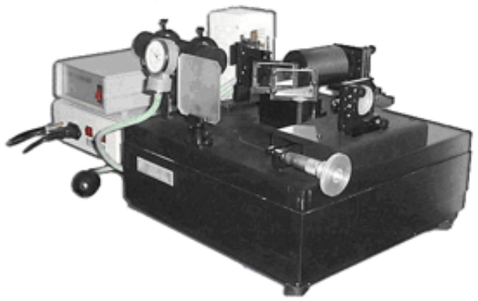
LEOI-20 Michelson Interferometer



Introduction
The table-type design Michelsen Interferometer facilitates easy examination of study sample into the light path. It is suitable for physics education in vairous higher learning institutions.

Experiment Examples
- Measurement of monochromatic light wavelength.
- Observing patterns of white light interference, equal inclination and equal thickness interference.
- Measurement of wavelength difference of yellow sodium doublet.
- Measurement of refractive index of air.

Key Features
- Easy operation and stable performance
- Detailed lecture notes
- Competitive price

Specifications	
Flatness of Beam Splitter and Compensation Plate	≤ 1/20 λ at 633nm
Min. Reading of Mirror Moving	0.5 μm

Travel of Movable Mirror	
Rough Adjustment	10 mm
Fine Adjustment	0.25mm corresponds to 690 interference fringes
Air Pressure Gauge	0~40kPa
He-Ne Laser Output	0.7~1mW
Wavelength Measurement Accuracy	~2% error as counting to 100th fringe

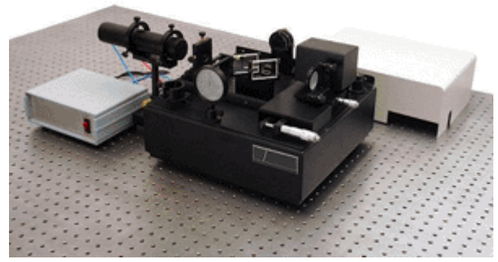
LEOI-21 Universal Michelson & Fabry-Perot Interferometer

Introduction
This equipment can be easily transformed between the historically important Michelson Interferometer and the high resolution Fabry-Perot Interferometer. It applies to optical experiment in physics teaching at institutions of higher learning.

Experiment Examples
- Precise measurements with two modes of operation.
- Easy operation and stable performance.
- Documentation contains both theoretical and practical descriptions.

Experiment Examples
The Michelson Interferometer
- Interference fringes
- Equal inclination fringes
- Equal thickness fringes
- White light fringes
- Determination of wavelength
- Precise comparing of wavelengths

The Fabry-Perot Interferometer
- Multiple beam Interference
- Precise comparing of wavelengths

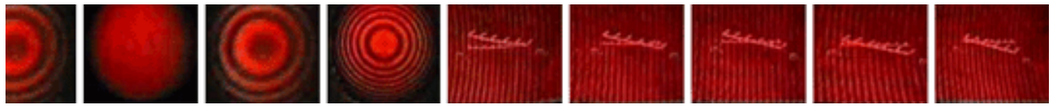


Specifications	
Flatness of Beam Splitter and Compensating Plate	0.05 λ
Min Division Value of Micrometer	0.0002 mm
Travel of Movable Mirror	0.25 mm for micrometer, and 10mm for presetting
Diameter of F-P Mirror	36 mm
He-Ne Laser Output	0.7-1mW
Wavelength of Laser	632.8 nm
Barometer	0-40 KPa
Wavelength Measurement Accuracy	Relative error 2% for 100 fringes

LEOI-22 Precision Interferometer

Introduction
This equipment integrates the historically important Michelson interferometer, the high resolution Fabry-Perot interferometer and the useful Twyman-Green interferometer into one unit. The Michelson interferometer is still an important instrument in today's laboratories. As the most typical instrument for interferometry, Michelson interferometer is often the first to be introduced to students. The Fabry-Perot interferometer is also an important metrological tool, allowing precise measurements of wavelength and free spectral range. A Twyman-Green interferometer is a very useful variant of the Michelson interferometer, usually used for measuring defects in optical components such as lenses, prisms, plane-parallel windows, laser rods, and plane mirrors. Measurements are precise in three modes of operation. Switching between the three modes and aligning components are relatively simple.

Example patterns of equal inclination fringes and equal thickness fringes produced by this interferometer.



