August- October 2022 | Issue 3

Tomorrow Today

-A Laser Science Newsletter

Laser Science Services (I) PVT. LTD.

Inside this Edition

Laser Science Installs First PetaWatt System in India

It gives us great pleasure to announce that Laser Science Services (I) Pvt Ltd has installed the first ever ALPHA XS 1.0 PetaWatt system in India, at the Raja Ramanna Centre for Advanced Technology (RRCAT) Indore, India. The system is from our French principal Thales, which offers the highest peak power lasers on the market.

While several PetaWatt systems have been installed worldwide, this happens to be the first of its kind in Asia. All of this was made possible by our excellent service and sales teams, who have been working on this project relentlessly to make it a success. Project leadership was provided by Mr. Rajneesh V (Vice President Service) at Laser Science Services (I) Pvt Ltd.

Installation of Petawatt Systems
Image Source: https://www.thalesgroup.com/en

In order to help scientific research institutions get the best results from their laser systems, Laser Science has wide range of services and solutions, which aims to build and facilitate long term relationships. The flexible services policy at Laser Science offers its customers a reliable access to the latest innovations and technical expertise.

About Thales: Today, Thales offers the highest peak power lasers on the market and is the best choice for particle physics, nuclear physics, and extreme light physics researchers. Thales' laser systems deliver reliable, optimum-performance lasers with easy upgradeability and maintenance. For more than 35 years, Thales has been a world leader in the design, development and manufacturing of high-energy diode-pumped and flashlamp-pumped nanosecond lasers for industrial applications, as well as powerful ultrashort pulse Ti:Sa femtosecond laser systems, boasting a power of up to 10 petawatts, for scientific applications.

For more information click here: ALPHA XS 1.0 PetaWatt system

Announcement: Laser Science and Coherent Laser India Introduce #LaserTalks

An interactive series of webinars featuring industry experts as speakers from all over the globe.

Laser Science and Coherent Laser India together have started an interactive series of webinars called #LaserTalks. Through these webinars, we invite reputed speakers who are industry experts from all over the globe, to speak about a topic related to the laser industry and its applications, that is not just educational and insightful, but also extremely relevant in todays industry and scientific context. Staying true to our motto of 'bringing tomorrow's technology today", #LaserTalks is designed to serve as a virtual platform for everyone interested in the laser industry (scientific and industrial) to easily stay up-to-date with the latest in technology and gain insight on how to navigate through challenges facing the industry.

The first of these webinars was conducted on 15th March, 2022 by Speaker Mr. Shigeto Mizutani -Business Development Manager, Coherent Inc. Japan. Topic: "Laser Solutions for E-Mobility & Li-Ion Battery welding application".

The second session was conducted in June 2022 on the topic "Pulsed Laser Deposition- Fundamentals and Advances Applications" by an elite panel of guest speakers, Mr. Rik Groenen, Sr. Sales Manager at TSST and Prof. Guus Rijnders, Nanoelectronic Materials & Scientific Director of MESA+ institute University of Twente, Chairman of NanolabNL.

This webinar was followed by "Ultrafast lasers and their ever-growing application to physics, chemistry, material and life Science" by Dr. Marco Arrigoni, Director of Segment Marketing - Scientific Instrumentation, Coherent Inc. This insightful session focussed on several applications of ultrafast lasers in multiphoton imaging, time-resolved spectroscopy, and in material sciences; showing how they are enabled, expanded, and simplified by ultrafast lasers.

Our most recent webinar was held on 26th September, by Dr. Baishi Wang, Ph.D, Global Business Manager at Thorlabs-Vytran, New Jersey United States on the topic "Latest Trend of Specialty Fiber Processing Technologies and Applications in Fiber Lasers and Bio-photonic Sensing".

We are extremely thankful and glad to see the turnout for each of these sessions has been has been growing every time. As always, we as an organization strive to bring the laser community together and add value through knowledge sharing and service. Do follow us on LinkedIn and watch the space for information on our upcoming #LaserTalks sessions.

