



橋 THE BRIDGE

MATERIALS ANALYSIS eNEWSLETTER

APRIL 2024, ISSUE 128

WELCOME

All eyes were on the sun earlier this month as people traveled to be in the path of the total solar eclipse on April 8, 2024. Well, not directly on the sun, because [we all know you're not supposed to do that, right?](#)

The eclipse crossed the Pacific coast of Mexico and traversed three major cities in Texas before swinging up through Arkansas, Indiana, Ohio, Pennsylvania, and Vermont before ending its North American journey in New Brunswick and Newfoundland. So many people wanted to witness the event firsthand that [some towns declared a state of emergency due to potential congestion and supply chain shortages](#).

Unfortunately, Houston was about sixty miles from the path of totality. We were supposed to have about 95% coverage, but it was hard to tell because the weather was uncooperative; it rained and was overcast. Something was blocking the sun but for us it was mostly clouds. It has been darker during the daytime here during a thunderstorm than it was during the eclipse.

An eclipse traversed Canada in 1972, starting out in Alaska and sweeping across the country until it ended up in Nova Scotia, where Carly Simon memorialized it in "You're So Vain," [a song that received a lot of airplay during the recent eclipse](#). The Connecticut Yankee in King Arthur's Court saved himself from being burned at the stake in 528 A.D. through his knowledge of an impending eclipse.

Predicting future eclipses is a special case of the three-body problem in that one of the three bodies is hugely more massive than the other two, so the computations are less fuzzy than when the three bodies in question are of near-equal mass. Total eclipses happen somewhere on the planet every two or three years but are often only visible from the middle of the ocean or somewhere else equally inaccessible, like at the poles of the earth. North America won't see another one for twenty years.

Eclipses provide researchers from many disciplines with the opportunity to conduct novel experiments in their fields. We highlight some of those projects in the News section. Rigaku Innovative Technologies was also involved in celestial research by developing a multilayer coating designed to capture extreme UV radiation across a broad spectrum for the study of Coronal Mass Ejections, about which you can read more below. And, in keeping with the exploration of the cosmos, the video in the spotlight features XRISM, a new X-ray satellite that observes plasma in stars and galaxies.

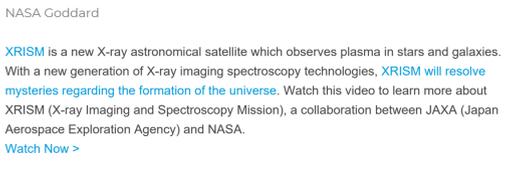
UPCOMING EVENTS

Ceramics Expo 2024
April 30, 2024 - May 1, 2024 Novi, MI
[Website](#)

The Advanced Materials Show
May 15, 2024 - May 16, 2024 Birmingham, United Kingdom
[Website](#)

Webinar: Illuminating The World of Sub-Micron Crystal Structures with the XtaLAB Synergy-ED: A Review
May 29, 2024 Webinar
[Register Now](#)

FEATURED TECHNIQUE



How to Choose kV and Filter for Your Micro-CT Experiment

People often ask me, "What kV and filter combination should I use to collect X-ray CT (computed tomography) data for my sample?" I understand why people ask this; it's one of the first things I consider when collecting CT data. kV is the voltage to apply to the X-ray source, and filters shift the X-ray energy. Together, the right choice of kV and filter can make the difference between great and bad CT data.

The good news is that you can use some basic guidelines and tools to determine the right combination. In this article, I share an approach to selecting the right combination based on your CT applications laboratory. Hopefully, you will find some tips to take away and apply when you plan your next X-ray CT experiments.
[Read more >](#)

VIDEO IN THE SPOTLIGHT



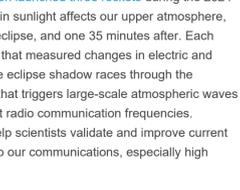
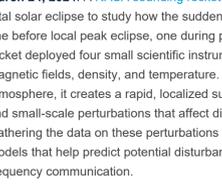
XRISM Exploring the Hidden X-ray Cosmos
NASA Goddard

XRISM is a new X-ray astronomical satellite which observes plasma in stars and galaxies. With a new generation of X-ray imaging spectroscopy technologies, XRISM will resolve mysteries regarding the formation of the universe. Watch this video to learn more about XRISM (X-ray Imaging and Spectroscopy Mission), a collaboration between JAXA (Japan Aerospace Exploration Agency) and NASA.
[Watch Now >](#)

PRODUCT IN THE SPOTLIGHT

MiniFlex XpC

Compact X-ray Diffractometer with an advanced quality control system



What is the MiniFlex XpC?

