**Focused Ion Beam Applications**

2023 Course Outline

(Note: All lectures are in boldface)

# Monday, June 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Morning* |  | | **Room** | **Lecturer** |
| 8:30-8:40 | **Welcome** | | 303\* | Kiely |
| 8:45-10:00 | Introduction to Focused Ion Beams | | 203 | *Giannuzzi* |
| 10:00-10:20 | Break | |  |  |
| 10:20-12:00 | **Physics of Ion/Matter Interaction** | | 203 | Michael |
| 12:00 | | Lunch |  |  |
| Afternoon |  | |  |  |
| 1:15-3:00 | Lab 1 : Software Simulations for Ion-Solid Interactions | | 257 | *Michael/Giannuzzi* |
| 3:00-3:30 | Break | |  |  |
| 3:30-5:00 | Imaging with Ions | | 203 | *Michael* |
| 5:15 | Dinner | |  |  |
| Evening |  | |  |  |
| 6:15-7:15  7:15-7:30  7:30-9:30 | Micro and Nanofabrication: Milling and Deposition for Prototyping  Break  Lab 2: Introduction to FIB instruments, imaging with ions, optimizing deposition and milling strategies  Scios FIB/SEM | | 203  271/172B | *Giannuzzi*  *Michael/*  *Giannuzzi/*  *Wu (Thermo Fisher)* |

\*All rooms are in Whitaker Lab unless otherwise noted

## Tuesday, June 6

|  |  |  |  |
| --- | --- | --- | --- |
| *Morning* |  | **Room** | **Lecturer** |
| 8:30-10:00 | **SEM Sample Preparation for 2D cross-sectioning and 3D Tomography** | 203 | K. Scott |
| 10:00-10:20 | Break |  |  |
| 10:20-12:00 | Lab 3: 2D FIB sectioning and FIB set-up methods for 3D tomography  Scios FIB/SEM | 271/172B | *K. Scott/Giannuzzi/Wu (Thermo Fisher)* |
| 12:00 | Lunch |  |  |
| Afternoon |  |  |  |
| 1:15-2:45 | Lab 4: Remote Zeiss Auriga – nanopatterning and 3D FIB SEM acquisition methods | 271 | *Laquerre (Fibics)/Liou*  *(with Giannuzzi/K. Scott)* |
| 2:45-3:00 | Break |  |  |
| 3:00-4:00  4:00-5:15 | **Plasma FIB and Laser FIB/SEM**  Lab 5: Remote Tescan- PFIB Lab | 203  271 | *Michael*  *Tescan personnel*  *(with Giannuzzi/K. Scott)* |
| 5:15 | Dinner |  |  |
| Evening 6:30-7:30 | Segmenting 3D Data Sets | 203 | *K. Scott* |
| 7:30-8:30 8:30-9:30 | **Ion Implantation Damage and**  **Redeposition During Ion Milling**  Student Samples  Scios FIB/SEM | 203  172B | *Giannuzzi*  *Wu (Thermo Fisher)* |

## Wednesday, June 7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Morning* |  | **Room** | **Lecturer** | | |
| 8:30-10:15 | **Specimen Prep for S/TEM and APT** | 203 | | Giannuzzi | | |
| 10:15-10:30 | Break |  | |  | | |
| 10:30-12:00 | Lab 6: S/TEM Specimen Prep I –  INLO  Scios FIB/SEM | 271/172B | | *Giannuzzi/K. Scott/Wu*  *(Thermo Fisher)* | | |
| 12:00 | Lunch |  | |  | | |
| Afternoon |  |  | |  | | |
| 1:15-2:45  2:45-3:00 | Lab 7: S/TEM Specimen Prep II –  Low Energy Polishing and APT prep  Scios FIB/SEM  Break | 271/172B | | *Giannuzzi/K. Scott/Wu*  *(Thermo Fisher)* | | |
| 3:00-5:00 | Lab 8: S/TEM Specimen Prep III –  APT prep and EXLO | 165 | | *Giannuzzi/K. Scott* | | |
| Evening |  |  | |  | | |
| 6:30  7:30 | Cocktail HourCourse Banquet | Wood Dining Room  Wood Dining Room | | |  |

## Thursday, June 8

|  |  |  |  |
| --- | --- | --- | --- |
| *Morning* |  | **Room** | **Lecturer** |
| 8:30-10:00  10:00-10:15  10:15-12:00 | Lab 9. *ex situ* Lift Out Break  **Organic Materials and Cryo-FIB Applications** | 165    203 | *Giannuzzi/K. Scott/Michael*  *K. Scott* |
| 12:00 | Lunch |  |  |
| Afternoon |  |  |  |
| 1:15-2:15 | **Cryo-FIB TEM** | 203 | *Giannuzzi* |
| 2:15-3:00  3:00-3:15 | Break  **FIB/SIMS/RAMAN** | 271 | *Giannuzzi* |
| 3:15-5:00 | **3D FIB/SEM for resin embedded biological samples** | 271 | *K. Scott* |
| 5:15 | Dinner |  |  |
| *Evening* |  |  |  |
| 6:30-9:30 | Lab 10: 3D Visualization Lab | 121 | *Marsh (ORS) / (with K.Scott)* |
|  |  |  |  |
|  |  |  |  |

## Friday, June 9

|  |  |  |  |
| --- | --- | --- | --- |
| *Morning* |  | **Room** | **Lecturer** |
| 8:30-9:15  9:15-9:45 | Post-FIB Cleaning of TEM SpecimensSelecting FIB Tools and Wrap-Up Q&A | 203  203 | *Bonifacio (Fischione)*  *K. Scott* |
| 9:45-10:00 | Break |  |  |
| 10:00-12:00 | Lab 11: Nanomill Lab demo  Lab 12: Student Samples and Hands-On Lab  Scios FIB SEM | 172F  172B | *Bonifacio (Fischione)*  *Wu (Thermo Fisher)* |
| 12:00 | Lunch (box lunches – Whitaker Lobby) |  |  |
| 1:15-3:00 | Lab 13: OPTIONAL. Hands-on Student Lab | 172B | *Wu (Thermo Fisher)* |