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Jupiter Discovery

Atomic Force Microscope

Next-generation AFM performance for everyone



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Jupiter Discovery

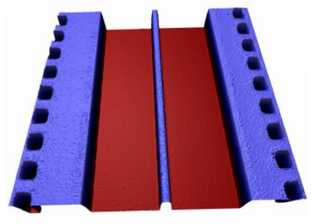


Next-generation AFM performance for everyone

The Jupiter Discovery Atomic Force Microscope offers a unique combination of best-in-class performance along with exceptional ease of use. Whether in academia or industry, researchers expect high-quality results with less training and effort. At the same time, today's AFM measurements demand higher performance as users strive to resolve finer details and achieve higher accuracy, repeatability, and throughput. The Jupiter Discovery is the only AFM that meets these needs, delivering both the ultra-high performance and exceptional usability that researchers need.



Pre-mounted probes make probe exchange quick and easy.



FFM-Topography mode with AutoPilot makes imaging easier than ever before.

Next-Generation AFM design delivers the highest performance of any large-sample AFM

Jupiter Discovery achieves ultra-high resolution and scan rates 5-20× faster than other AFMs, setting a new performance benchmark for large-sample AFMs.

Optimized workflow provides a simpler and more productive user experience

Pre-mounted probes, a unique side-view camera, and exclusive FFM-Topography imaging mode with AutoPilot enable new users to go from sample loading to results in mere minutes.

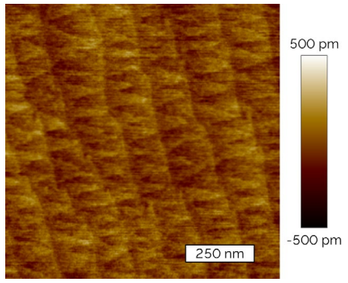
Unmatched configurability provides the versatility to meet the needs of any research group

A vast selection of accessories and capabilities enables multidisciplinary research, while configuration options help span a wider range of research budgets.

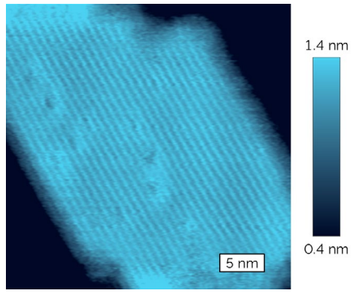
Jupiter Discovery outperforms all other large-sample AFMs

Achieve higher vertical and lateral resolution with next-generation design

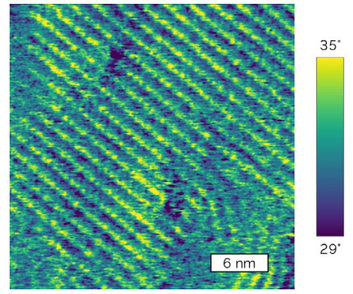
- Ultra-stable design maximizes rigidity and minimizes thermal drift, enabling a best-in-class noise floor of < 25 pm and the highest resolution imaging of any large-sample AFM.
- Oxford Instruments AFMs are the only ones to use LVDT position sensor technology, which delivers lower noise and never requires recalibration for the highest resolution and measurement accuracy.



Epitaxial Silicon wafers exhibit very low roughness, here ~60 pm. Jupiter's ultra-low noise performance enables accurate and repeatable measurements even at this extreme level where roughness is comparable to atomic dimensions.



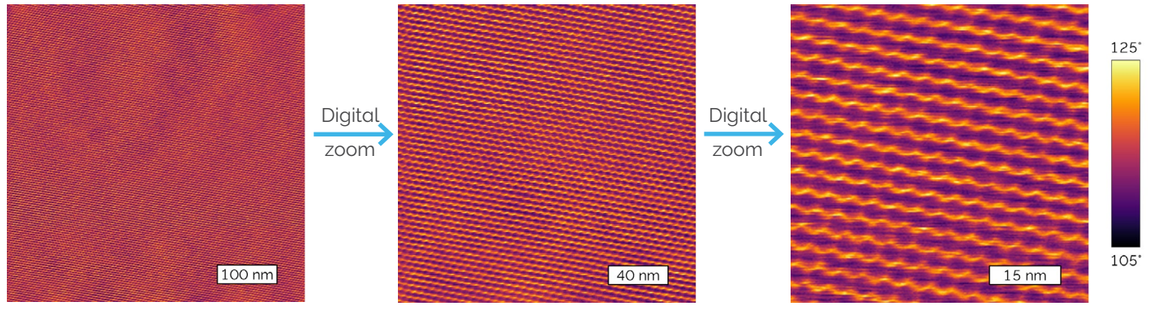
Polyethylene has crystalline regions where the polymer chains are tightly packed with sub-nm periodic spacing. Jupiter easily measures not only the average periodicity but also resolves nanoscale defects in chain packing



