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Physics Collection Development Policy

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1. Purpose of the collection

The Library purchases physics resources to support the needs of the following primary user groups.

The undergraduate and postgraduate teaching programs of the School of Physical Sciences include: pure and applied physics, experimental physics, theoretical physics and astronomy.

There is a choice between B.Sc. degree and the B.Sc.App. (Physics) degree. The School offers a three year undergraduate course for the B.Sc. degree, which has traditionally been divided into two "streams" - a pass stream and an honours stream. The pass stream provides a general knowledge of physics suitable for positions in commerce and industry for which a general scientific background is an advantage, including teaching in schools. Study towards a higher degree is facilitated via the (M.Sc.) program after a successful completion of a PG.Dip.Sc.(Physics) or by virtue having passed a fourth year M.Sc.(Qualifying) course.

The honours stream is intended for students wishing to specialize in physics. A series of honours subjects leads after three years to a B.Sc. degree, and provides entry to the fourth year honours course and the postgraduate B.Sc.(Hons) degree. A student obtaining honours Class 1 or 2A may proceed to enrolment in the Ph.D. program. A student with 2B honours may commence the M.Sc. program.

2. Primary user groups served

The research interests of staff and graduate students of the School, the Centre for Quantum Computing Technology, the Centre for Quantum-Atom Optics (both of which are ARC Centres of Excellence), the Centre for Biophonics and Laser Science, the Centre for Organic Photonics and Electronics, and the Centre for Mathematical Physics are listed below. Some sections of this material are also relevant to teaching and research in the Centre for Magnetic Resonance and the Centre for Drug Design and Development.

The broad areas of research are in:

- Astrophysics and astronomy
- Quantum science
- Laser science
- Condensed matter physics

School of Physical Sciences:

- ionospheric studies using satellite observations
 - astrophysical studies of physical processes occurring in stars and planetary nebulae.
 - Includes theoretical, radio and optical astronomy, theoretical physics of laser interactions, including quantum measurement, computation and communication
 - experimental laser physics, ranging from far-infrared laser development to spectroscopy in the ultra-violet. Includes laser cooling and trapping, micromanipulation, laser flow diagnostics and laser chaos
 - geophysics, including geographical exploration research, gravity research, earthquake strain studies, ore body delineation, airborne gravity and outburst prediction studies in deep underground coal mines
 - solid state physics using X-ray crystallography and neutron scattering techniques
 - marine physics - studies of estuaries and wind waves, time domain modelling of circulation and temperature, application of linear frequency-domain modelling of circulation
 - condensed matter biophysics
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- atom optics including experiment and theory on Bose-Einstein condensates, nonlinear and quantum dynamics, and quantum chaos
 - quantum science information including quantum optics and quantum information theory, entanglement in quantum information, quantum measurement and feedback control, entanglement in quantum many-body systems, simulation algorithms for quantum many-body systems, emergent phenomena in strongly correlated quantum systems
 - fundamental tests of quantum mechanics and advanced quantum technologies with future applications in metrology, communication, and computation, primarily based around optical architectures integrated onto silicon chips and compatible with current-day fiber optic systems
 - Quantum nanoscience, including quantum measurement, quantum electro-mechanical systems, quantum nonlinear dynamics and quantum information
 - Quantum technology, including biomolecular optoelectronic materials and devices, optical quantum computing, high-efficiency quantum interrogation, controlling quantum technologies, quantum holography encoding quantum information in optical patterns and quantum state engineering
 - Laser diagnostics of hypervelocity flows including development and application of advanced measurement techniques to high enthalpy

flows, flames and plumes with the aim is of characterising such flows by the use of non-intrusive laser-based methods

- Optical nano probes
- Nano-optics and quantum dots
- Laser micromanipulation
- Experimental and theoretical condensed matter physics

Centre for Biophotonics and Laser Science:

- Laser physics
 - Mesoscopic quantum systems and atom optics.
 - Quantum optics. This includes: quantum computing and quantum cryptography; quantum measurement and control; cavity QED and microlasers; squeezed light applications.
 - Future optical technologies, including: biological applications of optical tweezers; optical micro manipulation using donut beams; laser dynamics and patterns; laser diagnostics.
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- Fundamentals of light-matter interactions with core strength in atom optics, quantum information and communications, laser spectroscopy
 - Biological imaging and sensing, with core strength in optical spectroscopy of synthetic melanins
 - Biological spectroscopy and devices
 - Laser manipulation with core strength in fundamentals of optical force and torque application and measurement using optical tweezers
 - Biomedical and clinical applications with special concern for applications of lasers and optical techniques to dentistry