Note from the MD

Dr. Lalit Kumar
Managing Director, Laser Science Services (I) Pvt Ltd

Amid the COVID-19 challenges, business priorities had to be redefined, with health and safety becoming the primary imperative. At the same time, ensuring business continuity to meet customer needs, and maintaining robust financial health was also vital to our sustainable long-term growth. I am happy to share that our company performed admirably on all these counts.

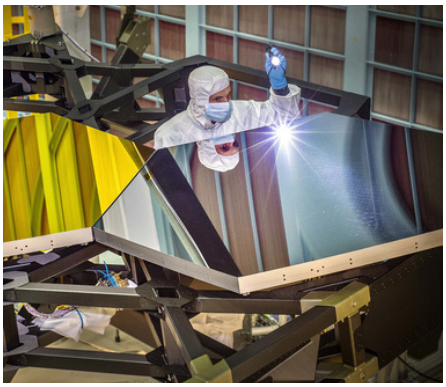
Laser Science delivered their highest ever throughputs during the later part of the year. Laser Science has been supplying a wide variety of products to our customers in numerous fields, mainly the scientific and industrial laser systems, spectroscopy and microscopy equipment, and imaging systems. The strength of the company's multi-industry and nationwide connect, and its sustained focus on increasing the share of business from products and services was a key driver of this achievement.

As such, we have been able to speedily provide products that meet the expectations and requests of the customer by the company working as a whole. We have constantly been a leader in our industry, for example, by introducing system based technologies and constantly expanding and strengthening our infrastructure, services capabilities and facilities.

However, I believe the most important asset that Laser Science has, is the relationship of trust that we have established in over 34 years with our principals and customers. Going forward, we shall continue to passionately engage in world-leading laser technology, while keeping our philosophy of " Bringing Tomorrow's Technology Today" at the core, as we have since our foundation, and continue to move forward with our principals and customers.

- Regards,
Dr. Lalit Kumar (Managing Director)
Laser Science Services (I) Pvt Ltd

Photonics Applications in Space : Coherent's *space-based photonics applications are making space discovery a reality.*



Coherent Tinsley Integrated Optics Systems (TIOS) ImageSource: www.coherent.com/components-accessories/custom-optics/tios

In today's world, human presence in space is both easy and extremly difficult. Satellite launches have become routine - over 1,000 a year. In part, this is due to technological advances that have made satellites more compact, durable, and lightweight.

A manned orbit, interplanetary landing, or flyby is still one of the most challenging engineering endeavors and still captivates the imagination of the public, for example the current discussion about landing on Mars. Coherent supports all these aspects of space exploration and operation with innovative technologies that have proven themselves in harsh space environments.

In September 1962, President John F. Kennedy said, "We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard; because that goal will serve to organize and measure the best of our energies and skills."

Coherent Tinsley Integrated Optics Systems (TIOS) produces precision aspheric optics and space-qualified coatings, some of which are used for space-based applications. In 1993, Coherent (then Tinsley Laboratories) supplied the COSTAR optical system used to correct the flawed shape of Hubble's primary mirror.

Coherent's large-format optics are what make it stand out from its competitors. In recent years, they have fabricated, polished, and coated mirrors for the James Webb Space Telescope. Currently, they are making 231 of the 492 primary mirror segments needed for the Thirty Meter Telescope. Plus, this division routinely fabricates high-performance, lightweight aspheres, and free forms for satellite imagers.

The coherent support satellite communication systems using both active and passive optical fibers, as well as diode laser sources that are space certified. Coherent's components of this type have even landed on Mars due to their expertise in radiation-hardened and heat-resistant fibers. In addition to producing optical fibers and wound coils for interferometric fiber-optic gyros (IFOGs), Coherent also produces specialty optical fibers. These reliable, high-performance components are at the heart of inertial navigation systems for launch vehicles and space inertial reference units used in satellites.

Coherent is also a major manufacturer of laser optics and crystals. The latter include laser gain crystals, complete, space-qualified gain assemblies and non-linear crystals for laser frequency multiplication. The activities of humans in space impact our lives on a daily basis, enabling telecommunications, the Global Positioning System (GPS), weather information, and vital defense intelligence. With its help, we've been able to peer directly into other worlds in our own solar system and collected spectacular images and valuable scientific data about objects literally at the edge of existence.

