Laser tools in Cultural Heritage Science and Conservation; non-invasive analysis and management of cleaning interventions

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Within the last two decades laser technology has been progressively established in cultural heritage study and conservation as it offers highly effective methodologies and versatile tools for material characterisation, structural assessment and cleaning. Non-invasive laser-based techniques are in this respect of high priority as they are able to illuminate complex diagnostic and analytical challenges, as well as to evaluate and monitor in-situ and in real-time the preservation condition of cultural heritage objects and monuments.

Specifically, laser spectroscopic techniques, such as Laser Induced Fluorescence (LIF), micro-Raman Laser Induced Breakdown Spectroscopy (LIBS), and Terahertz (THz) spectroscopy are employed to determine the chemical composition of materials in works of art and archaeological findings. Extensive research worldwide aims at the development of laser analytical methodologies and compact, portable and user-friendly instrumentation that will enable archaeologists, art historians and conservators to obtain information about cultural heritage objects, through chemical analysis of materials.

In parallel, laser interferometric techniques, such as holographic interferometry and speckle pattern interferometry, are increasingly being applied as non-destructive and non-invasive monitoring tools. Their ability to take full-field measurements remotely, fast and repeatedly, in combination with their high resolution (their detection limit is in the range of half of the operative laser wavelength i.e. 266 nm) have established laser interferometric techniques as structural diagnostic tools in preventive and active conservation of cultural heritage.

In this communication the portability and versatility of non-invasive laser based analytical and diagnostic techniques, together with their ability to operate synergistically with interventive actions (i.e. laser cleaning) in order to monitor and control their progress, will be presented and discussed.