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In this issue of the optics.org **Product Focus** we look at the how optical techniques are revealing the secrets of barnacle cement, FLIR's attempts to bring thermal imaging applications to the masses, and royal support for the 2015 International year of light.

You can also review some of the latest product launches from both exhibitors and non-exhibitors alike. We have included booth numbers *(where available)* making it easy for you to check out the products for yourself.

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In conjunction with the 2014 Messe Stuttgart Vision exhibition we are publishing **Vision Focus**, dedicated to delivering the latest news from the Machine Vision market.

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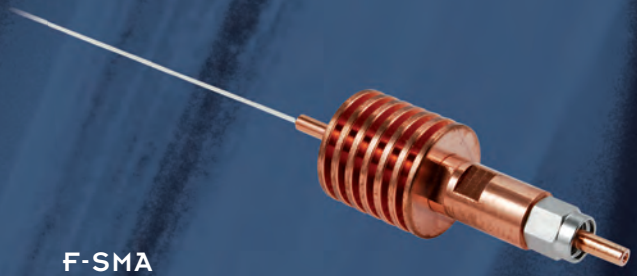
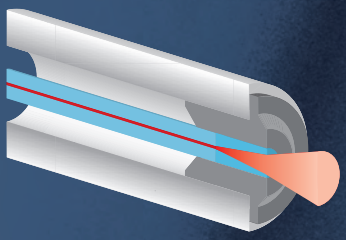
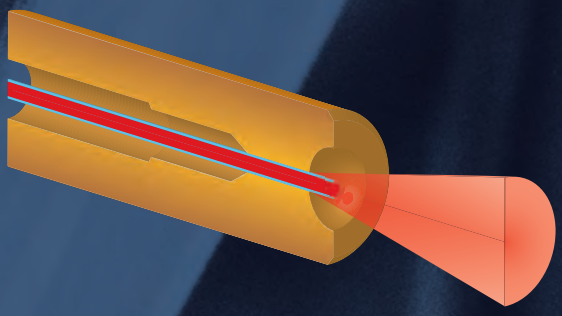


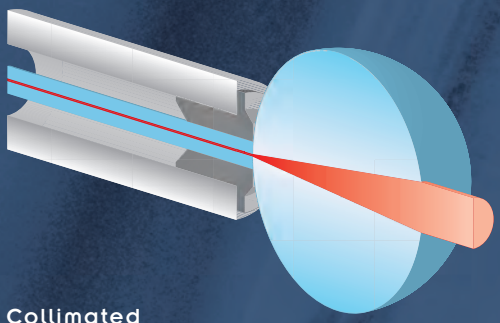
F-SMA
WITH HEATSINK



Diverging



Free standing with copper ferrule



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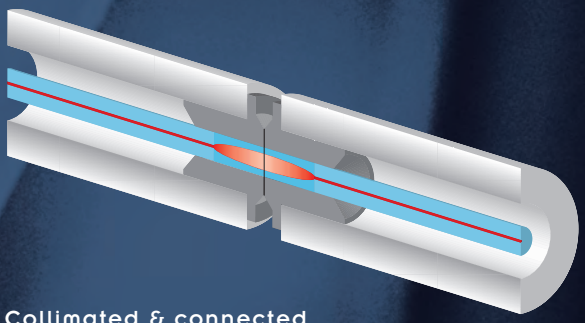

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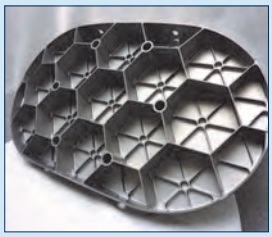

**Contact Details**

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# Laser reveals 'liquid' motion of atoms in clusters

## Leicester, UK-led project opens the door to development of novel nano-materials.

Researchers from the University of Leicester, UK, say they have extended understanding of how nanosystems function, and that they are unlocking the potential to create new materials using nano-scale "building blocks".

The study, which was last week published in Physical Review Letters, is based on a novel laser technique to examine the structure and internal atomic motion of a small cluster containing an acetylene molecule and a single helium atom.