As a supplier of reliable, proven space applications, Coherent has a long history of success.

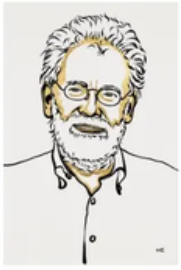
The most creative and bold projects that the world has ever seen will benefit from Coherent attention, energy, and skills.

For more information about Coherent's space based photonic products please contact Laser Science services Pvt Ltd

The Nobel Prize in Physics 2022: Three scientists share Physics Nobel for quantum mechanics

Ill. Niklas Elmehed © Nobel Prize Outreach
Alain Aspect
Prize share: 1/3

Ill. Niklas Elmehed © Nobel Prize Outreach
John F. Clauser
Prize share: 1/3



Ill. Niklas Elmehed © Nobel Prize Outreach
Anton Zeilinger
Prize share: 1/3

The physicists Alain Aspect, John Clauser and Anton Zeilinger have won the 2022 Nobel Prize in Physics for experiments that proved the profoundly strange quantum nature of reality. Their experiments collectively established the existence of a bizarre quantum phenomenon known as entanglement, where two widely separated particles appear to share information despite having no conceivable way of communicating.

Alain Aspect, John Clauser and Anton Zeilinger have each conducted groundbreaking experiments using entangled quantum states, where two particles behave like a single unit even when they are separated. Their results have cleared the way for new technology based upon quantum information.

The ineffable effects of quantum mechanics are starting to find applications. There is now a large field of research that includes quantum computers, quantum networks and secure quantum encrypted communication.

One key factor in this development is how quantum mechanics allows two or more particles to exist in what is called an entangled state. What happens to one of the particles in an entangled pair determines what happens to the other particle, even if they are far apart.

For a long time, the question was whether the correlation was because the particles in an entangled pair contained hidden variables, instructions that tell them which result they should give in an experiment. In the 1960s, John Stewart Bell developed the mathematical inequality that is named after him. This states that if there are hidden variables, the correlation between the results of a large number of measurements will never exceed a certain value. However, quantum mechanics predicts that a certain type of experiment will violate Bell's inequality, thus resulting in a stronger correlation than would otherwise be possible.

John Clauser developed John Bell's ideas, leading to a practical experiment. When he took the measurements, they supported quantum mechanics by clearly violating a Bell inequality. This means that quantum mechanics cannot be replaced by a theory that uses hidden variables. Some loopholes remained after John Clauser's experiment. Alain Aspect developed the setup, using it in a way that closed an important loophole. He was able to switch the measurement settings after an entangled pair had left its source, so the setting that existed when they were emitted could not affect the result.

"In India -- similar work on Entangled Photons is being carried out by Prof. Urbasi Sinha at RRI, Bangalore.

Prof. Urbasi Sinha heads the Quantum Information and Computing (QuIC) laboratory at RRI, Bangalore. This is one of the first labs in India to manufacture and establish the usage of entangled and heralded single photon sources towards various applications in quantum science and technologies.

Their research areas include experimental secure quantum communications including quantum key distribution (QKD) in free space, fiber and integrated photonics, Quantum Teleportation as well as Device Independent random number generation; higher dimensional quantum information processing including photonic quantum computing; fundamental tests in quantum optics and quantum mechanics including generalized measurements and various studies based on static and dynamic properties of entanglement.

"Dr. Sinha's lab is also heading India's first project on satellite based secure quantum communications through the project " Quantum Experiments using Satellite Technology" wherein entanglement based QKD is envisaged to be demonstrated between two Indian ground stations using a satellite as a trusted node."

Dr Sinha has been using Coherent femtosecond laser(Mira/Verdi) since 2013 for this experiment.

Using refined tools and long series of experiments, Anton Zeilinger started to use entangled quantum states. Among other things, his research group has demonstrated a phenomenon called quantum teleportation, which makes it possible to move a quantum state from one particle to one at a distance.

"It has become increasingly clear that a new kind of quantum technology is emerging. We can see that the laureates' work with entangled states is of great importance, even beyond the fundamental questions about the interpretation of quantum mechanics," says Anders Irbäck, Chair of the Nobel Committee for Physics.

