

ARC-MMA – Assets Include Equipment, Staff and Facilities

Equipment

Mass Spectrometry

1. GC/MS - Agilent 5973N Mass Selective Detector interfaced to a 6890 gas chromatograph which is equipped with a 7683 automatic liquid sampler with EI source.
2. GC/MS – Thermo Scientific ISQ QD single quadrupole GC-MS with Trace 1310 GC and with automatic liquid sampler.
3. GC/MSMS - Thermo Scientific TSQ 8000 Evo Triple Quadrupole GC-MS/MS, equipped with Triplus RSH autosampler and EI and CI (methane) sources.
4. MARKES Thermal desorption Unity-xr with Ultra-xr (100 sorbent tubes) autosampler. Interfaced to Thermo ISQ QD GC single quadrupole mass spectrometer.
5. Thermo-Finnigan LTQ LC/MSMS linear Ion-trap mass spectrometer with ESI source.
6. Bruker maXis Plus ultra-high-resolution quadrupole time of flight (QTOF) mass spectrometer with Waters Acquity H-class UPLC. Equipped with Bruker ESI and APCI sources.
7. LC/TOF-MS (accurate mass) Agilent 6224 walk-up time-of-flight mass spectrometer (WTOF) interfaced to an Agilent 1200 HPLC with electrospray and multi-mode (ESI/APCI) sources, and an IonSense Direct Analysis in Real Time (DART) ambient ionization source.
8. LC/TOF-MS (accurate mass) Agilent 6230 Agilent time-of-flight mass spectrometer (BTOF) interfaced to an Agilent 1290 Infinity UHPLC with electrospray and multi-mode (ESI/APCI) sources.
9. LC/QTOF-MSMS (accurate mass) Agilent 6510 quadrupole time-of-flight mass spectrometer (QTOF) interfaced to an Agilent 1200 HPLC with electrospray and multi-mode (ESI/APCI) sources
10. Waters Xevo UPLC-MSMS triple quadrupole with Waters Acquity H-class UPLC, with ESI ionization.
11. Waters Acquity UPLC with PDA detector.

NMR/EPR Spectroscopy

12. Agilent (Varian) 400MR: Equipped with Automated Tuning and a 7620 96-slot Sample Changer.
13. Bruker US400: Equipped with BBFO SMART Probe and SampleCase.
14. Bruker NEO400: Equipped with a Prodigy BBFO Cryo-Probe and SampleCase.
15. Bruker Ascend 400: Equipped with BBFO smart probe, sample case, and extended range VT.
16. Agilent Inova 500: With three channels, 3-axis gradients and many other accessories including HCN, broadband probes and a NANO (HRMAS) probe.
17. Agilent Inova 600: With four channels, 2H decoupling, 3-axis gradients and many other accessories including HCN and a flow-probe.
18. Bruker ELEXSYS E500 X-Band CW EPR Spectrometer System with Bruker cold edge and cryostat. Dual band and high sensitivity probe options are available.
19. Bruker EMX X-band EPR Spectrometer System.
20. Spare Parts Store (working): Three Inova Consoles, Two Mercury Plus Consoles, one mothballed narrow bore (NB) self-shielding Magnex US400 magnet and accessories, two de-energized NB 300 oxford magnets, Magnex Charging Kit, Stainless hydraulic solenoid lift kit, Variety of Varian solution probes, one 3.2mm Varian 400 MHz CPMAS probe.

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Spectroscopy

21. Nicolet iS-50 FT-IR spectrometer with a single pass diamond ATR-ZnSe also a high index of refraction Ge crystal for thin films, powders and liquids; Harrick Grazing Angle Reflectance Accessory for thin films on metal or semiconductor substrates; Gemini Diffuse Reflectance Accessory for non-reflecting powder materials.
22. Agilent (Cary) UV-Vis-NIR equipped with VASRA or Variable Angle Specular Reflectance Accessory that is used with thin films at angles from 20 to 70 degrees; Praying Mantis diffuse reflection analysis of solids and powders.
23. Malvern Zetasizer Nano ZS with 633nm 'red' laser for size measurement of particles and molecules (e.g. proteins) dispersed in a liquid (using dynamic light scattering, DLS); zeta-potential of colloids and nano particles for predicting dispersion stability (using electrophoretic light scattering); and the measurement of microrheology of protein and polymer solutions. The high performance of this instrument also enables the measurement of molecular weight of macromolecules.
24. Edinburgh FS5 spectrofluorometer for steady state (150 W xenon lamp) and time-resolved fluorescence emission measurements in the 230-870 nm spectral range. Fluorescence lifetime capability (TCSPC – Time Correlated Single Photon Counting) with EPLED 320nm, 365nm, 450nm, and 650nm LEDs, and EPL 510nm pulsed diode laser). Temperature controlled sample holder and solid sample holder. Integrating sphere for quantum yield measurements.

Magnetic and Physical Properties

25. Quantum Design PPMS – 9T, DC Resistivity, Electrical Transport, Vibrating Sample Magnetometer (VSM), Thermal Transport, Heat Capacity, Horizontal Rotator, Multi-Function Probe, VT from 1.8 K to 1000 K
26. Quantum Design MPMSXL – 5T supercon with SQUID AC susceptibility, Reciprocating Sample Option (RSO) for DC field measurements, VT from 1.8 K to 400 K
27. Quantum Design Dilution Refrigerator Probe, VT to 50mK (Prof. Kate Ross, Physics)
28. Quantum Design iQuantum Helium-3 Insert, VT to 500 mK (Prof. Kate Ross, Physics)

Thermal Analysis

29. TA Modulated DSC 2500 with sub-ambient accessory and multi-position sample holder.
30. TA TGA Q500 Thermogravimetric analyzer measures thermal stability, multi position sample holder for measurements from ambient up to 900°C.

