# Intro Course in Neutron Scattering

ESS/LINXS/MAX IV, Lund  27 Sep – 10 Oct 2025

| Time / Date | 7:00 – 8:30 | Lecture Session I 8:30 –10:00 | Exercise Session I 10:30 – 12:00 | 12:30 – 14:00 | Lecture Session II 14:00 – 15:30 | Exercise Session II 16:00 – 17:30 | 17:30 – 19:00 | 19:00 – … |
|---|---|---|---|---|---|---|---|---|
| Fri 26 Sep | **ARRIVAL DAY 1: Check-in at Motel L** | | | | | | *Free Time* | Dinner * |
| Sat 27 Sep | Breakfast | Mathematical Foundation 1<br>**Kim Lefmann,** | Mathematical Foundation 2<br>**Kim Lefmann,** | Lunch | Mathematical Foundation 3<br>**Kim Lefmann,** | Mathematical Foundation 4<br>**Kim Lefmann,** | *Free Time* | Dinner * |
| Sun 28 Sep | Breakfast | Mathematical Foundation 5<br>**Kim Lefmann,** | Mathematical Foundation 6<br>**Kim Lefmann,** | Lunch | Solid State Physics Foundation<br>**Kim Lefmann,** | Magnetism Foundation<br>**Kim Lefmann,** | FREE | **WELCOME RECEPTION Start: 19:00** |
| | **ARRIVAL DAY 2: Check-in at Motel L** | | | | | | | |
| Mon 29 Sep | Breakfast | **Welcome to the School**<br>• Practicals, Examination Process<br>• How to write a proposal (45 min)<br>• Safety at large-scale facilities<br>**Kim Lefmann, KU**<br>**Martin Månsson, KTH** | **L0: Overview of the course**<br>• The Neutron/scattering experiment<br>• Production / "Filters / Detection<br>• Elastic/Inelastic<br>• Brief overview of the techniques<br>**Martin Månsson, KTH** | Lunch | **L1.1: Intro**<br>• Basic interaction mechanism (+x-rays)<br>• Scattering from 1 & 2 nuclei<br>• Coherent / Incoherent / Absorption<br>**Kim Lefmann, KU** | **L1.2: Intro**<br>• Scattering from 1 & 2 Nuclei<br>• Coherent / Incoherent<br>**Kim Lefmann, KU** | *Free Time* | Dinner * |
| Tue 30 Sep | Breakfast | **L2: Neutron Sources & Instrumentation**<br>• Sources Moderators<br>• Monochromators / choppers<br>• Collimation / Filters / Guides<br>• Detection<br>**Kim Lefmann, KU** | **Ex. 1**<br>• Wiki problem: Pinhole collimation<br>• Quiz: Neutron detection<br>• Quiz: Test your knowledge of neutron sources and instrumentation<br>**(e-learning)** | Lunch | **L3: Neutron Interaction with Matter**<br>• Cross Section, Isotope Sensitivity<br>• Elastic / Inelastic<br>• X-rays/electrons<br>• Multiple Scattering<br>**Kim Lefmann, KU** | **Ex. 2**<br>• Quiz: The neutron cross section<br>• Wiki problem: Selection of materials<br>**(e-learning)** | *Free Time* | Dinner * |
| Wed 1 Oct | Breakfast | **L4: Magnetic Scattering**<br>• Magnetism<br>• Nuclear/Magnetic Scattering<br>**Kim Lefmann, KU** | **L5: Reflectometry I**<br>• Introduction<br>• X-ray vs Neutrons<br>• Specular/Off-Specular<br>**Samira Dorri, KTH** | Lunch | **Ex. 3**<br>• Simulation quiz: Reflectometer<br>**(e-learning)** | **L6: Reflectometry II + GiSANS**<br>• Instrumentation<br>• Neutron Mirrors<br>• Applications<br>• Plan for NR beamtime<br>**Samira Dorri, KTH** | *Free Time* | Dinner * |
| Thu 2 Oct | Breakfast | **L11: SANS I**<br>• Instrumentation2<br>• Scattering Length Density<br>• Form-/Structure Factor<br>• Approximations<br>**Andrew Jackson, Lund University / ESS** | **Ex. 8**<br>• Simulation quiz: Small Angle Neutron Scattering<br>• Resolution (wavelength vs. angle)<br>• Data Treatment<br>**(e-learning)** | Lunch | **L12: SANS II**<br>• Geometrical models<br>• Contrast Variations<br>• Time-resolved / stroboscopic<br>• Applications<br>**Andrew Jackson, Lund University / ESS** | **"FREE" ?** | *Free Time* | Dinner * |
| Fri 3 Oct | Breakfast | **Should arrive at 09:00 (get badges)**<br>**9:15 – 10:00 DanMAX 1**<br>**10:00 – 10:45 BLOCH/VERITAS 1** | **Tour 1 MAX IV**<br>**11 - 12** | Lunch 12-13 | **13:00-14:00 Tour 2**<br>**14:15 – 15:00 DanMAX 2**<br>**15:00 – 15:45 BLOCH/VERITAS 2**<br>**Conference Room for 30 persons** | *Catch up on assignments/e-learning and inquire about things you did not understand + possible questions about proposal writing.*<br>**TBC** | *Free Time* | **GALA DIN-NER 19:00** |