Key Features
- Stable: heavy steel base enhances stability.
- Three Modes: Michelson, F-P & Twyman-Green.
- Easy Operation: Two micrometers, one for presetting, the other for fine adjustment to control mirror movement. Mounting holes for screen, air chamber, easy to assemble or dismantle.
- Precise: Min division of micrometer 0.2 mm. Flatness of BS & compensator 0.05 ..
- Large Optics: 30mm in diameter produces larger patterns for more accurate experiment result.
- Complete Solution: Includes necessary components to perform 9 experiments in Michelson mode, 2 in Fabry-Perot mode and 1 in Twyman-Green mode.
- Time saving Documentation: Comprehensive document contains both theoretical and practical description, save your time for preparing the experiments.
- Competitive Price: affordable price within your budget.

Application Notes
The Michelson Interferometer
- Interference fringes
- Equal inclination fringes
- Equal thickness fringes
- White light fringes
- Determination of wavelength
- Precise comparing of wavelengths
- Refractive index of transparency Slice
- Refractive index of air

The Fabry-Perot Interferometer
- Multiple beam Interference
- Precise comparing of wavelengths

The Twyman-Green Interferometer:
Demonstration of the Twyman-Green interferometer features

Specifications	
BS & Compensator Flatness	0.05 λ
Min Division Value of Micrometer	0.0002 mm
Travel of Movable Mirror	25 mm for micrometer, and 10mm for presetting
Diameter of F-P Mirror	30 mm
He-Ne Laser Output	0.7-1 mW
Wavelength of Laser	632.8 nm
Barometer	0-40 KPa
Wavelength Measurement Accuracy	Relative error 2% for 100 fringes

Components List

No.	Name	Description	Qty
1	He-Ne Laser	0.7~1mW	1 Set
2	Laser Holder	LEPO-44	1
3	Ground Glass Screen	80mm in diameter	1
4	Adaptor		1
5	Small Telescope	6X with holder	1 set
6	Sodium-tungsten Lamp	Sodium lamp: 10W, Bromine tungsten lamp: 15W	1 set
7	Low Pressure Sodium Lamp	20W	1 set
8	Gauge	0~40KPa	1 set
9	Air Chamber	L=80mm	1
10	Measuring Telescope	8mm	1

LEOI-30 Diffraction Intensity System

Introduction
The system is suitable for general physics experiments in universities, featuring stable performance, easy operation, LED display and accurate reading. The photocell receiver includes an amplifier.

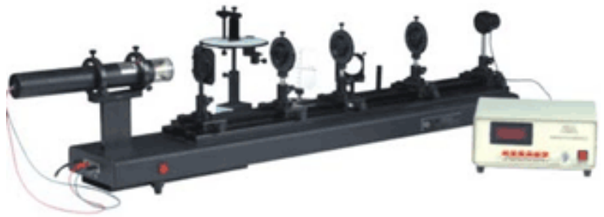
Complete Set of System including:
Special optical rail, slide, multi-slit plate, He-Ne laser, grating, adjustable slit, photocell.

Experiment Examples
- Single-slit diffraction
- Double-slit diffraction
- Multi-slit diffraction

Specifications	
He-Ne Laser	1.5 mW
Multi-slit Plate	8 slits, 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1, 2 mm in width
Displacement of Photocell	Range: 80 mm, Accuracy: 0.01 mm
Receive Unit	Photocell, 20 μW-200 mW

LEOI-40 Experimental System for Polarized Light

Introduction
The system experimental system is for study of polarized light. Students can complete the following experiments through manual operation:
- Polarizing reflection
- Measuring Brewster angle
- Verifying Malus' law



Complete System Set
- Polaroid, wave plate holder
- Lens holder group
- Small source with high brightness
- Special guide and sliding bench, optical goniometer
- Half wave plate, quarter wave plate, lens group
- Special guide and sliding bench, optical goniometer, He-Ne Laser, photoelectric receiver

LEOI-50 Experimental Device for Semiconductor Laser Pumping

Introduction
Designed for non-linear optical experiments in modern physics taught at universities and colleges, it takes a 808 nm semiconductor pump Nd: YVO4 as the object to be studied, allowing students to adjust the laser's light path themselves. By putting a KTP crystal into the cavity to generate frequency-doubled light, it is possible to observe frequency doubling phenomenon, and measure frequency doubling efficiency, phase matching angle and other basic parameters, thereby gaining some knowledge on laser principle and laser technology.

