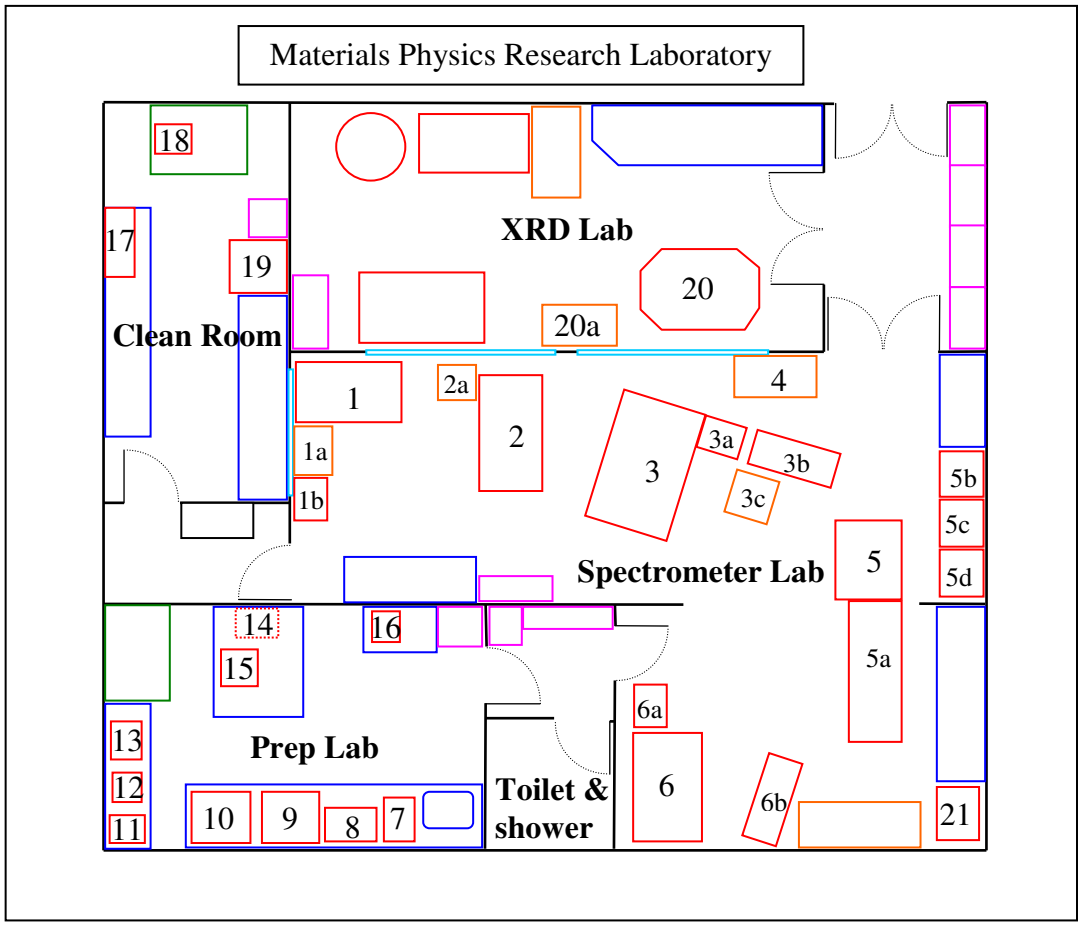
Aberystwyth University
Institute of Mathematics & Physics



Red: Equipment & Instrumentation
Dark Blue: Fitted Benches
Green: Fume Cupboards
Orange: Movable tables & benches
Pink: Storage

The UWA Institute of Mathematical and Physical Sciences, located on Penglais campus in Aberystwyth, is equipped with a diverse range of research instrumentation and facilities. This equipment is situated in various parts of the Institute of Mathematical and Physical Sciences building. The following list of facilities has been broken down according to the location (or intended location) of the equipment. If you require the use of any equipment located in Aberystwyth or require further information please contact the senior experimental officer: Dr Dave Langstaff (Email: dpl@aber.ac.uk, tel:01970 621 913)