X-ray Science

31. Bruker D8 Discover Series II Diffractometer with Parabolic Göbel mirror for parallel and monochromatic beam, ¼-circle Eulerian cradle, Equipped with 4-Bounce monochromator capable of HRXRD, XRR and GAXRD.
32. Bruker D8 Discover – DAVINCI with Flip-Stick sample stage, Lynx-Eye Detector, Diffrac.EVA, TOPAS and other software for powder XRD, adaptable for VT experiments with Anton Parr HTK1200N stage.

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33. Bruker D8 Discover Series II – theta-theta mode, Göbel mirror or Bragg, Cu radiation, Lynx-Eye detector upgrade
34. Bruker APEXII single-crystal diffraction system.
35. Rigaku Small Angle X-ray Scattering with Cu rotating anode and MicroMax-007HF
36. Bruker D8 Quest Single Crystal XRD with fixed CHI, Photon 50, sealed Mo tube, Triumph monochromator and motorized track.

Helium Recovery

37. Quantum Design ATP30 Helium Purifier and ATL160 Helium Liquifier – high pressure recovery system, auxiliary storage components provide for approximately 25 liter per day of liquid.

Staff

Staff Scientists – five full-time PhD scientists cover all major instruments, chemistry, engineering and life science disciplines, provide expertise for student training and full collaborations as may be needed or desired.

Post-Doctoral Research Associates – one temporary post-doc assignment at fifty percent level to the MMA is desirable where need is demonstrated, and funding becomes available.

Graduate Research Assistants – two or three graduate student teaching/research assistants are assigned to MMA laboratories via collaborative opportunities provided by Chemistry, OVPR and SAMD. These students receive advanced training in the instrument arts, are involved in all aspects of the MMA laboratory including teaching, training, assisting with classroom labs and demonstrations, instrument maintenance and method development

Undergraduate Student Interns – three to five undergraduate student hourly employees and for-credit internships from the Chemistry department that receive training and experience in laboratory operations and professional development around team science and soft skills. Many of these students become very proficient in sample preparation, instrument operation and basic maintenance.

Business and Office Management – the MMA is aided by one full-time-equivalent business manager, in charge of CORE business management, recharge center cost-accounting, and grant proposal pre-and post-award management.

Facilities

Approximately 8150 square feet of space is assigned to the MMA

Chemistry Main Basement Laboratory: Total space is 6800 square feet for ARC-MMA. This includes staff offices and break area (1200 sq ft of total) and investigator collaborative area, C1; laboratory equipment and computer work station floor space in C2B, C3, C4 and C5 (C5 includes undergraduate student intern office pod); 400 square foot NMR Lab, C3E; 700 square feet of additional space for project staging, C2; a 150 square foot gender neutral bathroom, C2A.

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Equipment found here includes ARC-MMA mass spectrometers, NMRs, XRDs, Magnetic Properties, Spectroscopic tools and Thermal Analysis instruments, as well as a few ARC-ISS surface analysis instruments (XPS, CAG, VASE).

Chemistry High Field Basement NMR Laboratory is a 400 square foot lab with a 14 Tesla narrow bore, unshielded NMR magnet and console, B2.

Chemistry B115 XRD Laboratory is a 600 square foot laboratory in the 1st floor B-wing with office space. Instruments found here include a powder XRD, a single crystal XRD and a SAXS.

Chemistry Research Building CRB-109 is 350 square feet of new laboratory space plus office with vibrationally isolated floor that holds two 400 MHz NMRs, a routine electrospray mass spectrometer.

Chemistry Research Building CRB-204Lb is 175 square feet of new laboratory space that houses a Bruker D8 QUEST single crystal XRD system capable of shutterless data collection.

Computers and Data Management Infrastructure. Instrument data are collected and stored on instrument hard drives for up to one year. A copy of the data is also be stored through automatic backups onto the CSU's ACNS Research Storage solution, RStor, which currently is configured with over 300 terabytes of storage. This is a recently implemented DELL Isilon storage platform located in the CSU campus data center and can be accessed directly from any computer workstation in the ARC-MMA lab. The ARC-MMA has three networked workstations in addition to our instrument computers where students can access and process data. Data is stored on RStor and accessible to users for 5 years. After this period, data files are transferred onto an external hard drive for archiving and cleared from RStor. This data management plan, which is implemented throughout the ARC-MMA, guarantees secure backup of any data collected on all instruments.

Software licenses

ARC-MMA maintains current licenses for several software packages, including data acquisition and processing software of vendors of the different instruments. Data can be analyzed by users using the instrument software on the workstations in the MMA, or remotely (for most instruments) from their own computers by RemotePC™, a license provided by the ARC-MMA to all users. The following licenses are offered to investigators for their own use and installation with an additional fee as they cannot be accessed through RemotePC™:

- Cambridge Crystallographic Data Centre (CCDC)
- CrystalMaker software package (including CrystalMaker, SingleCrystal, CrystalDiffract, and SingleCrystal Viewer)
- Inorganic Crystal Structure Database (ICSD-web)