P3HT, a semiconducting polymer, assembles into molecular scale domains on hBN. Jupiter easily resolves the domains, domain boundaries, and even sub-molecular ordering.

Fast scanning enables higher productivity and new ways of working

- Unique design with higher electronic and mechanical bandwidth enables scan rates 5-20× faster than other large-sample AFMs, without restricting access to the full range of modes and accessories.
- Fast scanning boosts productivity by capturing images faster, but it can also enable new ways of working. Large sample areas can be explored while maintaining high pixel resolution, or even larger sample areas can be mapped by tiling multiple scan areas across the motorized stage area.



Twisted Tungsten Diselenide (WSe_2) exhibits a moiré pattern when imaged with torsional force microscopy. The periodicity of the pattern can be related to its twist angle, which can vary spatially even across the same sample. Fast scanning makes it practical to scan a larger area at high pixel density, which preserves resolution while sampling a larger area. Here, a 500 nm area was imaged with 2048x2048 pixels at 10 Hz line rate in about 3.5 minutes. By performing digital zooms on the single image one can compare the twist angle at different locations within the scan area or increase the number of samples for better statistics. The original 500 nm scan area (far left) contains the equivalent of 64 scans at 62.5 nm (far right). *Sample courtesy of Prof. Young, U. California Santa Barbara.*

Jupiter Discovery delivers a better AFM experience

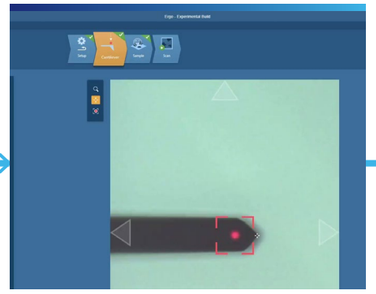
Jupiter Discovery dramatically simplifies the workflow so that even less experienced users can easily get high-quality images. Advanced users benefit too, but for them, "ease of use" goes beyond the basics. Jupiter's ultra-high performance and its unique operating modes and accessories enable novel research by making it not merely possible, but also practical and within reach. These scalable capabilities make it ideal for shared instrumentation facilities that host users from many different backgrounds.

Simplified workflow makes setup quick and easy

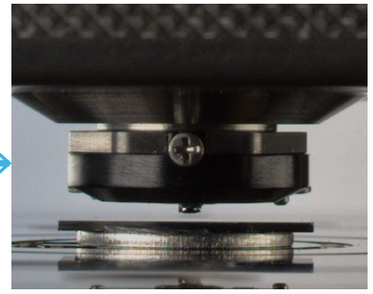
- Pre-mounted probes are easily exchanged by hand, eliminating a common pain point for AFM users.
- AFM setup is fully motorized and requires just a few clicks from start to finish.
- Unique side-view camera and high-resolution top view optics make it easy to find a region of interest.



Pre-mounted probes are easily exchanged with your fingers and snap into place magnetically.



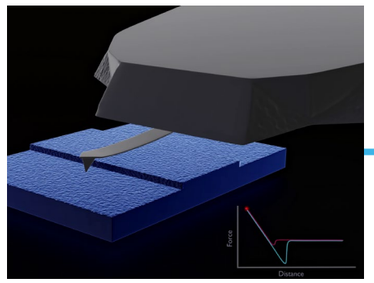
SpotOn laser alignment positions the laser and zeroes the detector with just one click.