In a move to bring lab-quality performance to the manufacturing floor, Rigaku introduces the [MiniFlex XpC](#), a manufacturing-optimized powder diffractometer for fast and accurate quality control measurements. It is extremely easy to operate using Rigaku's new EasyX quality control software, which requires minimal clicks to run. A minimal interface means there will be no accidental error variance from operator to operator. The MiniFlex XpC can be configured with a conveyor belt or robot for automated sample processing and collaboration with other instruments. With an 800 W X-ray source and a short-diameter goniometer, the system has the performance of a lab unit, and thus can greatly improve throughput for quality control measurements.

New Sample Loading Mechanism
The optimal loading mechanism for quality control allows the operator to easily place the sample without opening the instrument door. This system also supports online measurement using a transfer robot. Workers can easily place samples not only online but also offline. A newly designed sample spinner can be used with a variety of sample holders.

Highly Durable and Highly Accurate Horizontal Goniometer Suitable for Quality Control
Using the technology cultivated with SmartLab, we have developed a new, durable, compact horizontal sample goniometer that is optimal for quality control.

New, Compact, High-Output X-ray Generator
The MiniFlex XpC features a compact molded ceramic X-ray tube. The generator for the X-ray source has also been improved, enabling a high output of 800 W while being almost the same size as the 600 W generator of the MiniFlex desktop X-ray diffractometer.

High-Resolution, High-Speed One-Dimensional Detector Boasting a Wide Detection Area
The D/tex Ultra250 has a detection area 1.5 times larger than the D/tex Ultra2 used in the desktop MiniFlex, achieving higher-intensity measurement data. Therefore, measurement time can be reduced.

EasyX Software for Screening and Quality Control
Simple measurement, automatic analysis, display of results and pass/fail judgment are possible with this software, so even those who are unfamiliar with analysis can use it with confidence. In addition, the trend graph creation function makes it possible to visualize the results and tangible changes in the device status.

Automation Support
The MiniFlex XpC can be connected to automation equipment by combining with a robot arm or a conveyor belt (both optional). Industry standard sample holders (steel rings) are supported as standard. This apparatus achieves the world's smallest footprint for an online diffractometer (approx. 1 m²).

MiniFlex XpC features:

- The world's smallest footprint for an online diffractometer
- 100% compatible with sample holders of major online system vendors
- Able to connect with a sample-loading robot
- Utilizes newly developed, compact 800 W generator and compact X-ray tube
- High-resolution, high-speed 1D detector with a wide detection area
- θ-θ sample rotation goniometer
- EasyX software
- Touch panel operation
- Runs within 3 taps from measurement to data analysis
- Based on SmartLab Studio II
- Languages: Japanese, English, Chinese

Rigaku provides X-ray diffractometers for quality control developed using the X-ray diffractometer technology cultivated for research and development over many years. It is easy for anyone to use and stable analysis results can be obtained regardless of the operator, so there is no difference in the results between operators. Work efficiency can be improved using the sample loading mechanism and D/tex Ultra250 detector.
[Read more >](#)

IN THE NEWS

March 24, 2024: A NASA sounding rocket mission launched three rockets during the 2024 total solar eclipse to study how the sudden drop in sunlight affects our upper atmosphere, one before local peak eclipse, one during peak eclipse, and one 35 minutes after. Each rocket deployed four small scientific instruments that measured changes in electric and magnetic fields, density, and temperature. As the eclipse shadow races through the atmosphere, it creates a rapid, localized sunset that triggers large-scale atmospheric waves and small-scale perturbations that affect different radio communication frequencies. Gathering the data on these perturbations will help scientists validate and improve current models that help predict potential disturbances to our communications, especially high frequency communication.

March 27, 2024: One eclipse science project, which aimed to identify how particles escape the upper solar atmosphere, is rising above with the help of kites. [Using kites to fly a spectrometer 3,500 feet up helps the project have a better chance at a clear view of the Sun regardless of weather conditions on the ground during the eclipse](#). The data from the spectrometer measured the abundance of key elements in the corona, helping scientists understand how particles escape the Sun through the corona to form the solar wind. The project builds on a successful trial run during an eclipse in 2023.

April 8, 2024: Teams made up of over 750 student participants scattered across the U.S. [launched balloons into the Moon's shadow](#). Utilizing 1064 nm Raman balloon systems to live stream video, observe how Earth's atmosphere changes, and conduct individually designed experiments. Atmospheric science teams flew weather sensors every hour for 24 hours prior to the eclipse and 6 hours after it to study the atmospheric response to the cold, dark shadow.

April 8, 2024: Psychology and neuroscience researchers are studying the psychological effects people might have felt as they witnessed the eclipse by collecting data on individuals' experiences before, during and after the event. "When the light changes and the temperature drops, that triggers primal fear. When we have that short response, our whole body is tuned in to taking in as much information as possible," explains [psychologist Kate Russo in a recent Scientific American article](#). This kind of deep awe at something so much larger and more powerful than us usually comes along with other feelings, including a profound connection to others and a deep sense of beauty and wonder that can alter your outlook and positively improve your mental health.

