasse 5, Vienna

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