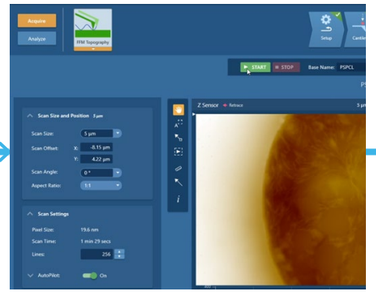
Side-view camera makes it safe and simple to focus and engage on the sample.

FFM-Topography with AutoPilot automatically captures high-quality images

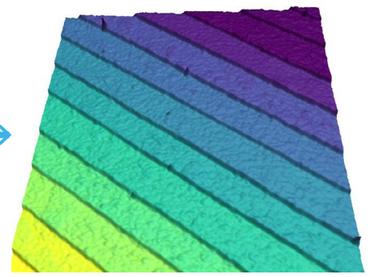
High-quality imaging is now as easy as choosing a scan size and clicking Start using our exclusive FFM-Topography imaging mode with AutoPilot automatic scan optimization.



FFM-Topography is based on the commonly used fast force mapping technique.



AutoPilot automatically collects a survey scan of sample topography to determine initial scan parameters.



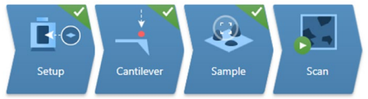
Capture high-quality images in just a few minutes, here 0.75 nm steps in silicon carbide.

Discover Ergo: a new standard for AFM software ease of use

Ergo, our next-generation AFM software, is designed to improve the AFM user experience by helping guide them through instrument setup and data acquisition. We embed intelligent algorithms, like our AutoPilot feature, that help set up and optimize the operating modes to easily acquire high-quality data.

A simple workflow helps guide users through setup and data acquisition

All operating modes are built on the same principle that leads the user through initial setup steps. Where possible, these steps are fully automated, and steps that require user assistance include detailed instructions to guide users to success.



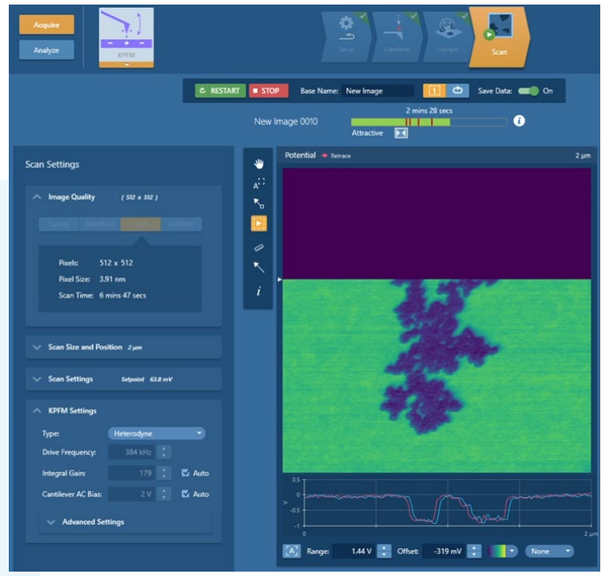
AutoPilot and other intelligent algorithms simplify the operation of commonly used modes

While AutoPilot focuses on the optimization of basic imaging with tapping mode and the new FFM-Topography mode, other advanced modes have been greatly simplified too. Even more advanced modes like Conductive AFM (CAFM), Kelvin Probe Force Microscopy (KPFM), Piezoresponse Force Microscopy (PFM), and Scanning Capacitance Microscopy (SCM) are now easy to use without requiring extensive experience.

Advanced Automation streamlines multi-site and other repetitive measurements

The optional Advanced Automation package allows users to create recipes that define different scan types to be completed at specific sample site locations. This is especially useful for industrial QA/QC type applications, for example, monitoring the roughness of a deposition or etch process at different wafer coordinates. However, it can also be used to automate many types of repetitive measurements and free the researcher to work on other tasks. Combined with fast scanning capabilities, it can also enable large-area sample mapping.

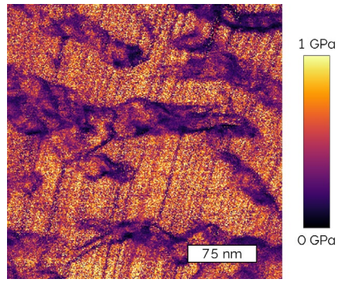
Modes like KPFM (right) are often considered advanced because they require users to not only optimize basic imaging parameters, but also carefully select and optimize additional settings. Ergo can now automatically control many of these parameters, enabling even novice users to get high-quality results.



