

| Time / Date | 7:00 – 8:30   | Lecture Session I<br>8:30 – 10:00                                                                                                                                                                                                                       | Exercise Session I<br>10:30 – 12:00                                                                                                                                                                                                               | 12:30 – 14:00 | Lecture Session II<br>14:00 – 15:30                                                                                                                                                                                                                                 | Exercise Session II<br>16:00 – 17:30                                                                                 | 17:30 – 19:00            | 19:00 – ...           |
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| 7 Sep       | ARRIVAL DAY 1 |                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                   |               |                                                                                                                                                                                                                                                                     |                                                                                                                      |                          | Free Time<br>Dinner * |
| 8 Sep       | Break-fas     | Mathematical Foundation 1<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                                                                                                                                                | Mathematical Foundation 2<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                                                                                                                                          | Lunch         | Mathematical Foundation 3<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                                                                                                                                                            | Mathematical Foundation 4<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                             | Free Time<br>Dinner *    |                       |
| 9 Sep       | Break-fas     | Mathematical Foundation 5<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                                                                                                                                                | Mathematical Foundation 6<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                                                                                                                                          | Lunch         | Solid State Physics Foundation<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                                                                                                                                                       | Magnetism Foundation<br>Kim Lefmann, Lise Sandberg & Johan Hellsvik                                                  | WELCOME RECEPTION        |                       |
|             |               | ARRIVAL DAY 2                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                   |               |                                                                                                                                                                                                                                                                     |                                                                                                                      |                          |                       |
| 10 Sep      | Break-fast    | Welcome to the School <ul style="list-style-type: none"><li>Practicals, Examination Process</li><li>How to write a proposal (45 min)</li><li>Safety at large-scale facilities</li></ul><br>Kim Lefmann, University of Copenhagen<br>Martin Månsson, KTH | L0: Overview of the course <ul style="list-style-type: none"><li>The Neutron/scattering experiment</li><li>Production / “Filters” / Detection</li><li>Elastic/Inelastic</li><li>Brief overview of the techniques</li></ul><br>Martin Månsson, KTH | Lunch         | L1: Intro <ul style="list-style-type: none"><li>Basic interaction mechanism (+x-rays)</li><li>Scattering from 1 &amp; 2 nuclei</li><li>Coherent / Incoherent / Absorption</li></ul><br>Kim Lefmann, University of Copenhagen                                        | Ex. 1 <ul style="list-style-type: none"><li>Scattering from 1 &amp; 2 Nuclei</li><li>Coherent / Incoherent</li></ul> | Free Time<br>Dinner *    |                       |
| 11 Sep      | Break-fast    | L2: Neutron Sources & Instrumentation <ul style="list-style-type: none"><li>Sources Moderators</li><li>Monochromators / choppers</li><li>Collimation / Filters / Guides</li><li>Detection</li></ul><br>Kim Lefmann, University of Copenhagen            | Ex. 2 <ul style="list-style-type: none"><li>Build your virtual neutron instrument</li></ul><br>(e-learning)                                                                                                                                       | Lunch         | L3: Neutron Interaction with Matter <ul style="list-style-type: none"><li>Cross Section, Isotope Sensitivity</li><li>Elastic / Inelastic</li><li>Nuclear/Magnetic + X-rays/electrons</li><li>Multiple Scattering</li></ul><br>Kim Lefmann, University of Copenhagen | Ex. 3 <ul style="list-style-type: none"><li>Cross Section</li><li>Selection of materials *</li></ul><br>(e-learning) | Free Time<br>Dinner *    |                       |
