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):
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

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):
analyses 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

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<th>Institution</th>
<th>Topic</th>
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<td>Dr. Christof Asbach</td>
<td>Institut für Energie und Umwelttechnik e.V. (IUTA), Duisburg, Germany</td>
<td>Particle deposition: particle impaction, diffusion and filtration</td>
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<tr>
<td>Dr. Julia Burkart</td>
<td>University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria</td>
<td>Aerosol mechanics</td>
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<tr>
<td>Prof. Dr. Lea Ann Dailey</td>
<td>University of Vienna, Faculty of Life Sciences, Department of Pharmaceutical Sciences, Austria</td>
<td>Aerosol &amp; respiratory system</td>
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<tr>
<td>Dr. Josef Gasteiger</td>
<td>Hamtec Consulting GmbH/EUMETSAT, Darmstadt, Germany</td>
<td>Aerosol remote sensing</td>
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<td>Prof. Dr. Hinrich Grothe</td>
<td>TU Wien, Institute of Materials Chemistry, Austria</td>
<td>Primary biological aerosol in the atmosphere</td>
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<td>Prof. Dr. Helmuth Horvath</td>
<td>University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria</td>
<td>Aerosol optics</td>
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<td>Prof. Dr. Anne Kasper-Giebl</td>
<td>TU Wien, Analytical Chemistry, Austria</td>
<td>Aerosol chemistry</td>
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<td>Prof. Dr. Jyrki Mäkelä</td>
<td>Tampere University, Aerosol Physics Laboratory, Finland</td>
<td>Electrical properties of aerosols, electrical aerosol measurement</td>
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<td>Prof. Dr. Reinhard Niessner</td>
<td>Technical University Munich, Analytical Chemistry, Germany</td>
<td>Modern spectroscopy as a tool for aerosol characterization</td>
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<td>PD Dr. Andreas Petzold</td>
<td>Research Center Jülich, Institute for Energy and Climate Research, Germany</td>
<td>Measurement methods for black and brown carbon</td>
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<td>Swiss Centre for Occupational and Environmental Health, Winterthur, Switzerland</td>
<td>Aerosol &amp; health effects</td>
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<tr>
<td>Prof. Dr. Imre Salma</td>
<td>Etővös University, Institute of Chemistry, Budapest, Hungary</td>
<td>Particle statistics, aerosol sampling &amp; measurement</td>
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<tr>
<td>Dr. Gerhard Scheuch</td>
<td>GS Bio-Inhalation GmbH, Gemünden/Wohra, Germany</td>
<td>Plenary lecture: Aerosol &amp; COVID-19</td>
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<tr>
<td>Dr. Johannes Schneider</td>
<td>Max Planck Institute for Chemistry, Mainz, Germany</td>
<td>Aerosol mass spectrometry</td>
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<td>Dr. Gerhard Steiner</td>
<td>GRIMM Aerosol Technik, Ainring, Germany</td>
<td>Aerosol generation</td>
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<td>Prof. Dr. Wladyslaw Szymanski</td>
<td>University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria</td>
<td>Optical particle measurements</td>
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<td>University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria</td>
<td>Nucleation and condensation – basics</td>
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<tr>
<td>Prof. Dr. Bernadett Weinzierl</td>
<td>University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Austria</td>
<td>Organizer of the Summer School to aerosol &amp; the atmospheric aerosol, field experiment</td>
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