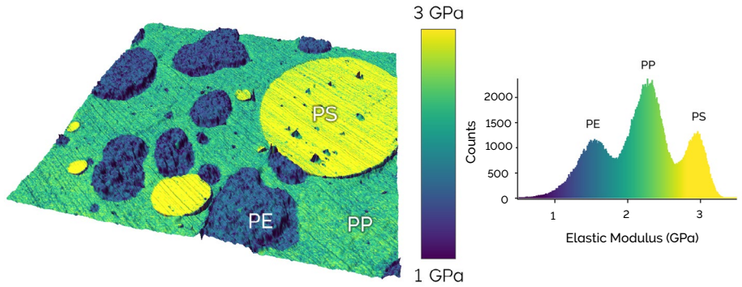
A wide range of modes and accessories

Quantitative Nanomechanical Measurements

Jupiter offers several techniques for quantitative mapping of storage and loss moduli.



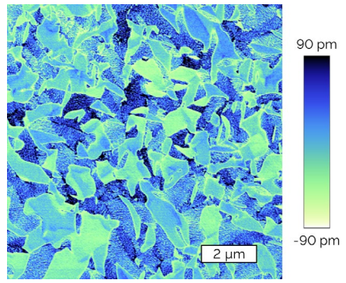
PTFE film imaged with Fast Force Mapping. Modulus is higher on the crystalline regions and lower on amorphous regions.



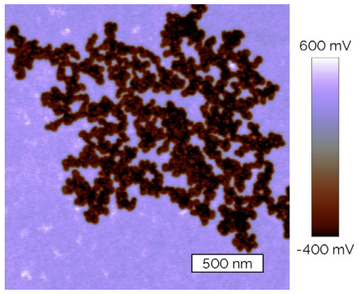
Ternary rubber blend containing polystyrene, polypropylene, and polyethylene imaged with AM-FM Viscoelastic Mapping Mode. Image shows topography overlaid with modulus, 15 µm scan. Histogram on the right shows the corresponding range of elastic modulus for each component.

Highest Sensitivity Nanoelectrical and Functional Measurements

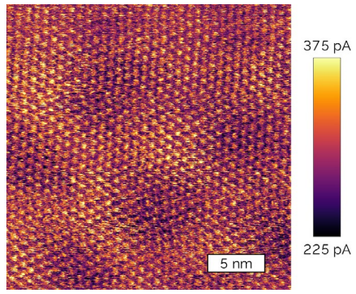
Evaluate properties including current, surface potential, capacitance, and piezoelectric response.



PMN-PT is a relaxor-ferroelectric material. This DART PFM image shows the amplitude response of the relaxor domains.



$F_{14}H_{20}$ is a semi-fluorinated alkane imaged here with heterodyne KPFM, which provides both high spatial and surface potential resolution.



Melamine and cyanuric acid, imaged here with conductive AFM, which resolves both individual molecules and a moiré pattern.

Easy to use accessories for environmental control and more

Jupiter Discovery offers a wide range of accessories, including blueDrive photothermal excitation, sample heating and cooling capabilities, support for imaging in liquids, a high-voltage module for both piezo/ferro-electric research and nanoTDDB studies, a sample tensile stretching stage, and the ability to study materials under applied magnetic fields. Ask how we can help you achieve even your most ambitious research goals.

Specifications

Scanner	
X&Y range	100 µm (typical, closed-loop)
X&Y sensor noise	< 150 pm
Z range	> 10 µm
Z sensor noise	< 35 pm
The X-Y and Z scanners and chucks are fully modular and easily exchanged for future upgrades and accessory options.	

Cantilever Deflection Sensing	
Optical detection light source	Superluminescent diode (SLD) source. Spot size of ~10 µm is compatible with small levers such as the Asylum FS-1500 in addition to all conventional probes.
Wavelength	680 nm (nominal)
DC detector noise	< 10 pm
AC detector noise	< 30 fm•Hz$^{-½}$ above 100 kHz
Detector bandwidth	DC to 7 MHz
Point-and-click spot positioning and detector adjustment are fully motorized and software controlled.	