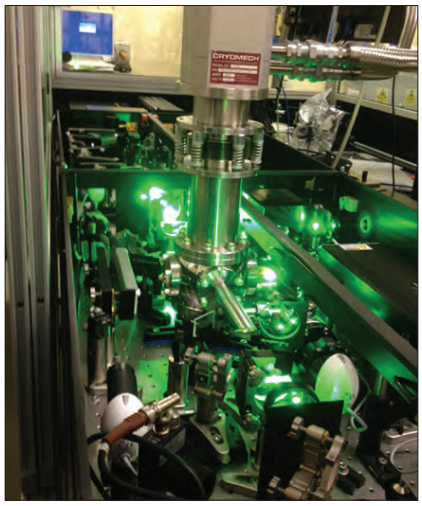


Photo: Gediminas Galinis (University of Leicester).

*Set-up at Rutherford Appleton Laboratories in the Artemis laser facility.*

The laser excites single clusters and generates rotational wavepackets, composed of multiple waves illustrating the individual motion of atoms. The team has tracked the wavepackets in real time for up to one nanosecond covering many rotations. The experiment was undertaken at Rutherford Appleton Laboratories in the Artemis laser facility using an advanced femtosecond laser system to resolve rotations of complexes.

The wavepacket approach provides greater detail of the structure and behavior of clusters than traditional spectroscopic techniques, improving understanding of small systems and allowing for the creation of new artificial materials.

The research forms part of the PhD thesis of University of Leicester student Gediminas Galinis, a key contributor to the project, and has been performed in collaboration with seven research groups from six European institutions, led by the University of Leicester Physics group.

### 'Liquid' behavior

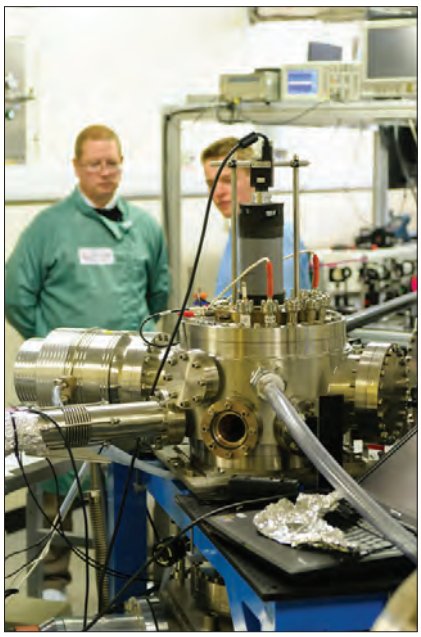
Galinis said, "We used a combination of laser beams to excite rotations in small clusters comprising a molecule and a helium atom. We have found that the helium atom rotates and vibrates almost freely, occupying nearly the entire volume within the cluster. Hence, the cluster does not have a rigid structure: it behaves rather like a liquid.

"We believe that the extension of this technique to other complex systems, in which weak interactions take place, is possible. The approach may also have the potential for exploring liquids, such as superfluid helium, in which the binding forces are similarly sensitive."

Using the wavepacket technique, the research team from the University of Leicester's Department of Physics & Astronomy have successfully controlled the rotation and vibration of an acetylene molecule and single helium atom complex without destroying it. Gediminas believes the same method could be applied to other types of cluster.

### New materials

Dr Klaus von Haeften, Reader in Nanoscience at Leicester, who supervised the research, said, "This achievement was enabled through the collaboration of an international team of researchers from six different



*Vacuum apparatus where rotations of complexes were measured.*

European institutions. The research is enhancing our fundamental knowledge of nanoscale systems and it can now take many different directions in the fields of physics and chemistry.

"Ultimately, the knowledge gained through our work will enable the design of novel materials based on nanoscale building blocks. These materials may show entirely new physical properties or catalyze chemical reactions that were otherwise impossible. This knowledge is important in enhancing our fundamental understanding of physical principles but also for applications of nanostructures in chemistry."