| 12 Sep      | Break-fast    | L4: Crystallography <ul style="list-style-type: none"><li>Crystallography</li><li>k-space</li><li>Brillouin Zone</li></ul><br>Lars Eriksson, Stockholm University                                                                                       | Ex. 4<br><br>(e-learning)                                                                                                                                                                                                                         | Lunch         | L5: Diffraction I <ul style="list-style-type: none"><li>Instrumentation</li><li>Powder</li><li>Neutron / x-rays</li></ul><br>Lars Eriksson, Stockholm University                                                                                                    | Ex. 5 <ul style="list-style-type: none"><li>Refinement</li></ul>                                                     | Free Time<br>Dinner *    |                       |
| 13 Sep      | Break-fast    | L6: Diffraction II <ul style="list-style-type: none"><li>Laue, Single-crystal</li><li>Total Scattering</li><li>Nuclear / Magnetic</li></ul><br>Lars Eriksson, Stockholm University                                                                      | Ex. 6 <ul style="list-style-type: none"><li>Refinement (cont.)</li></ul>                                                                                                                                                                          | Lunch         | L7: Neutron Imaging <ul style="list-style-type: none"><li>Instrumentation</li><li>Radiography / Tomography</li><li>In operando</li><li>Neutrons / x-rays</li></ul><br>Luise Theil Kuhn, DTU                                                                         | Ex. 7 <ul style="list-style-type: none"><li>Virtual Imaging Experiment</li></ul><br>(e-learning)                     | Free Time<br>Dinner *    |                       |
| 14 Sep      | Break-fast    | L8: Reflectometry I <ul style="list-style-type: none"><li>Instrumentation</li><li>Specular/off-specular</li><li>Optical Matrix</li><li>Kinematic Approximation</li><li>Applications</li></ul><br>Adrian Rennie, Uppsala University                      | Ex. 8 <ul style="list-style-type: none"><li>Virtual reflectometry</li><li>Optical matrix fits</li></ul><br>(e-learning)                                                                                                                           | Lunch         | L9: Reflectometry II + GiSANS <ul style="list-style-type: none"><li>Distorted Born approximation</li><li>GiSANS Instrumentation</li><li>In plane / out of plane</li><li>Applications</li></ul><br>Adrian Rennie, Uppsala University                                 | Ex. 9 <ul style="list-style-type: none"><li>Biomembranes</li><li>Contrast Variations</li><li>Magnetism</li></ul>     | Free Time<br>GALA DINNER |                       |
| 15 Sep      | Break-fast    | FREE DAY / EXCURSION<br>Dinner *                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                   |               |                                                                                                                                                                                                                                                                     |                                                                                                                      |                          |                       |

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| 16 Sep | Break-fast | <b>L10: SANS I</b> <ul style="list-style-type: none"><li>Instrumentation2</li><li>Scattering Length Density</li><li>Form-/Structure Factor</li><li>Approximations</li></ul> <b>Andrew Jackson, Lund University / ESS</b>                                                                                              | Ex. 10 “Experiment” <ul style="list-style-type: none"><li>Virtual SANS experiment</li><li>Resolution (wavelength vs. angle)</li><li>Data Treatment</li></ul> <b>(e-learning)</b>                                                                           | Lunch | <b>L11: SANS II</b> <ul style="list-style-type: none"><li>Geometrical models</li><li>Contrast Variations</li><li>Time-resolved / stroboscopic</li><li>Applications</li></ul> <b>Andrew Jackson, Lund University / ESS</b>                                                                               | Ex. 11 “Data Modeling” <ul style="list-style-type: none"><li>Spheres vs. cylinders</li><li>Polydispersity</li><li>Resolution</li><li><b>Magnetism !!!</b></li></ul> | Free Time | Dinner *   |