Imaging Performance	
Scan speed	Up to 20× faster than typical AFMs
DC height noise	< 25 pm
AC height noise	< 25 pm
All noise measurements are quoted as the average deviation measured with a 1 Hz to 1 kHz bandwidth at the center of the scanner range. Specifications assume required vibration and acoustic isolation in an appropriate laboratory environment.	

Top-view Bright-Field Optics	
Resolution	Diffraction limited (< 1.5 µm), NA=0.30
Field of view	At least 930×1240 µm
Illumination	Intensity adjustable from software

Sample Chuck and Motorized Stage	
Sample chuck	Accommodates samples up to 210 mm in diameter and up to 35 mm tall. Wafer locating pins and vacuum rings are provided for 2 in, 4 in, 5 in, 6 in (150 mm), and 8 in (200 mm) wafers. Additionally, a single point vacuum access is available for small flat samples. Eight magnetic mounting points are provided for samples prepared on standard 10-15 mm diameter discs.
Motorized Stage	Allows positioning of any point on a 200 mm wafer under the AFM probe (i.e. fully addressable).

Instrument Isolation	
Acoustic	Included enclosure provides ~20 dB of isolation.
Vibration	Passive (pneumatic) isolators included. Active vibration isolators may offer improved performance in challenging laboratory environments (available optionally).

Probe Holders	
Pre-mounted probe holder	Included and compatible with select Oxford Instruments probes and modes.
Clip mount probe holder	Included and compatible with all standard AFM probes and all the included operating modes listed below.
Liquid probe holder	Sold separately

Certain optional modes include specialized probe holders.

Included Operating Modes	
Basic Modes	Contact mode; Fast Force Mapping Topography with AutoPilot; Force curves; Frequency modulation; Lateral force mode (LFM); Nanolithography and nanomanipulation; Phase imaging; Tapping mode (AC mode); Tapping mode with digital Q control.
Nanomechanical Modes	Dual AC (Bimodal); Force mapping mode (force volume); Force modulation; Loss tangent imaging.
Nanoelectrical, Functional & Electromechanical Modes	Electric force microscopy (EFM); Kelvin probe force microscopy (KPFM); Magnetic force microscopy (MFM); Dual AC Resonance Tracking (DART) piezoresponse force microscopy (PFM); Switching spectroscopy PFM; Vector PFM.

Optional Operating Modes	
Nanomechanical Modes	AM-FM Viscoelastic Mapping Mode (requires blueDrive); Contact Resonance Viscoelastic Mapping Mode (requires blueDrive); Fast Force Modulus Mapping (FFM-Modulus), Torsional Force Microscopy (TFM).
Nanoelectrical Modes	Conductive AFM (CAFM) with ORCA; Current mapping with Fast Force Mapping; Ergo KPFM (single pass with heterodyne, sideband, and amplitude modulation); Nanoscale Time-Dependent Dielectric Breakdown (nanoTDDB); Scanning Capacitance Microscopy (SCM).

Optional Accessories

blueDrive photothermal excitation, Liquid cell, High voltage module, Sample heater, Sample cooler-heater, Sample tensile stretching stage, Variable magnetic field module (VFM).

Software

Features the Ergo software, which includes many of the most used modes, with more in each new version. The legacy Igor Pro-based software is also provided, which includes some advanced modes not yet in Ergo and extra options for user customization.

Other	
Warranty	One-year comprehensive warranty
Support	Ask about service and support agreements that extend the original warranty and offer additional training and support services.
Regulatory Information	Jupiter Discovery is CE compliant. Jupiter Discovery is a Class 1 laser product.

Order Today

Need more information? At Oxford Instruments we are committed to finding the correct solution for you. With a dedicated team of technical advisors, we are able to offer you one-to-one guidance and technical support on all products.

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Our regional headquarters are:

North America
Santa Barbara, CA, USA
Phone +1 805 696 6466

Europe
Tubney Woods, England
Phone +44 (0)1865 393200

Japan
Tokyo
Phone +81 (3) 6744 4704

China
Shanghai
Phone +86 (400) 678 0609

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