universität wien

Summer School: Basic Aerosol Science – Programme

Sunday, 10 July 2022 – Saturday, 16 July 2022
Christian-Doppler Lecture Hall, Strudlhofgasse 4, 1090 Vienna
Sky Lounge, 12th floor, Oskar-Morgenstern-Platz 1, 1090 Vienna and Hohe Wand

Sunday, 10 July 2022

Room: Christian-Doppler Lecture Hall, 3rd floor

16:00
Registration

16:30–17:00
Welcome, presentation of participants, opening (Bernadett Weinzierl)

17:00–18:30
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

19:00
Get-together at a Heuriger, a wine tavern typical of Vienna

Monday, 11 July 2022 – Basics

Room: Christian-Doppler Lecture Hall, 3rd floor

8:30–9:00
Registration & coffee

9:00–10:30
Aerosol mechanics (Julia 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 (Helmuth 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 (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

15:30–15:45
Martin Rigler, Head of Research and Development Department:
Multiple faces of carbonaceous aerosols

15:45–16:15
Coffee break

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

Sky Lounge and Terrace © Universität Wien

17:15
Plenary Lecture (Gerhard Scheuch):
Breathing is enough – the role of aerosol particles in spreading SARS-CoV-2

18:30
Ice breaker & get-together, Sky Lounge University of Vienna

Tuesday, 12 July 2022 – Basics

Room: Christian-Doppler Lecture Hall, 3rd floor

9:00–10:30
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

10:30–11:00
Coffee break

11:00–12:30
Electrical properties of aerosols (Jyrki 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 (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

15:30–16:00
Coffee break

16:00–17:30
Aerosol generation (Gerhard Steiner):
collison 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

Room: Christian-Doppler Lecture Hall, 3rd floor

9:00–10:30
Nucleation and condensation - measurements (Paul Winkler):
homogeneous and heterogeneous nucleation: experiments, condensation nuclei counters

10:30–11:00
Coffee break

11:00–12:30
Electrical aerosol measurement (Jyrki 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 (Wladyslaw 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 (Josef 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

Room: Christian-Doppler Lecture Hall, 3rd floor

9:00–10:30
Particle deposition (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 (Anne 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 (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

15:30–16:00
Coffee break

16:00–17:30
Modern spectroscopy as a tool for aerosol characterization (Reinhard 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

Room: Christian-Doppler Lecture Hall, 3rd floor

9:00–10:30
Measurement methods for black and brown carbon (Andreas 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 (Hinrich 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 (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

15:30–16:00
Coffee break

16:00–17:30
Aerosol matter & health effects (Michael Riediker):
indoor, outdoor and biological aerosols: how combinations of properties translate into effects; combining exposure and health status distributions: small on average ≠ no problem; understanding properties for risk reduction and therapeutics

Saturday, 16 July 2022 – Field Experiment

Room: Christian-Doppler Lecture Hall, 3rd floor, and Hohe Wand mountain

8:30–10:30
Short introduction to the field experiment (Bernadett Weinzierl)

10:30–11:00
Coffee break

11:00
Departure by bus from Boltzmanngasse 5/Strudlhofgasse 4, Vienna, to **Hohe Wand** mountain

13:00
Field experiment at Hohe Wand

16:30
Departure from Hohe Wand

17:00
Presentation of results, general discussion

17:30
Closing & get-together at a Heuriger, a wine tavern typical of Vienna

20:00
Departure from Möllersdorf

21:00
Arrival at Boltzmanngasse 5/Strudlhofgasse 4, Vienna

List of Lecturers

Name	Institution	Topic
Dr. Christof Asbach	Institut für Energie und Umwelttechnik e.V. (IUTA), Duisburg, Germany	Particle deposition: particle impaction, diffusion and filtration
Dr. Julia Burkart	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Aerosol mechanics
Prof. Dr. Lea Ann Dailey	University of Vienna, Faculty of Life Sciences, Department of Pharmaceutical Sciences, Austria	Aerosol & respiratory system
Dr. Josef Gasteiger	Hamtec Consulting GmbH/EUMETSAT, Darmstadt, Germany	Aerosol remote sensing
Prof. Dr. Hinrich Grothe	TU Wien, Institute of Materials Chemistry, Austria	Primary biological aerosol in the atmosphere
Prof. Dr. Helmuth Horvath	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Aerosol optics
Prof. Dr. Anne Kasper-Giebl	TU Wien, Analytical Chemistry, Austria	Aerosol chemistry
Prof. Dr. Jyrki Mäkelä	Tampere University, Aerosol Physics Laboratory, Finland	Electrical properties of aerosols, electrical aerosol measurement
Prof. Dr. Reinhard Niessner	Technical University Munich, Analytical Chemistry, Germany	Modern spectroscopy as a tool for aerosol characterization
PD Dr. Andreas Petzold	Research Center Jülich, Institute for Energy and Climate Research, Germany	Measurement methods for black and brown carbon

List of Lecturers

Name	Institution	Topic
Prof. Dr. Michael Riediker	Swiss Centre for Occupational and Environmental Health, Winterthur, Switzerland	Aerosol & health effects
Prof. Dr. Imre Salma	Etövös University, Institute of Chemistry, Budapest, Hungary	Particle statistics, aerosol sampling & measurement
Dr. Gerhard Scheuch	GS Bio-Inhalation GmbH, Gemünden/ Wohra, Germany	Plenary lecture: Aerosol & COVID-19
Dr. Johannes Schneider	Max Planck Institute for Chemistry, Mainz, Germany	Aerosol mass spectrometry
Dr. Gerhard Steiner	GRIMM Aerosol Technik, Ainring, Germany	Aerosol generation
Prof. Dr. Wladyslaw Szymanski	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria	Optical particle measurements
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 of the Summer School to aerosol & 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