## Venues:

27 September – 2 October & 5-8 October: LINXS – "The Loop"

3 October: MAX IV

9 – 10 October: ESS

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| **Sat 4 Oct** | **FREE DAY** | | | | | | | |
| **Sun 5 Oct** | Breakfast | **L10: Neutron Imaging**<br>• Instrumentation<br>• Radiography / Tomography<br>• In operando<br>• Neutrons / x-rays<br>**Luise Theil Kuhn, DTU** | **Ex. 7**<br>• Simulation quiz: Bragg Edge Imaging on Viking Sword<br>**(e-learning)** | Lunch | **L7: Crystallography**<br>• Crystallography<br>• k-space<br>• Brillouin Zone<br>**Elisabetta Nocerino, Stockholm Univ./PSI** | **Ex. 4 "Reciprocal lattice of Ni"**<br>• Quiz: Reciprocal lattice of Ni<br>• Simulation quiz: Diffraction from powder<br>**(e-learning)** | *Free Time* | Dinner * |
| **Mon 6 Oct** | Breakfast | **L8: Diffraction I**<br>• Intro<br>• Neutrons vs. X-rays<br>**Elisabetta Nocerino, Stockholm Univ. / PSI** | **L9: Diffraction II**<br>• Magnetism<br>• Total Scattering<br>• Etc.<br>**Elisabetta Nocerino, Stockholm Univ. / PSI** | Lunch | **Ex. 5 - TUTORIAL**<br>• The Rietveld method<br>• Foolproof intro + start of refinement<br>**Elisabetta Nocerino, Stockholm Univ. / PSI** | **Ex. 6**<br>• Foolproof refinement continued<br>• When is Xray or Neutron diffraction suitable?<br>• Wiki problem: Bragg scattering from non-Bravais lattices<br>**Elisabetta Nocerino, Stockholm Univ. / PSI** | *Free Time* | Dinner * |
| **Tue 7 Oct** | Breakfast | **L13: INS I "Intro"**<br>• Instrumentations (TAS/ToF)<br>• Direct / Indirect geometry<br>• Pulsed/Continuous<br>• E/p conservation<br>• k-space (reminder)<br>• Examples (nuclear / magnetic)<br>**Kim Lefmann, KU** | **Ex. 9**<br>• Simulation quiz: Ni single crystal in a Triple Axis Spectrometer<br>• Quiz: Phonons of Ni<br>**(e-learning)** | Lunch | **L14: INS II "Nuclear"**<br>• Phonons (basics)<br>• ⟘/∥ domain<br>• Cross sections<br>• Applications<br>**Gediminas Simutis, Paul Scherrer Institute** | **L15: INS III "Magnetic"**<br>• Spin waves<br>• Magnetic Cross Section<br>• Applications<br>**Kim Lefmann, KU** | *Free Time* | Dinner * |
| **Wed 8 Oct** | Breakfast | **L16: Polarized Neutron Scattering: BASICS**<br>• Polarizing/Flipping/Detecting the neutron spin (theory & technologies)<br>• Basic theory<br>• Examples (Elastic & Inelastic)<br>**Werner Schweika, ESS** | **L17: QENS**<br>• Instrumentation<br>• Energy/timescales<br>• Coherent / Incoherent<br>• Diffusion, Molecular dynamics<br>• Cross section & Isotope labeling<br>**Mark Telling, STFC/ISIS** | Lunch | **Ex. 11 - TUTORIAL**<br>• Polymer Dynamics (dynamics / diffusion)<br>• Isotope labeling<br>**Mark Telling, STFC/ISIS** | **Ex. 11 (continued)**<br>• Polymer Dynamics (dynamics / diffusion)<br>• Isotope labeling<br>**Mark Telling, STFC/ISIS** | *Free Time* | Dinner * |
| **Thu 9 Oct** | Breakfast | *Start at 08:00 !!!*<br>**Tour of ESS** | **L21: Keynote Lecture**: *"Challenge 1"*<br>**Neutrons for Engineering**<br>**Robin Woracek**<br>**ESS** | Lunch | **L19: Keynote Lecture**: *"Challenge 2"*<br>**Neutrons for Quantum Matter**<br>**Henrik Rønnow**<br>**EPF Lausanne, Switzerland** | **L20: Keynote Lecture**: *"Challenge 3"*<br>**Neutrons for Life**<br>**Trevor Forsyth**<br>**LINXS, Sweden** | *Free Time* | **End Din-Ner**<br>**19:00** |
| **Fri 10 Oct** | Breakfast<br>Check-out Motel L | ***Help for Proposal Writing***<br>***+***<br>***Free Discussion*** | **L18: Keynote Lecture**: *"Challenge 4"*<br>**Neutrons for Sustainability**<br>**Martin Månsson**<br>**KTH Royal Institute of Technology Sweden** | Lunch | **L22: Key-Note Lecture**: *"ESS"*<br>**Future Science at ESS**<br>**Giovanna Fragneto, ESS** | ***Departure*** | | |

*Dinners during the normal lecture days are your own responsibility. SwedNess/NNSP are only organizing the "Welcome Reception", "Gala Dinner" and "End Dinner". Lunch is included.