Centre for Quantum Computing Technology:

- solid state quantum computing
 - semiconductor nanofabrication and atomic manipulation
 - single electron quantum electronics
 - quantum algorithms
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- quantum information
 - quantum dot quantum computing
 - experimental optical quantum computation
 - linear optics quantum computation

Centre for Mathematical Physics (in conjunction with UQ Mathematics):

- Quantum groups, quantum affine algebras
- Supersymmetry, supergeometry
- Knot theory, 3-manifolds
- Integrable models in statistical mechanics
- Foundations of quantum mechanics
- Algebraic methods in quantum chemistry
- Quantum field theory
- Quantum chaos

Centre for Quantum-Atom Optics

- Atom lasers and formation of quantum degenerate gases
- Coherent manipulations of matter waves
- Quantum statistics and pairing correlations in ultracold Bose and Fermi systems
- Macroscopic correlations, entanglement and fundamental tests
- Computational physics and theoretical methods for Bose and Fermi systems

3. Description of the collection

The majority of the collection is housed in the Dorothy Hill Physical Sciences & Engineering Library, although older less-used material may have been withdrawn to the on-campus warehouse. Many full-text resources are also available via the Library Web catalogue. Relevant, quality web sites are also sent for cataloguing and inclusion in the Web Catalogue.

The monograph series *Lecture notes in physics* and *Topics in applied physics* are received on standing order, from Volume 1 in each case. The collection is especially strong in the area of quantum optics, an area of excellence within the University.

The Dorothy Hill Physical Sciences and Engineering Library maintains a strong core reference collection that includes *Encyclopedia of physics*, *Encyclopedia of applied physics*, *Encyclopedic dictionary of physics* and *Zahlenwerte und Funktionen aus Physik, Chemie, Astronomie, Geophysik und Technik*. Other reference material includes the *CRC Handbook of Chemistry and Physics*, the *CRC Handbook of Laser Science and Technology* and the *Encyclopedia of Lasers and Optics*. The full text of 1200 Elsevier Science journals is available through *ScienceDirect*.

The *INSPEC* database incorporates *Physics abstracts*, *Computer and control abstracts*, and *Electrical and electronics abstracts*. The Library maintains access via the library database network from 1969 onwards. *Science Citation Index* is available as part of the *Web of Science* database from 1945 onwards. Other databases available and relevant to aspects of physics include *MathSciNet*, *GeoRef*, and *Compendex* and *Scopus*. *SciFinder Scholar* is also useful to those working in the Quantum area.

Current awareness services are facilitated by *Web of Science*, *ScienceDirect* and *Inspec* electronic databases.

4. Interdisciplinary relationships

Theoretical physics is strongly supported by the mathematics collection, geophysics collection and the physics collection in the Dorothy Hill Physical Sciences & Engineering Library. Staff and students of chemical, civil and mechanical engineering, as well as mathematics heavily use fluid mechanics material.

A wide range of clients within physical sciences and engineering generally uses applied physics material. Nanotechnology in particular is an emerging area with overlaps between Chemical Engineering, Chemistry, Computer Science and Electrical Engineering.

5. Scope of current collecting

1. Languages collected

Current material collected in physics is in English, whatever its country of origin.

2. Geographical areas collected

Not relevant to physics.

3. Chronological areas collected

Not relevant to physics.

4. Types (formats) of material collected

The collection contains mainly material in printed format. A small collection of videocassettes is held for undergraduate teaching. Patents, preprints and laboratory manuals are not collected.

To ensure timely access to core journals by teaching and research staff, journal titles which become available in electronic format are purchased unless costs are prohibitive. The Library has an especially strong collection of full text electronic journals in Physics, including journals published by the Institute of Physics, the American Physical Society and the American Institute of Physics.

5. Publication dates

Collecting focuses on current and recently available imprints. Retrospective purchase of selected items has occurred on previous occasions to support new research programs.

6. Special considerations

None.

7. Conspectus

The general Physics collection is currently at a 3b level. There are particular strengths in Spectroscopy and Quantum Optics, both of which are currently at level 4.