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Advanced 3D and 4D X-Ray Imaging Techniques for Heritage Science

In the last two decades, Earth scientists and (bio)archaeologists have developed analysis protocols suitable to investigate and quantify microstructural features of multiple materials relevant for Heritage Science studies to extract precious historical and evolutionary information, but also for restoration purposes, economic evaluation, and fabrication of replicas.

This talk aims to present the possibilities of X-ray and neutron imaging techniques and related software tools for the non-destructive analysis of rare or unique artefacts. More specifically, the potential and importance of three-dimensional (3D) and 4D (3D + time) X-ray computed microtomography techniques in the field of heritage science will be presented through several applications and successful stories. The adoption of a multiscale and multimodal imaging approach, complemented by advanced visualisation tools, will be illustrated as a high-accuracy method to improve accessibility to museums and heritage science, as well as for the integrative restoration of samples.

Lucia Mancini (PhD 1998, Université Joseph Fourier, Grenoble, France) is a material science physicist strongly involved in Earth Science studies and interested in heritage science applications by using non-destructive three-dimensional (3D) advanced imaging techniques. She coordinated the hard X-ray imaging research activity in Materials Science at the Elettra synchrotron facility (Trieste, Italy) between 2001 and 2022, and for the last 2 years she has been working as a Senior Researcher in the Department of Materials at ZAG (Ljubljana, Slovenia). She is also a Core Member of the Heritage Science theme at LINXS (Sweden). Her research work is focused on microstructural characterisation techniques combining synchrotron, neutron and laboratory X-ray sources as well as computational analysis to extract quantitative information from 3D imaging data, in static and dynamic conditions. This expertise has allowed her to support several research teams working in the cultural and natural heritage domain to answer historical and evolutionary questions. Over the past two decades, she has dedicated a significant portion of her research to applying X-ray and neutron micro-radiography and tomography for the study of fossil remains and archaeological finds. Her research work is also focused on the study of innovative materials and cutting-edge approaches for restoration and conservation purposes. She has a CV that includes more than 200 articles in international journals and over 100 invited and plenary lectures at international congresses; she is presently co-supervisor of the EU MSCA postdoctoral project ENIGMA, member of the EU ERC project MOTHERS led by Sapienza University of Rome (Italy) and Core Member of the Heritage Science theme at the Lund Institute for advanced Neutron and X-ray Science (LINXS, Sweden). She is a member of the European Association of Archaeologists.

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