April 9, 2024: Scientists and zookeepers watched as giraffes, gorillas, lions, macaws and flamingoes [exhibited unusual behavior during the total solar eclipse](#). They studied animals on Monday at several zoos situated along the eclipse path of totality, such as the Fort Worth Zoo in Texas. Animals were largely calm at the Fort Worth Zoo, though some, including the gorillas, lions and leopards, showed increased signs of vigilance and curiosity. Several animals made their way toward their barn doors, which is where they go at night, as the skies darkened during the eclipse. Zoos were also able to observe some unique daytime behavior from nocturnal animals.



NASA's Sun Coronal Ejection Tracker (SunCET)

The [SunCET project](#) represents a significant leap forward in solar research, focusing on understanding Coronal Mass Ejections (CMEs) and their acceleration mechanisms. These eruptions, which can have profound effects on space weather, propel solar particles into the vastness of space, influencing our solar system's dynamics.

Jointly led by the Johns Hopkins Applied Physics Laboratory and the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder, the primary objective of SunCET is to map the complete acceleration profile of CMEs, with a particular focus on events with speeds exceeding 621 miles (1,000 kilometers) per second. By analyzing at least 350 such events, researchers aim to gain unprecedented insights into the underlying physics driving these phenomena.

One of the key challenges in solar research is capturing data during the rapid acceleration phase of CMEs. SunCET addresses this challenge with its innovative optical system, which includes Rigaku Innovative Technologies' multilayer coated imaging optic. This technology enables the precise capture of EUV from the sun, providing crucial data for understanding CME dynamics.

The multilayer coating developed by [Rigaku Innovative Technologies](#) achieves a high-reflectivity broadband reflection for EUV, specifically in the wavelength range of 17 nm to 20 nm. This coating, with its aperiodic structure, ensures efficient capture of EUV across a broad spectrum, contributing to the success of SunCET's mission.

Furthermore, SunCET's observational capabilities fill a critical gap in solar extreme ultraviolet imaging, enhancing the scientific yield from existing solar observatories. Additionally, the development of miniaturized EUV instruments like those used in SunCET represents a significant technological advancement for future solar exploration missions.

Beyond its scientific significance, SunCET's mission aligns closely with the goals of NASA's Heliophysics Division, which seeks to understand the processes occurring in the space environment throughout the solar system. By deepening our understanding of solar dynamics, SunCET contributes to efforts to predict and mitigate the impact of extreme space weather events on Earth and space-based technologies.

We're proud to contribute our expertise to this groundbreaking project and look forward to the insights it will provide into the dynamic nature of our sun. The project is planned to be ready to launch in 2025.
[Learn more about the SunCET project >](#)

Rigaku Analytical Devices Awarded Funding for Year 3 of its R&D Contract from the TSA to Enhance Raman Technology for Screening

While not yet in use in TSA airports, the Rigaku CQL series of handheld Raman analyzers are in use around the world to analyze unknown substances. By utilizing 1064 nm Raman technology, Rigaku CQL analyzers have the ability to analyze dirty, colored or mixed materials – even through translucent packaging – without fluorescence interference. With a library that contains explosives, chemical warfare agents, hazardous chemicals, narcotics, as well as precursor chemicals, the Rigaku CQL product line can be used by border security, law enforcement, the military, public safety officials, or first responders to identify chemical threats.
[Read More >](#)

FEATURED APPLICATION NOTE

Analysis of Coal Fly Ash

Applied Rigaku Technologies

Coal fly ash may contain trace levels of heavy metals, so testing is critical to ensure it is safe before using it in cement production or as a soil enhancer, among other uses. The analysis of coal fly ash is demonstrated using [NEX CG II](#), an indirect excitation EDXRF analyzer featuring a Cartesian Geometry optical kernel that employs polarized excitation from secondary targets. The Rigaku NEX CG II powered by Rigaku's RPF-SQX Fundamental Parameters software is offered to address these needs.
[Read More >](#)

WEBINAR

Illuminating the World of Sub-micron Crystal Structures with the XtaLAB Synergy-ED: a Review

Explore the diverse realm of sub-micron crystal structures through the lens of the XtaLAB Synergy-ED. This webinar delves into its applications across a wide spectrum of materials, including small molecules, MOFs, COFs, biological samples, minerals, and beyond. Highly beam-sensitive samples or measured under cryogenic conditions, the XtaLAB Synergy-ED offers exceptional capabilities for precise analysis. Discover how this instrument contributes to advancements in chemistry, materials science, and related fields.

Date/time
May 29, 2024 at 4 PM | CET
[Register >](#)

PODCASTS

The Opioid Matrix is a podcast for anyone looking for the latest information in the illegal drug supply chain—beginning to end. Each episode will feature a discussion with industry experts about the current opioid crisis, including drug trafficking, drug manufacturing, drug identification, drug addiction, as well as the role of government, law enforcement, new health and social programs, and more.
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