Lasers provide a new way to analyse priceless art without damage

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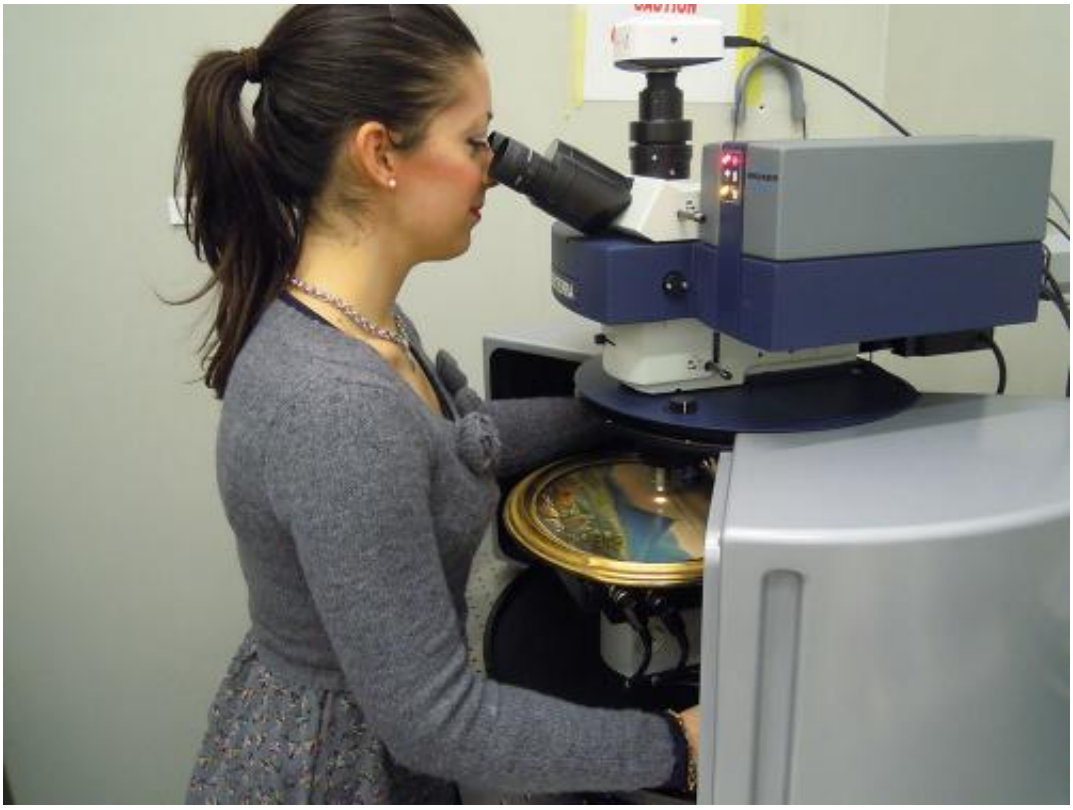

Painting stratigraphy analysed by micro-SORS at CNR-ICVBC, Milan. Credit: ICVBC-CNR, Milan

UK scientists, working on an international project to conserve precious works of art, have found a new way to analyse paintings without having to remove even a tiny speck of the paint to inspect the layers below.

Using laser spectroscopy, a method that uses light to probe under the surface of an object, the international team has developed a new, non-invasive way to identify the chemical content of the paint layers present.

This new technique will reduce the risk of damage to precious paintings, often worth thousands or even millions of pounds, when conservation and restoration work is being carried out.

The new approach is derived from a technique called Spatially Offset Raman Spectroscopy (SORS). It was originally developed by UK researchers at the Science and Technology Research Council's (STFC) Central Laser Facility within the Research Complex at Harwell. Now they have joined forces with researchers from the Institute for the Conservation and Promotion of Cultural Heritage (ICVBC), part of Italy's National Research Council (CNR) to adapt this technology to test paintings without having to destroy any part of them.

The SORS technique involves shining the laser light onto an opaque object. A small number of photons (light 'particles') will scatter back, changing colour according to the different paint components they represent, and allowing the scientists to analyse the chemical composition in depth.

Professor Pavel Matousek, from STFC's Central Laser Facility, explained. "Building on our earlier SORS research, we've transformed the method to allow us to probe the painted layers for the first time," he said. "We've called it Micro-SORS because we can analyse the layers at the micrometer scale, rather than the usual millimetre scale".

For comparison of scale, a human hair is about 100 micrometers wide.

Dr Claudia Conti, a scientist at the ICVBC in Italy, said, "When I heard about the potential of SORS and how it could be applied, I realised the

huge contribution this method of analysis could bring to the conservation of artworks."

The research team tested the Micro-SORS method by collecting data from the light scattered across a surface of painted layers, artificially prepared to mimic a real painting. They isolated the light signals of the individual paint layers, enabling them to assess the chemical make-up of each layer.

The next step in the team's research is to optimise the sensitivity and depth of penetration, and apply the technique to real artwork.

One of the leading experts in the UK on the preservation of cultural heritage is Professor May Cassar, Director of UCL's Centre for Sustainable Heritage and the Programme Director for the UK Science and Heritage Research Programme. She has a keen interest in innovative methods that allow for the study of artefacts in a non-invasive way and, although not directly involved in this project, she said of this research that, "In the field of cultural heritage, the objects being studied are unique artworks. Removing even a minute sample for analysis is only justified when essential data cannot be obtained in any other way. The application of this novel Micro-SORS technique has potential for non-invasive study of artworks and is definitely worth further exploration."

Dr Conti said, "Micro-SORS promises to make a major contribution to the knowledge and conservation of artworks. We will continue to work with our colleagues at the CLF to take forward this important research. Our ultimate goal is to develop the Micro-SORS technology into a portable device that can be used in the field. "

The original SORS technique has already been applied to a number of problems, including non-invasive breast cancer diagnosis and bone disease diagnosis.The Science and Technology Facilities Council (STFC)

has also launched a spin-out company, Cobalt Light Systems, which uses the SORS technology and has recently developed products for scanning liquids in unopened bottles for airport security, and in pharmaceutical quality control.

More information: An article describing this work will appear in the June 2014 issue of *Applied Spectroscopy*. It is available online now: www.ingentaconnect.com/content … 68/00000006/art00013

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