**About the Author**
Matthew Peach is a contributing editor to optics.org.

Article appeared optics.org/news/5/7/46

*Sponsored Editorial*

# Diamond's Fiber Assemblies for Medium-High Power Laser Delivery

**Diamond has further developed its existing F-SMA and X-BEAM MM connectors specifically for medium-high power laser delivery and thermal management in various industrial and defense applications.**

## F-SMA connector

This class of connectors is employed typically for beam delivery of medium-high power Diode Lasers (DL) in order to provide a fiber-optic link between the DL source and the target.

Diamond's enhanced F-SMA connector is based on the Cu-ferrule free-standing fiber technology with outstanding mechanical tolerances and eccentricity. The fiber-end free from epoxy glue allows a proper thermal dissipation in the region of maximum power density.

A proprietary design mode-stripper can be integrated to obtain laser power confinement in the fiber core. The amount of power stripped out from the cladding is a function of the laser Beam Product Parameter (BPP) and of the receiving fiber core diameter and numerical aperture (NA).

For a typical 200um/0.22 fiber, the stripped power can vary from 4 to 10% of the injected power at 200 W CW @0.808nm, depending on the laser BPP.

The choice of connector coupled with a proper multimode optical fiber core/cladding size, NA and configuration can guarantee optimum thermal management at the desired power level.

## Expanded beam (X-BEAM) connector

The X-BEAM connector is based on expanded beam technology by coupling the multimode fiber with a collimating spherical lens. Beam expansion can ensure medium-high power handling, which is especially challenging in harsh environment conditions.

In order to safely withstand the requested power levels, the beam expansion process carried out by the ball lens must take place at the core-lens interface. To achieve this, light propagation through the fiber must in turn be confined in the core of the multimode fiber. The presence of radiation cladding modes can cause damage to the fiber-lens interface at medium-high power.

As a consequence, in Diamond's F-SMA – X-BEAM assembly, mode propagation in the fiber core is obtained by a mode stripper on the F-SMA side. Moreover, this minimizes the losses and possible patchcord damage due to leakage of undesired radiation coming from the cladding modes in the bending region of the fiber.

The X-BEAM – X-BEAM connection opto-mechanical design is also highly critical in terms of lens-to-lens and lens-receiving fiber interfaces, particularly at medium-high power. The receiving lens-to-fiber optics must ensure an efficient and accurate refocusing of the almost collimated beam into the core of the fiber for safe further beam propagation in the next assembly slots.

The typical X-BEAM–X-BEAM connection losses are < 0.5 dB thanks to the use of an antireflective (AR) coating on the lenses in the desired wavelength range.

## Diamond SA

Visit us at Booth #342

### MIL 38999 Fiber Optic Connector

The new MIL 38999 connector, provides an efficient, comprehensive and cost efficient solution for connectivity in harsh and environmentally challenged applications. The MIL 38999 is based on the new **Diamond Multipurpose (DM)** 4 channels insert; this allow customers to assemble precision-engineered optical and electrical **termini** and offer an easy field termination and repair.

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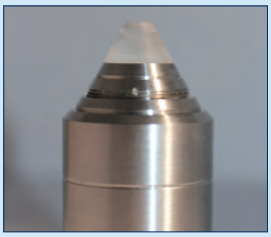

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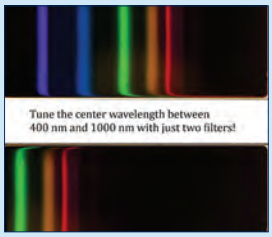


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DELTA Optical Filters
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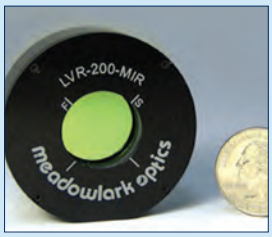



**Contact Details**
Meadowlark Optics, Inc.
P.O. Box 1000
Frederick, CO 80530
www.meadowlark.com
Tel: +1 303 833 4333
Fax: +1 303 833 4335

# Near-IR lasers set to aid vaccinations

## US firm SemiNex awarded project funding by National Institutes of Health.

SemiNex, Peabody, Ma, USA, a manufacturer of high power infrared lasers, was awarded a Small Business Technology Transfer grant by the US National Institutes of Health (NIH) to develop small laser devices to enhance immune responses to vaccines. The grant will enable the development of these lasers and comparative testing against existing large laser systems.