Materials Research Laboratory

The following equipment is located in the materials physics research laboratory (Mat-Lab). The layout of this laboratory and the locations of the equipment are shown on the preceding diagram. The facilities include:

1. **Spectroscopic Ellipsometry**
    a. Control and data capture computer
    b. Sample chamber temperature control rack

   Sopra GESP5 Variable incidence Spectroscopic Ellipsometer
   Additional measurement capabilities: Spectroscopic reflectivity and transmission measurements, Off-specular scattering
   Sample Chambers: Cryogenic sample chamber for temperatures down to 4K, Optically heated sample chamber for temperatures up to 1000K, LS sample chamber for investigations at the Liquid/Solid interface

2. **Raman Spectrometer**
    a. Control and data capture computer

   Jobin Yvon LabRam HR Raman Spectrometer with confocal microscope and Sperhead for in-situ measurements.
   Lasers: HeNe 632.8 nm and Argon Ion 488 nm
   Sample Chambers: Cryogenic chamber for temperatures down to 4K

3. **Real-time Electron Energy Spectroscopy (REES)**
    a. Services rack – vacuum control and monitoring
    b. Instrumentation rack – spectrometer control electronics
    c. Data capture computer

   Specs PhoiBOS 100 analyzerm, X-ray Photoelectron Spectroscopy – twin anode x-ray gun (Al kα & Mg kα), Ultraviolet Photoelectron Spectroscopy (Specs UVS UV lamp), Low Energy Electron Diffraction, Organic Molecular Beam Deposition, Metal evaporation, In situ I-V measurement.

4. **I-V Measurement suit**
   I-V measurements for semiconductor device characterization

5. **ESCA X-ray Photoelectron Spectroscopy System – AEI ES200**
    a. Measurement instrumentation and data capture computer
    b. X-ray Power Supply
    c. Electron beam heating controllers, prep chamber controllers
    d. Pump controllers

   Old but well characterized XPS system.

6. **ESCALAB Mk2 XPS System**
    a. Service rack – vacuum control and monitoring

b. Instrumentation rack – spectrometer control electronics

Vacuum Generators ESCALAB MK2 XPS system.
Currently being fitted with prototype vacuum polymer electrospray system.

7. **Grinder-Polisher**
   Buehler Ecomet 3 variable speed grinder-polisher with Automet 2 power head.

8. **Carbolite drying oven**

9. **Carbolite 1700 °C furnace**

10. **Carbolite 1500 °C furnace**

11. **Buehler Isomet 1000 precision saw**
    150mm diamond disc cut off saw for preparing ceramic samples.

12. **Specac 15 ton hydraulic press**
    For pressing powder samples into pellets, crushing solids for XRD measurements etc.

13. **Spex Certi Prep 8000D Mixer Mill**
    Ball mill for breaking down samples to nanoparticles and mixing powdered samples.

14. **Elga Labwater Option R7 water purification system**
    Reverse osmosis water purification with UV lamp and 25L reservoir. Produces 7L of 15 MΩ cm water per hour.

15. **Laboratory scales**
    Collage B154 scales. Range up to 150g, resolution 10^{-4}g.

16. **Ultrasonic Cleaner**
    Decon FS200 frequency sweep ultrasonic cleaner for cleaning samples and equipment.

17. **Belling Drying Oven**

18. **Plasma Cleaner**
    Harrick PDX-3XG Plasma cleaner with Argon gas supply for cleaning and sterilizing samples and equipment.

19. **Turbo vacuum System**
    Scanwel Cube frame turbo vacuum pumping system for electron detector testing and characterization.

20. **X-ray Powder Diffractometer**

a. Control and data capture computer

Brucker D8 Advance powder diffractometer fitted with Vantech Super Speed position sensitive detector.

21. Portable Vacuum System

Pfeiffer TPU 330 turbo vacuum system on mobile frame for testing purposes and running small experiments

The following equipment is located in various rooms thorough the department. Much of the equipment is set up for use and some is in temporary storage until it is required.

