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Summer School: Basic Aerosol Science – Programme

Sunday, 7 July 2024 – Saturday, 13 July 2024
University of Vienna, Faculty of Physics
Strudlhofgasse 4, 1090 Vienna

Sunday, 7 July 2024

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

19:15
Get-Together at Schutzhaus am Schafberg – sponsored by Grimm Aerosol Technik
Czartoryskigasse 190–192, 1170 Vienna

Summer School lectures (with the exception of the Pleanry Lecture) **will take place in the Ludwig-Boltzmann Lecture Hall** (ground floor, Strudlhofgasse 4, 1090 Vienna).

Registration and coffee breaks will take place in the Ernst-Mach Lecture Hall (2nd floor, Strudlhofgasse 4, 1090 Vienna).

Lunch will be served at Hotel Strudlhof (Pasteurgasse 1, 1090 Vienna), which is about a 5–10 minute walk from the Summer School venue.

Monday, 8 July 2024

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
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

15:30–16:00
Coffee break

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

17:15
Plenary Lecture (Charles A. Brock):
Exploring the stratospheric aerosol: natural processes and human impacts from geoengineering, aircraft, and rockets

18:30
Ice Breaker & Get-Together – sponsored by the Vienna Doctoral School in Physics

Tuesday, 9 July 2024

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
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
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

15:30–16:00
Coffee break

16:00–17:30
Aerosol generation (Gerhard Steiner):
Dispersions of powders, atomization of liquids, electrospray atomization, condensation methods, generation of ion clusters, generation of calibration aerosols with a DMA

17:30–17:45
How to measure nano particles more accurately – technology solutions from Catalytic Instruments (Eda Sorani)

Wednesday, 10 July 2024

09:00–10:30
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):
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

15:30–16:00
Coffee break

16:00–17:30
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

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

Thursday, 11 July 2024

09:00–10:30
Particle deposition: particle impaction, diffusion and filtration (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

10:30–11:00
Coffee break

11:00–12:30
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

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 (Frank Keutsch):
Offline: ensemble average techniques, X-ray techniques, electronic spectroscopy, optical microscopy, vibrational spectroscopy, trapped particles
Online: photoacoustic spectroscopy, cavity-based techniques, single-particle soot photometer, wideband integrated bioaerosol sensor

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

Friday, 12 July 2024

09:00–10:30
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
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

12:30–14:00
Lunch break

14:00–15:30
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

15:30–16:00
Coffee break

16:00–17:30
Aerosol and the 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

Saturday, 13 July 2024

08:30–10:30
Introduction to field experiment
(Bernadett Weinzierl)

10:30–11:00
Coffee break

11:00
Departure by bus from Boltzmanngasse 5, 1090 Vienna,
to mount Hohe Wand

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

16:30
Departure from Hohe Wand

17:00
Presentation of results, general discussion

17:30
Get-Together at a Heuriger, a wine tavern typical of Vienna –
sponsored by Swisens
Weingut Gross
Karl Adlitzerstraße 45 – 47, 2514 Möllersdorf

20:00
Departure from Möllersdorf

21:00
Arrival at Boltzmanngasse 5, 1090 Vienna

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
Dr. Charles A. Brock	NOAA Chemical Sciences Laboratory Boulder, USA	Keynote Lecture
Prof. Dr. Lea Ann Dailey	University of Vienna, Faculty of Life Sciences, Department of Pharmaceutical Sciences, Vienna, Austria	Aerosol & respiratory system
Dr. Maximilian Dollner	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Vienna, Austria	Field experiment
Dr. Josef Gasteiger	Hamtec Consulting GmbH / EUMETSAT, Darmstadt, Germany	Aerosol remote sensing
Prof. Dr. Hinrich Grothe	TU Wien, Institute of Materials Chemistry, Vienna, Austria	Primary biological aerosol in the atmosphere
Prof. Dr. Anne Kasper-Giebl	TU Wien, Institute of Chemical Technologies & Analytics, Vienna, Austria	Aerosol chemistry
Prof. Dr. Frank Keutsch	Harvard University, Department of Chemistry and Chemical Biology, Cambridge, USA	Modern spectroscopy

List of Lecturers

in alphabetical order

Name	Institution	Topic
Prof. Dr. Jyrki Mäkelä	Tampere University, Aerosol Physics Laboratory, Tampere, Finland	Electrical properties of aerosols, electrical aerosol measurement
Prof. Dr. Andreas Petzold	Research Center Jülich, Institute for Energy and Climate Research, Jülich, 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
Eda Sorani, MSc.	Catalytic Instruments, Rosenheim, Germany	Solutions for nano particle measurements
Dr. Gerhard Steiner	GRIMM Aerosol Technik, Ainring, Germany	Aerosol generation
Prof. Dr. Andreas Stohl	University of Vienna Faculty of Earth Sciences, Geography and Astronomy, Department of Meteorology and Geophysics, Vienna, Austria	Aerosol transport modelling
Dr. Agnieszka Straus (Kupc)	University of Vienna, Faculty of Physics, Aerosol Physics and Environmental Physics, Vienna, Austria	Aerosol mechanics

List of Lecturers

in alphabetical order

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

We thank our sponsors for their support

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Gesellschaft für Aerosolforschung
Association for Aerosol Research

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