To conduct the tests, SemiNex is collaborating with Dr. Satoshi Kashiwagi of the Vaccine and Immunotherapy Center (VIC) at Massachusetts General Hospital, which discovered that treatment of human skin with certain infrared lasers promotes better immune responses to vaccines. With positive results, the company plans to continue collaboration with VIC to develop a small laser device suitable for clinical use.

Early studies by VIC have shown near-infrared laser treatment pre-vaccination to increase influenza vaccine efficacy as well as currently-approved chemical adjuvants (boosters). A report of the findings can be found in the open-access journal PLOS ONE.

*Vaccination booster: SemiNex's Laser Engine NIR source.*

Using NIR lasers as an adjuvant has the benefit of being compatible with intradermal vaccines, without the side effects seen frequently with chemical adjuvants, such as inflammation and tissue damage. Many influenza vaccines are administered without any adjuvants due to these side effects and the complications of adding a chemical adjuvant to the vaccine.

"The use of an infrared laser to promote immune responses to vaccination is a novel approach that has shown benefit with an influenza vaccine," said Dr. Kashiwagi. "To reach the clinic, the technology first needs to be more widely assessed by laboratories studying vaccines for other diseases."

The NIH grant will support development of small laser prototypes that will allow testing device kits to be sent to laboratories working on new vaccines. SemiNex currently produces a laser device for skin applications that is small and portable.

Dr. John Callahan, Vice President of Engineering & Development at SemiNex, will work in conjunction with VIC to modify the laser device to meet the necessary optical parameters required to further enhance immune responses to vaccination. The grant will also enable SemiNex to develop software to control the laser from a computer, tablet or smart phone.

"We are interested in developing a laser system that will be easy for scientists to program, use and advance scientist research and development of wide-ranging medical treatments," said David Bean, President of SemiNex. "We want to develop tools that will help scientists make advances in health care. The creation of inexpensive devices that can do the same job as more expensive lasers is at the heart of what our company does."

**About the Author**
Matthew Peach is a contributing editor to optics.org.

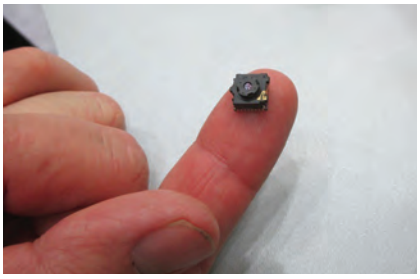
Article appeared optics.org/news/5/7/51

# FLIR launches 'ONE' thermal imager for iPhone

**Much-trailed $350 accessory puts infrared imaging hardware in the hands of the consumer.**

Thermal imaging company FLIR Systems has formally launched its "ONE" smart phone accessory, in the hope that mass adoption by the consumer market will revolutionize a sector previously dominated by military applications.

Trailed by the Oregon-based company for much of the past year – FLIR showed off a proof-of-concept prototype using its "Quark" sensor core at an event last August – the commercial release could also mark a turning point in FLIR's fortunes, which have been hit by recent declines in military budgets around the world.



Credit: Ford Burkhart.

*Shown at this year's SPIE DSS 2014 exhibition in Baltimore, the "Lepton" long-wave infrared (LWIR) is at the heart of the FLIR ONE accessory.*

Now based around the "Lepton" core, an 80x60 pixel resolution sensor featuring a wafer-scale lens and an uncooled long-wave infrared (LWIR) microbolometer focal plane array, the ONE accessory weighs under 4 oz and can be "snapped" onto an iPhone 5 or 5S model.

It captures light in the 8-14 µm wavelength range, typically consumes 150 mW power and comes with its own rechargeable battery, which FLIR says is good for two hours of continuous use.

FLIR is hoping that consumers will use it for applications ranging from spotting leaks in their homes and optimizing energy efficiency, to searching for lost pets at night.

But perhaps more fundamentally, the company is urging consumers and applications developers to dream up whatever uses they like, the approach that has proved so successful in the world of smart phone applications.