Press release: https://bit.ly/3BLf9gK

For more information click here:
Mira
Verdi

Celebrating the Indian Science & Research Personalities

Featuring: Dr. Soma Venugopal Rao Renowned Senior Professor from ACRHEM, University of Hyderabad

Dr. Soma Venugopal Rao from ACRHEM, University of Hyderabad

Being in the lasers and photonics fields for more than 34-years Laser Science is associated with prominent research centres, institutes and researchers. Dr. Soma Venugopal Rao from ACRHEM, University of Hyderabad is one of them, who is among the most prominent individuals in the Ultrafast community, with numerous publications with very high impact factors.

Dr Soma. Venugopal Rao has more than TWENTY-SEVEN (27) years of research experience in the field of experimental Ultrafast Nonlinear Optics, Photonics, and Spectroscopy. He had obtained his Master's and PhD degrees from the University of Hyderabad, India in 1994 and 2000, respectively. His thesis dealt with Incoherent Laser Spectroscopy for the measurement of ultra-fast relaxation times and third-order nonlinearities in a variety of organic molecules, including C60, Porphyrins, and Phthalocyanines.

Dr.Soma interests at NUS involved proton beam writing and its applications for Polymer Photonics. Since June 2007 he has been associated with the Advanced Centre of Research on High Energy Materials (ACRHEM), the University of Hyderabad working towards understanding the interaction of nanosecond, picosecond, and femtosecond laser pulses with high energy materials using various spectroscopic techniques such as laser-induced breakdown spectroscopy, pump-probe studies, ultrafast ablation, and femtosecond laser direct writing.

He has been identified as one of the top 2% of scientists worldwide in the field of optoelectronics & photonics by a Stanford study in October 2020 and was awarded the MRSI medal for 2022 from the Materials Research Society of India and the chancellor's award from the University of Hyderabad for the year 2016. He was also awarded of the NASI-SCOPUS award for the year 2012 in the Physics category. Dr.Soma also been elected as SENIOR MEMBER of OSA, SPIE, and IEEE. He is now serving as (a) Topical Editor of Optics Letters (OSA) (b) Associate Editor of Opto-Electronic Advances (c) Associate Editor of RSC Advances. He is a member of the editorial board of the Defence Science Journal (India) and is now an Associate Editor for the journal Frontiers (Optics & Photonics).

Following are his most recent publish papers:

I. Journal of Photochemistry & Photobiology, A: Chemistry 435 (2023) 114324
Metalated porphyrin-napthalimide based donor-acceptor systems with long-lived triplet states and effective three-photon absorption

Md Soif Ahmed et al.

They report the ultrafast photophysical characterization of one free base and three transition metallated porphyrin-napthalimide based donor-acceptor systems (PN-Fb, PN-Ni, PN-Cu, and PN-Zn) in dichloromethane (DCM) solution using transient absorption spectroscopy (TAS). The photophysical model consisted of the following various processes: (a) internal conversion in the range of 215–400 fs, (b) vibrational relaxation in the range of 1.35–62 ps, and (c) singlet state relaxation times in the range of 0.17–2.06 ns, and finally (d) 0.03–10 μs was attributed to the triplet state lifetimes.

II. Journal of Photochemistry & Photobiology, A: Chemistry 433 (2022) 114141
Ultrafast intramolecular charge transfer dynamics and nonlinear optical properties of phenothiazine-based push–pull zinc porphyrin

C. Biwas et al.

Comprehensive investigations of the ultrafast photophysical properties and charge injection dynamics (adsorbed on mesoporous TiO2) of phenothiazine-functionalized push–pull Zinc porphyrin (LG6) utilizing a benzothiadiazole (BTD) as an acceptor unit are presented in this work. The multicomponent electron injection analysis from different excited electronic energy levels reveals ultrafast electron injection times of 434 fs and 336 fs for LG6 and LG5, respectively, revealing the impact of acceptor units on charge injection times. Further, femtosecond nonlinear optical (NLO) properties were characterized using the femtosecond Z-scan measurements with 70 fs, 800 nm pulses.

Since 2007, Dr. Soma Venugopal Rao has been using the Coherent femtosecond laser system. He has worked with LIBRA (50 fs, 1 kHz, 800 nm) from M/s Coherent which was used to pump the TAS (M/s Ultrafast Systems).