Complete System
- Optical Rail, 2-D positioning mount, and 4-D positioning mount
- Light source for pump: 808 nm semiconductor laser
- Indicating light source: 650 nm semiconductor laser
- Doublefrequency crystal: KTP Nd: YVO4
- Output mirror and filter
- Laser power meter
- IR viewing card

LEOI-40 Experimental System for Polarized Light

Introduction
The system experimental system is for study of polarized light. Students can complete the following experiments through manual operation:
- Polarizing reflection
- Measuring Brewster angle
- Verifying Malus' law

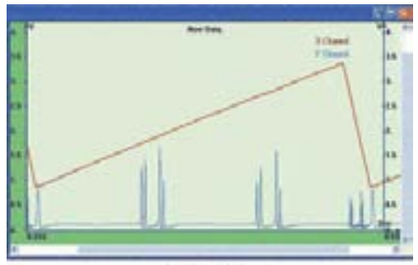
Complete System Set
- Polaroid, wave plate holder
- Lens holder group
- Small source with high brightness
- Special guide and sliding bench, optical goniometer
- Half wave plate, quarter wave plate, lens group
- Special guide and sliding bench, optical goniometer, He-Ne Laser, photoelectric receiver

LEOI-51 Laser Mode Analyzer

Introduction
This device allows users to quantitatively assess the mode characteristics of a laser. For example, precision measurements and holograms need fundamental transverse mode laser output while laser ranging requires not only fundament transverse but also single longitudinal mode. This is done through performing a series of experiments and obtaining various parameters from which we can determine how the laser diode is performing. It is then possible to establish whether the laser diode meets the desired specifications. Users may perform laser mode analysis on a computer (provided by user) after connecting it to your PC. Users may also observe the mode spectrum with an oscilloscope connected (provided by user).

Experiment Examples
- Familiar with principle and operation of scanning confocal interferometer
- Observation of longitudinal and transverse modes distribution.
- Observation of several of modes of different lasers
- Determination of mode structure by calculating modes spacing of the laser

Specifications	
He-Ne Laser	
Cavity Length	246 mm
Wavelength Accuracy	1 nm
Center Wavelength	632.8 nm
Scanning Confocal Interferometer	
Cavity Length	20 mm
Curvature of Concave Mirror	20 mm
Reflectivity of Concave Mirror	99%
Fine Constant	> 200
Free Spectral Range	4 GHz
Mode Spacing Error	< 20 MHz


Mode spectrum

The software
The software will lead the user into different functions of the system. User can perform mode analysis, graphically display it, and print it out.

LEOI-60 Single-photon Counting Experimental System

Introduction
This single-photon counter, specially used for weak signal measurement, can be combined with grating spectrograph to detect weak signal, Raman spectrum and fluorescence spectrum of substances from 300 nm to 650 nm. It can also be applied for other weak signal measurement. The counter features high sensitivity, low noise, compactness, and ingenious structure.

Specifications	
Wavelength Range	360-650 nm
Integration Time	0-30 min (1ms/stop, adjustable)
Threshold Voltage	0-2.56V (10 V/stop, adjustable)
Max Count Reading	more than 107
Dark Count	less than 30 cps (-20°C)

Complete System Set
- Working power supply and amplifier system
- Counter card
- Semiconductor refrigeration system
- Computer and operating software
- CR 125 Photomultiplier tube and mounting component

LEOI-61 Single-photon Counting Experiment System

Introduction
The experimental system, composed of a single photon counter and external light path, employs pulse height discrimination technology and digital counting technology and has a higher linear dynamic range. The digital output signal enables computer to process the data. It offers a highly relevant teaching tool.

Specifications	
Wavelength Range	360-650 nm
Integration Time	0-30 min (1ms/stop, adjustable)
Threshold Voltage	0-2.56V (10 V/stop, adjustable)
Max Count Reading	more than 107
Dark Count	less than 30 cps (-20°C)

Complete System Set
- Single photon counter;
- Semiconductor refrigerator system;
- External light path (including light source, filter, weakener, and optical rail)
- Computer and operating software; USB Interface;
- Light energy indicating meter.

LEOI-100 Multi-channel Optical Analyzer

Introduction
This is an accurate tool for physics experiment and spectrum analysis in light source studies at universities, colleges and research institutes.