## The sixth sense

At SPIE's DSS 2014 exhibition in May, FLIR showed off the ONE accessory and told optics.org: "The market will reinvent what thermal is. Nobody here knows what that app is. Let everybody go play with it."

In a company statement accompanying the official product launch, CEO Andy Teich said: "FLIR is dedicated to developing and delivering technologies that provide users with a sixth sense."

"Based on technology that was formerly reserved for the military, FLIR ONE is the first in a new generation of affordable thermal imaging devices designed to inspire imaginative and innovative uses by consumers. This represents a revolutionary step forward for both FLIR Systems and thermal imaging."

As well the basic FLIR ONE application, which will be sold via the Apple App Store, others scheduled for release currently include time-lapse software designed to reveal changes in temperature over time,

Credit: FLIR Systems.

*FLIR is hoping that its iPhone-compatible thermal imaging accessory will spark a revolution in the world of infrared technology, transforming it from largely military use to the mass consumer market.*

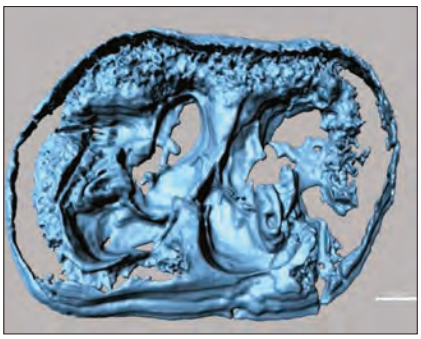
a "Paint" app for sharing dramatic imagery, and "Panorama", which converts a set of thermal images into a single panoramic one.

FLIR says that units pre-ordered through the firm's dedicated web site will ship to consumers starting the week of August 4, with availability in Europe is expected to start by the middle of the month. Availability in other regions will follow shortly afterwards.

FLIR ONE will also be sold via Apple's web site and in its retail stores, first in the US and Canada before a global roll-out.

Credit: FLIR Systems.

# Optical techniques reveal secrets of barnacle cement



*"An incredibly clever solution to the problem of adhering through a water barrier."*

**Discovery promises novel synthetic bioadhesives for medical implants, micro-electronics.**

More than 150 years since it was first described by Darwin, scientists are now uncovering the secrets behind the super strength of barnacle glue. Still far better than any synthetic adhesive, barnacle glue – or cement – sticks to any surface, under any conditions. But exactly how this ultimate superglue works has remained a mystery – until now.

*Finally revealed: how barnacle cement is far stronger than any synthetic "superglue".*

An international team of scientists led by Newcastle University, UK, and funded by the US Office of Naval Research, have shown for the first time that barnacle larvae release an oily droplet to clear the water from surfaces before sticking down using a phosphoprotein adhesive. The work was published this week in Nature Communications.

Author Dr Nick Aldred, a research associate in the School of Marine Science and Technology at Newcastle University, says the findings could pave the way for the development of novel synthetic bioadhesives for use in medical implants and micro-electronics. The research will also be important in the production of new anti-fouling coatings for ships. Biofouling, the accumulation of marine life on ship's hulls, increases drag on ships and costs the global industry an estimated $7.5 billion a year in wasted fuel.

Aldred commented, "We've known for a while there are two components to the bioadhesive but until now, it was thought they behaved a bit like some of the synthetic glues - mixing before hardening. But that still left the question, how does the glue contact the surface if it is covered with water?

## Imaging advances

"Advances in imaging techniques, such as 2-photon microscopy, have allowed us to observe the adhesion process and characterise the two components. We now know that these two substances play very different roles – one clearing water from the surface and the other cementing the barnacle down.

The Nature Communications article, explains the team's photonic techniques in detail: "With the aid of multi-photon and broadband coherent anti-Stokes Raman scattering microscopies, we report that the larval adhesive of barnacle cyprids is a bi-phasic system containing lipids and phosphoproteins, working synergistically to maximize adhesion to diverse surfaces under hostile conditions."

Aldred added, "The ocean is a complex mixture of dissolved ions, the pH varies significantly across geographical areas and, obviously, it's wet. Yet despite these hostile conditions, barnacle glue is able to withstand the test of time.