22. Ozone Oxidation System

Ozomax ozone generation, oxidation and destruction system for rapid controlled oxidation of semiconductor materials.

23. Imaging Ellipsometer

Experimental prototype imaging ellipsometer for surface characterization. Still under development.

24. Edwards 15 cm bell jar evaporator

Edwards speedvac combination pumping unit with 6.E.2. coating unit for evaporating films from a variety of materials.

25. Mobile Luminescence end station

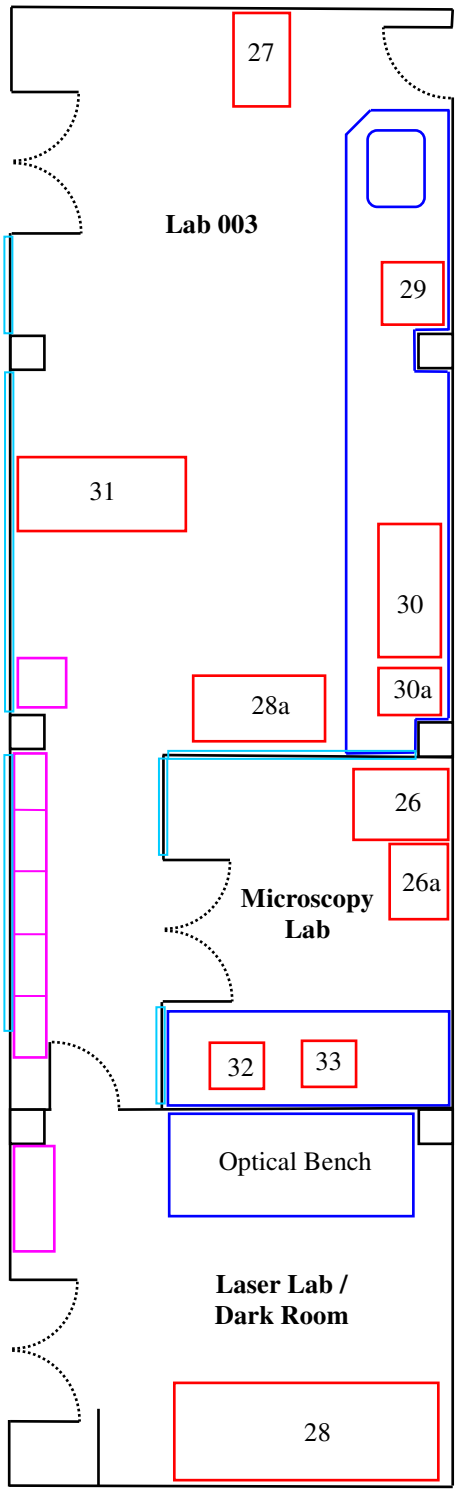
a. Closed loop helium cryostat cooler
b. Data capture and control computer

Luminescence system for use as a synchrotron end station or off line with laser absorption.

26. 4 Axis Gonioreflectometer

Measures "Bidirectional Reflectance Distribution Function" BRDF of small samples (min approx 1cm square). White light source, Spectrometer spectral range 300-1150nm, Angular resolution 0.25 deg on each axis, LabVIEW control.

The following facilities are situated in the new extension of the materials research laboratory (room 003) in the basement of the physics building. The lab is equipped with a closed loop water cooling system and includes a microscopy suit and a dark room / laser lab.



27. Atomic Force Microscope

a. Control electronics, control and data capture computer

Psia XE100 Advanced Scanning Probe Microscope
Capabilities: Atomic force microscopy, Electric Force Microscopy, Interfacial Force Microscopy, Scanning Tunneling Microscopy. Includes a High precision temperature controlled liquid cell for in vivo imaging.

28. Edwards 30 cm bell jar evaporator

For evaporating films from a variety of materials.

29. Aberystwyth experimental levitating furnace

a. Control and data capture computer

Spherical samples levitated on a jet of Argon and heated with Synrad Evolution 125W CO_2 laser.

30. Gold Sputter Coater

Polaron Bio Rad E5200 automatic gold sputter coater.