Experiment Examples
- Innovative design, yet low cost
- CCD unit as a receive unit to extend its range of application
- Capable of real-time acquisition and 3-D display

Specifications	
Wavelength Range	300~900 nm
Focal Length	302.5 mm
Relative Aperture	D/F=1/7
Resolution	≤0.2 nm
Wavelength Accuracy	≤ ±0.2 nm
Wavelength Repeatability	≤ 0.1 nm
Stray Light	≤10^{-3} nm
CCD	
Receiver	2048 cells
Integration Time	1~88 stops
Weight	25 kg
Grating	600 lines/mm; blazed wavelength at 550 nm
Filter	
Yellow Filter	320~500 nm
White Filter	500~900 nm

Main Interface
The following figure shows the main menu screen of the software. By selecting different submenus, the software will lead the user into different functions of the system. The user can capture a set of spectral data, graphically display it, and print it out.

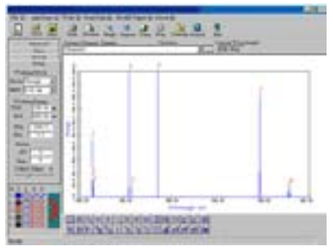
LEOI-101 Modularized Multifunctional Grating Spectrometer

Introduction
It is specially designed for universities, colleges and research institutes. The modular structure that makes experiments and tests much easier, are recommended to physics laboratories of institutions of higher learning. With new appearance and powerful software, the product offers an advanced means to users for test.

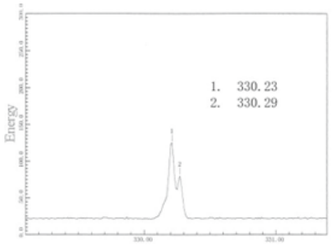
Experiment Examples
- Spectral region from 0.2 .m to 15 .m by changing gratings
- Modular structure especially aims at developing students. ability
- Photomultiplier and CCD separately adopted for convenience of teachers
- High resolving power, can be used in Hydrogen-Deuterium and Sodium spectrum experiment

Specifications	
Focal Length	500 mm
Wavelength Range	200~660 nm
Relative Aperture	D/F=1/7
Grating	2400 lines/mm; blazed wavelength at 250 nm
Stray Light	≤ 10^{-3}
Resolution	≤ 0.06 nm
Photomultiplier Tube	
Wavelength Range	200~660 nm
Wavelength Accuracy	≤ ±0.2 nm
Repeatability of Wavelength	≤ 0.1 nm
CCD	
Receive Unit	2048 cells
Spectral Response Range	300~660 nm
Integrating Time	88 stops
Filter	White filter: 320~500 nm; yellow filter: 500~660 nm
Weight	25 kg

The Software
The software is a family of Windows-based applications that control your spectrometer and manage, process and extract information from acquired spectra. Sodium spectrum principal line: 330.23 330.29 nm



Software Panel



Sodium spectrum principal line: 330.23 330.29 nm

SGC-1A Ellipsometer

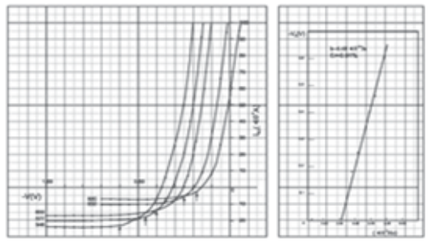
Introduction
This is a manually experimental demonstrator of Ellipsometer. An input beam of random polarization is firstly transferred to a linear polarized beam by passing a polarizer. It is then transferred to an elliptical polarized beam using a quarter wave plate and incidents on the film of the sample to be measured. The polarization status of the reflected beam from the film will be altered. The optical parameters, thickness and refractive indices, of the measured film can be calculated by the analysis of the polarization changes. Student will gain knowledge about working principle of Ellipsometer and grasp operation skills of the instrument.

Item	Description	Qty
1	Ellipsometer Main Machine	1
2	He-Ne Laser	1
3	Photo-electric Amplifier	1
4	Photo Cell	1
5	Si02 Film on Si Sample	1
6	Application Program	1
7	Manual	1

Specifications	
Measurement Range	1 nm ~ 300 nm
Incident Angle	30° ~ 90°, Error ≤ 0.1°
Polarizer/Analyzer Angle Range	0° ~ 180°
Disk Angle Scale	2 degree/scale
Min. Reading of Vernier	0.05°
Optical Center Height	152 mm
Working Stage Diameter	Φ50 mm

LEDI-1 Experimental Unit of Planck's Constant

Introduction
This is an instructional instrument that demonstrates photoelectric effect and quantifies current-voltage characteristics of photocathode upon illumination by monochromatic light at different frequencies. Establish cut-off voltage, validate the Einstein Equation, and determine the Planck.s Constant.