"It's an incredibly clever natural solution to this problem of how to deal with a water barrier on a surface it will change the way we think about developing bio-inspired adhesives that are safe and already optimised to work in conditions similar to those in the human body, as well as marine paints that stop barnacles from sticking."

"The key here is the technology," he said. "With these new tools we are able to study processes in living tissues, as they happen. We can get compositional and molecular information by other methods, but they don't explain the mechanism. There's no substitute for seeing things with your own eyes. In the past, the strong lasers used for optically sectioning biological samples have typically killed the samples, but now the technology allows us to study life processes exactly as they would happen in nature."

**About the Author**
Matthew Peach is a contributing editor to optics.org.

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# Duke of York to front UK's International Year of Light effort

INTERNATIONAL YEAR OF LIGHT 2015

**United Nations-sanctioned effort to raise awareness of light and light technologies gets royal patronage.**

The Duke of York has agreed to become patron of the International Year of Light (IYL2015) in the UK, and will help to raise awareness of the power, ubiquity and economic impact of photonics during next year's celebrations.

The Duke, well known for his support of entrepreneurship and science, technology and engineering education, is set to front the IYL2015 opening ceremony in the UK. He will also host a competition for young people and visit photonics companies throughout the year.

Photo: Steve Parsons/PA Wire.

*The Queen and The Duke of York view displays showcasing UK technology at a Buckingham Palace reception last month.*

In the UK, the IYL2015 efforts are being co-ordinated by the Institute of Physics (IOP). Welcoming The Duke of York as UK patron, IOP's president Frances Saunders said:

"On behalf of the national committee, I am delighted that The Duke of York has agreed to be our patron. We could not hope for a better or more supportive friend. He has already shown his support for science in the UK and in particular an interest in the photonics industry, a real UK success story worth an annual £10.5 billion to the economy and with a growing, high-tech export market, and I know that he is equally enthusiastic about the wider aspirations for [IYL2015]."

The UK's Photonics Leadership Group (PLG) also welcomed the news, with its chairman Chris Dorman – also general manager at laser firm Coherent Scotland – saying:

"[IYL2015] will be pivotal in raising awareness of the impact of photonics and in encouraging young people to pursue the many and varied careers available in light based technologies. We hope the Duke of York's involvement will inspire more young people to get involved with photonics and encourage more light-based technical innovation in the UK."

## Economic impact

According to the PLG's figures, the UK photonics industry employs more than 70,000 people at 1500 firms, as well as adding £10.5 billion to the economy – predominantly in exports.

But the group also stresses the need to raise greater awareness of how and where light is and can be used, and inspire more young people to take up science and technology, to ensure that the sector has sufficient supply of engineers, innovators and entrepreneurs in the future.

"The PLG welcomes [IYL2015], significantly boosted by the Duke of York's involvement, to help encourage UK photonics to fulfil its full potential, continue to grow and lead further innovation," it said.

Ratified by the United Nations in December 2013, IYL2015 is intended to raise awareness of how optical technologies can provide solutions to worldwide challenges in energy, education, agriculture, communications and health. The year also represents the anniversary of a number of key discoveries in the science of light, starting with what is regarded as the first ever work on optics by Islamic scholar Ibn Al-Haytham in 1015.

Other anniversaries include the outstanding achievements of two UK scientists: the electromagnetic theory of light propagation proposed by James Clerk Maxwell in 1865, and Charles Kao's demonstration in 1965 of the transmission of light in fibers – now fundamental to global communications.

As well as enthusing young people about science in general, the goals of IYL2015 include support for women in scientific careers, and an accelerated distribution of solar lighting in rural communities in Africa through the "Study After Sunset" program.

**IYL2015 is set to kick off in style next January with an official opening ceremony at the Paris headquarters of the United Nations Educational, Scientific and Cultural Organization (UNESCO). In April, lighting giant Philips signed up as the first IYL2015 sponsor.**

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# the bigger picture

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tel: +44 (0)117 905 5330

fax: +44 (0)117 905 5331

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