31. Hall effect & 4 point probe system

a. Data capture computer

Signatone 4 point probe for conductivity measurements.
Oxford instrument electromagnet and measurement instrumentation for determining carrier concentrations in semiconductor materials.

32. Classix (Chemical Luminescence and Structure of Surface via micro Imaging X-ray absorption)

Luminescence imaging system for use as a synchrotron end station or off line with laser absorption.

33. Meiji MX9430 Polarizing microscope

Triocular head, strain free 4X 10X 40X objectives, 10X eyepieces, rotation stage with XY mechanical stage, Transmitted and reflected Koehler 30W illumination. A digital SLR camera and photo eyepiece is available for use with this microscope.

34. Optical inspection microscopes

A selection of basic optical microscopes for sample examination and inspection.

Simulation and Visualization

35. Modeling and simulation supercomputer

SGI Altix 3000 supercomputer system for modeling and simulation. 64bit computer running linux operating system.

36. 3D visualization
ImmersaDesk 3D visualization system, PC controlled, LINUX based, DUAL 64-bit AMD Athlon platform, visualization software by AVS (Development Suite).

Mars Laboratory

37. Simulation mars terrain
Mars terrain simulation region with Mars soil stimulant-D

38. Motion capture camera system
12 Infra Red camera Vicon motion capture and tracking system and software

39. Mars rover chassis
RCL ExoMars concept E Mars rover chassis

40. Panoramic camera system
UWA ExoMars panoramic camera system for rover guidance and navigation

41. Theodolite system
High resolution theodolite surveying system

42. Computing suit
Standard computing suit with Envision robot modeling, simulation and visualization software

43. Laser terrain mapping scanner
Scans terrain to map surfaces in 3D
Range 25m, Resolution better than 5mm

Rheology

44. TA Instruments AR2000 Advanced Rheometer
Measures viscosity, normal stress difference and dynamic properties of fluids as a function of shear rate and temperature.

45. TA Instruments AR1000 Rheometer
Measures viscosity, normal stress difference and dynamic properties of fluids as a function of shear rate and temperature.

46. TA Instruments CP20 Rheometer
Measures dynamic fluid properties as a function of frequency

47. Bohlin Instruments RH10 advanced capillary Rheometer
Measures shear and extensional viscosities as a function of stress rate and temperature.

48. High Speed Camera
Vision Research Phantom V7.3 colour high speed camera. 800 x 600 pixel resolution at 6688 frames per second, up to 190,000 frames per second at 32 _ 32 pixel resolution.

Robotic Telescopes

IMAPS is equipped with two robotic telescope systems for observations of the night sky and the sea over Cardigan Bay. The telescopes are located on the roof of the physics building and at Frongoch farm just outside the campus (installation of this telescope is not yet complete). Frongoch farm offers a wide unobstructed view of the sky and is an excellent dark sky site outside of Aberystwyth. The telescopes are housed in Homedome Robodomes and fitted with Robofocus units so that they can be controlled remotely and are protected from adverse weather. The telescopes are as follows:

49. Meade 10" Schmidt Cassegrain telescope situated on physics roof
Fitted with Watec 902H low light CCD camera. Also has a wide angle CCD cameras piggybacked on telescope.

50. Celestron CPC 11¼" telescope to be situated on Frongoch farm
A second remotely controlled telescope system. Installation is not yet complete.

51. Meade ETX-70AT Robotic Refracting telescope.
A small and portable refracting automated telescope.

Workshop Facilities

UWA Physics has well equipped electronics and mechanical engineering workshop facilities, providing technical support to the research laboratories. The workshop staff have years of experience in instrumentation and equipment maintenance, manufacture and modification, with capabilities including:

52. Electronics workshop
PCB design, etching and assembly
PicAxe microprocessor programming
Programmable logic control
LabView Interfacing

53. Mechanical Workshop
Machining (turning, milling etc)
Grinding (surface and spindle)
Welding (TIG, MIG MMA, Brazing, silver soldering)
Precision fitting
Wood machining