Complete System Set
- 75W Tungsten halogen lamp and power supply
- Monochromator
- Photoelectric cell and micro-current measuring amplifier
- Objective lens

XGS-1 Electronic Speckle Pattern Interferometry (ESPI) Experimental System

Introduction
Electronic speckle pattern interferometry (ESPI) is a method for studying object surface deformation. It involves techniques of computing image processing and holographic interferometry.

Complete System Set
- He-Ne Laser w/power supply: 1
- SZ-04 Magnetic Base w/post holder: 7
- SZ-02 2-D Adjustable Stage: 3
- SZ-11 Small 2-D stage: 1
- SZ-07 2-D Tiltable Holder: 5
- SZ-12 Plate Holder: 2
- SZ-04 SZ-42 Laser Tube Holder: 1
- SZ-04 SZ-13 White Screen: 1
- SZ-04 Flat Mirror: 3
- SZ-04 Beam Expander (f =4.5 mm): 1
- SZ-04 Beam Splitter (6:4, 60x50x6.3 mm): 1
- SZ-04 Lens (f =70 mm): 1
- SZ-04 Mtested Object 1 w/power supply: 1
- SZ-04 tested Object 2: 1
- B/W CCD w/power supply: 1
- Image Card: 1
- Application Program and Manual: 1

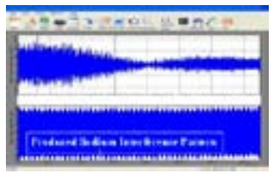
Specifications	
He-Ne laser	1.5 mW, 632.8 nm
Voltage Variable Supply	0 V to 110 V
B/W CCD Camera	752 (H) x 582 (V) pixels
Image Card	640 x 480 x 16 bit
Measurement Error	1/2 ? @ 632.8 nm

LEOI-200 Fourier Transform Spectrometer

Introduction
The LEOI-200 is designed to demonstrate the principle of Fourier Transform Spectrometry. It is designed for visible measurement spectral range of 400~800 nm.

Key Features
- He-Ne laser as built-in reference source
- Windows-Based software.

Specifications
- Wavelength range: 400-800 nm
- Wavelength accuracy: 1.0 nm
- Resolution: 1.0 nm



LEMI-1 CCD Young' s Modulus Measuring Instrument

Introduction
The measurement of Young's modulus is one of the classical assignments that frequently appear in the basic laboratory courses of general physics at colleges and universities. This instrument is a laboratory type design with microscope and CCD imaging system. It acquires length variation images of weighted sample through a microscope imaging system to determine Young.s modulus.
Key Features
Very easy to operate, simple structure and stable performance, visual result displayed by a monitor, documentation covers both theoretical and practical descriptions.

Specifications	
Stainless Steel Wire	90 cm in length, 0.25 mm in diameter
Molybdenum Wire	90 cm in length, 0.12 mm in diameter
Upright Column	About 100 cm in height
Reading Microscope	Range: 3 mm, min. graduate: 0.05 mm, 14x
CCD Video Camera	Effective pixel 752(H)x582(V)
Video Monitor	Black and white, 35 cm, input impedance 75 Ω
Operating Temperature	-5°C ~ 40°C
Ambient Humidity	10 ~ 18%
Total Magnification	54x
Measurement Uncertainty	< 5%

LETI-1 Thermal Expansion Experiment Unit

Introduction
This instrument allows electric heated metal sample to drive planeÂ mirror by means of its linear expansion. The resulting changes in optical path difference in a Michelson Interferometer induce variation in interference fringes. Through counting fringe variation, the linear thermal expansion coefficient is determined.
Key Features
Compact structure, Various type of short sample, Low power consumption, High accuracy.

Specifications	
He-Ne Laser	1.0 mW, 632.8 nm
Type of Sample	Copper, aluminum, and steel
Sample Length	150 mm
Heating Range	18°C ~ 60°C, with temperature-control
Temperature Measurement Accuracy	0.1°C
Display Value Error	±1%
Power Consumption	50 W
Error of Expansion Coefficient	< 3%