For more information click here:
Libra

Laser Science Now Represents Dantec Dynamics, Denmark in India

Laser Science is proud to announce that we now exclusively represent Dantec Dynamics, Denmark in the Indian market. With Dantec Dynamics, Laser Science has found an ideal partner to drive development of next generation laser solutions in India.

Left to Right: Yuan Chen, Robert Littlewood, Dr. Lalit Kumar and O.E Jagadesh

Dantec Dynamics is a complete solutions provider in the field of fluid mechanics, solid dynamics, microfluidics etc. They have been a pioneer in the development and production of state-of-the-art measurement equipment for scientific and quality assurance applications for more than 70 years, serving research and industrial customers worldwide.

The company delivers turnkey and customized solutions built on high-end laser optics, imaging, and sensor technologies. Their user-friendly software performs advanced data analysis and produces real-time results.

With this association, Indian contomers can now benefit by being able to use the most advanced laser solutions by Dantec Dynamics. In this rapidly evolving market, our collaboration provides technology leadership, leading-edge productivity and superior cost of ownership to our customers.

We are very excited to be working with Dantec Dynamics and look forward to a long, fruitful relationship. We believe this partnership will create compelling and sustainable value for our industry.
For more information click here: Dantec Dynamics

What is the Role of Lasers in Semiconductor Device Manufacturing ?

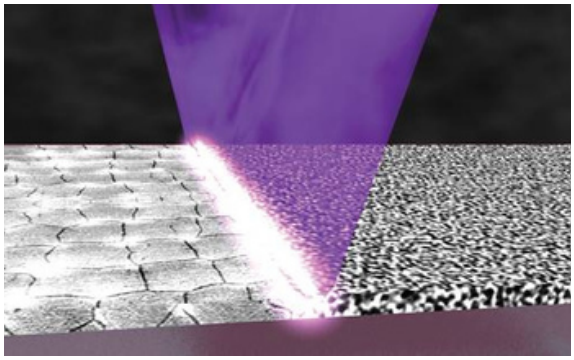
Today a wide variety of Lasers are used in various applications in the semiconductor industry. Laser technology has started integrating into major semiconductor processes, including laser annealing, cutting, drilling, welding/bonding, debonding, marking, patterning, marking, measurement, and deposition, driven by motherboards.

Semiconductor devices are built up in a series of nanofabrication processes performed on the surface of substrates made from highly pure single crystal silicon. These substrates are usually known as wafers. Excimer Laser-based Annealing is the first process that is widely used in the fabrication of wafers. Wafers that are thinner give photonic cutting tools an opportunity to gain a competitive edge over mechanical saws. The thinner the wafer, the faster a laser can dice it. Kerf widths and positioning tolerances are tighter, enabling street widths below 30 µm, instead of the 125 µm or more that is common with mechanical methods. Laser dicing systems also waste less silicon, so chip designers potentially gain more space to create more patterns.

LED technology provides further momentum to laser scribing applications. LEDs are grown on high-cost substrates, such as GaAs, Sapphire, GaP, and SiC, that only grow in value following epitaxy. Despite the common use of high-precision saws for dicing these devices, the use of blue emitters grown on sapphire has allowed UV laser systems to be developed resulting from the hardness of Sapphire and the low cost of consumables involved with traditional mechanical dicing. Laser Lift-off (majorly Excimer laser-based) is another exciting process used in the fabrication of LEDs.

Depending on the application and type of device, lasers' power can be modulated, which makes them useful for a wide range of applications. Lasers can also be used to make tiny markings on sensitive equipment, which makes them ideal for semiconductor manufacturing. The main reasons why the laser marking process is important are traceability and readability. There are two main types of lasers used for marking of this kind: Near-Infrared (NIR) and Green Lasers. Both are well-suited to the job, but they differ in some fundamental ways. The near-infrared laser is extremely versatile, making it ideal for a wide range of machine applications like semiconductor manufacturing. Their effectiveness is due to the energy range falling within the spectral range needed to mark wafers. On the other hand, Green Lasers are the result of second-harmonic generation processes, also known as frequency doubling.