| 17 Sep | Break-fast | <b>L12: Magnetic Scattering II</b> <ul style="list-style-type: none"><li>Magnetism</li><li>Magnetic Scattering</li></ul> <b>Kim Lefmann, University of Copenhagen</b>                                                                                                                                                 | Ex. 12 <ul style="list-style-type: none"><li>Magnetic Peaks !!!</li><li>Spin Structure</li></ul> <b>(new e-learning)</b>                                                                                                                                   | Lunch | <b>L13: INS I “Intro”</b> <ul style="list-style-type: none"><li>Instrumentations (TAS/ToF)</li><li>Direct / Indirect geometry</li><li>Pulse/Continuous</li><li>E/p conservation</li><li>k-space (reminder)</li><li>Examples (nuclear / magnetic)</li></ul> <b>Kim Lefmann, University of Copenhagen</b> | Ex. 13 <ul style="list-style-type: none"><li>Virtual INS experiment</li></ul> <b>(e-learning)</b>                                                                   | Free Time | Dinner *   |
| 18 Sep | Break-fast | <b>L14: INS II “Nuclear”</b> <ul style="list-style-type: none"><li>Phonons (basics)</li><li><math>\omega/\tau</math> domain</li><li>Cross sections</li><li>Applications</li></ul> <b>Gediminas Simutis, Paul Scherrer Institute</b>                                                                                   | Ex. 14 <ul style="list-style-type: none"><li>Virtual INS experiment</li></ul> <b>(e-learning)</b>                                                                                                                                                          | Lunch | <b>L15: INS III “Magnetic”</b> <ul style="list-style-type: none"><li>Spin waves</li><li>Magnetic Cross Section</li><li>Applications</li></ul> <b>Kim Lefmann, University of Copenhagen</b>                                                                                                              | Ex. 15 <ul style="list-style-type: none"><li>Extract J’s ???</li><li>Spin-W ???</li></ul> <b>(new e-learning)</b>                                                   | Free Time | Dinner *   |
| 19 Sep | Break-fast | <b>L16: Polarized Neutron Scattering</b> <ul style="list-style-type: none"><li>Production, guiding and flipping</li><li>Blume equations</li><li>Uniaxial polarised neutron diffraction</li><li>Vector polarisation analysis</li><li>Neutron Depolarization</li><li>Applications</li></ul> <b>Werner Schweika, ESS</b> | <b>L17: QENS</b> <ul style="list-style-type: none"><li>Instrumentation</li><li>Energy/time-scales</li><li>Coherent / Incoherent</li><li>Diffusion, Molecular dynamics</li><li>Cross section &amp;Isotope labeling</li></ul> <b>Mark Telling, STFC/ISIS</b> | Lunch | Ex. 16 <ul style="list-style-type: none"><li>Polymer Dynamics (dynamics / diffusion)</li><li>Isotope labeling</li></ul>                                                                                                                                                                                 | Ex. 16 (continued) <ul style="list-style-type: none"><li>Polymer Dynamics (dynamics / diffusion)</li><li>Isotope labeling</li></ul>                                 | Free Time | Dinner *   |
| 20 Sep | Break-fast | <b>L18: Keynote Lecture: “Challenge 1”</b><br><b>Neutrons for Sustainability (energy)</b><br><b>Martin Månsson</b><br><b>KTH Royal Institute of Technology</b><br><b>Sweden</b>                                                                                                                                       | <b>L19: Keynote Lecture: “Challenge 2”</b><br><b>Neutrons for Quantum Evolution</b><br><b>Henrik Rønnow</b><br><b>EPF Lausanne</b><br><b>Switzerland</b>                                                                                                   | Lunch | <b>L20: Keynote Lecture: “Challenge 3”</b><br><b>Neutrons for Life</b><br><b>Tommy Nylander</b><br><b>Lund University</b><br><b>Sweden</b>                                                                                                                                                              | <b>L21: Keynote Lecture: “Challenge 4”</b><br><b>Neutrons for Industry/Engineering</b><br><b>Michael Preuss</b><br><b>University of Manchester</b><br><b>UK</b>     | Free Time | End Dinner |
| 21 Sep | Break-fast | <b>Help for Proposal Writing</b> <ul style="list-style-type: none"><li>Proposal Writing “Workshop”</li><li>Teachers + NNSP/SwedNess admin will be available</li></ul>                                                                                                                                                 | <b>L22: Key-Note Lecture: “ESS”</b><br><b>Future Science at ESS</b><br><b>Andreas Schreyer, ESS</b>                                                                                                                                                        | Lunch | <b>Help for Proposal Writing (continued)</b>                                                                                                                                                                                                                                                            |                                                                                                                                                                     |           | Dinner *   |
| 22 Sep | Break-fast | DEPARTURE DAY                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                            |       |                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                     |           |            |

\* 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.