Each step of the semiconductor manufacturing process is important for achieving a high-quality result. However, the choice of the most suitable laser processing type depends strongly on the material to be processed, the processing parameters, and the manufacturing process step. Compact and highly functional electronics are driving the semiconductor industry to produce smaller devices on thinner wafers and with new materials. Laser micromachining increasingly presents a solution to cutting, dicing, and scribing of microelectronic devices built on silicon and similar substrates, particularly as new chip and package designs emerge in the next decade.



Coherent pioneered the development of Excimer Laser Annealing for producing Low Temperature Polysilicon TFTs (LTPS and LTPO backplanes) enabling high resolution OLED and MicroLED displays.
Source: Coherent Inc. website

Credit: Ankit Singhal
(Vice President)
Laser Science Services (I) Pvt Ltd
ankit@laserscience.in/ 9911052905

For more information click here:
Excimer Lasers

Newly Launched Products

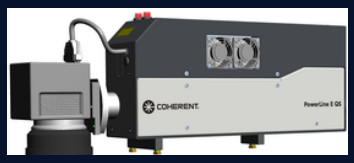
OBIS LS/LX lasers

The original smart laser platform, offering plug-and-play simplicity with over 30 wavelengths from the UV to the near-IR plus optional fiber delivery.OBIS LS/LX lasers provide commonality across the spectrum in dimensions, beam, and interface. The compact package includes integrated control electronics. They support analog, digital, and mixed modulation modes. Accessories include a CDRH controller and the Galaxy beam combiner.

A.P.E pulseCheck NX

A.P.E pulseCheck NX Autocorrelators cover the broadest range of wavelengths and pulse widths. The complete set of control electronics is now integrated in the optical unit. No more need of a separate controller. A new software shows a user-friendly interface, supporting real-time data display and giving easy access to comprehensive data analysis. It offers best in class resolution, down to 50 attoseconds and much more.

PowerLine E QS Models:



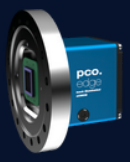
The Coherent. Inc PowerLine E QS Models:
Compact, air-cooled green lasers for marking applications. The compact, economical PowerLine E 6 QS (AC) and PowerLine E 12 QS (AC) laser marking sub-systems include an air-cooled green (532 nm) laser, optional scanning optics, and power monitoring, for marking applications in the semiconductor and electronics industries.

Solid State Streak Camera

With the world's first commercially available Solid State Streak Camera (S3C), Optronis GmbH from Kehl, Germany, offers research a new instrument to enable detailed scientific investigations in the field of ultrafast processes.
Streak cameras allow measurements of optical phenomena in the range of pico-, down to femtoseconds.
Conventional streak cameras based on vacuum tubes are not only cost-intensive, but also sensitive in terms of their handling.

pco.edge 4.2 bi XU

The pco.edge 4.2 bi XU is based on a back illuminated sCMOS sensor with a very specific coating which allows applications in the visible light down to extreme UV (EUV) and soft X-ray radiation.



The camera is adapted for ultra-high vacuum operations and has been characterized using soft X-ray in the energy range from 30 eV to 1000 eV. The image sensor features 2048 x 2048 pixel with a pixel size of 6.5 µm x 6.5 µm and allows full frame acquisitions at 48 Hz with a dynamic range of 88 dB at a noise level of 1.9 e -. The camera is compact and offers various software integration options.

Bringing Tomorrow's Technology Today

Laser Science Services (I) Pvt. Ltd.

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LASER SCIENCE
Bringing Tomorrow's Technology Today

Since over 34 years, Laser Science Services (I) Pvt. Ltd. is the pioneer in distribution of a diverse range of lasers and related equipment, that cater to industrial manufacturing and scientific research in India.

Founded in the year 1988 by Dr. Lalit Kumar, Laser Science, today represents 25 leading laser manufacturers from all over the globe, covering a wide range of products which includes: scientific and industrial laser systems, spectroscopy and microscopy equipment, and imaging systems.

This enables us to equip Indian universities, research institutes and corporate laboratories with R&D systems; as well as the industry, with production tools and manufacturing systems.

Bringing tomorrow's technology today.