

<b>Scientific Area</b>	Synchrotron Light Applications		
<b>Project Title</b>	Development of machine learning methods for data analysis of X-ray diffraction mapping applied to cultural heritage		
<b>Recruiting Institution</b>	ESRF (3 years), Antwerp University (1 year)		
<b>PhD awarding Institution</b>	TU Delft and Antwerp University	<b>PhD Duration</b>	48 months
<b>Supervisor/Institution</b>	Matthias Alfeld and Joris Dik, TU Delft		
<b>Co-Supervisor/Institution</b>	Koen Janssens, Antwerp University		
<b>Secondment(s)</b>	Regular travels in Belgium and the Netherlands		
<b>Project Description</b>			
<p>X-ray diffraction mapping (combined with X-ray fluorescence mapping) is increasingly used to study cultural heritage (CH) artefacts. Synchrotron-based micro-beams are well suited for the analysis of small samples while portable and Inverse Compton Scattering (ICS) sources -based instruments have been developed for the analysis of entire CH objects such as paintings. In both cases, the obtained crystal phase maps can be exploited to obtain information about the artistic techniques as well as the conservation state of the CH artefacts. The development of new X-ray sources and new detectors permit a dramatic improvement of acquisition speed. The main bottleneck is now data analysis which can be either fast but qualitative (based on XRD peak intensities) or quantitative (Rietveld refinement) but slow. Machine learning is a promising approach for addressing this challenge.</p>			
<b>Project Objectives</b>			
<p>At the ESRF, you will join a consortium of 10 European research groups (“Heritage BAG”) having a shared access to beamtime for the characterisation of artistic materials. You will develop software tools based on machine learning for analysis of two-dimensional hyperspectral X-ray diffraction (XRD) and X-ray fluorescence (XRF) maps. You will participate in experiments at an X-ray micro-beam at the ID13 beamline, ESRF, Grenoble but also by means of portable instrument (University of Antwerp) and the future Smart*Light ICS instrument (TU Delft). Applications will be in the CH field, in particular related to art historical study and conservation of historical paintings. The main objective will be to provide the CH community with tools for fast, efficient and quantitative crystal phase determination and mapping. The benchmark for the performance of the developed tools will be Rietveld refinement.</p>			
<b>Required Candidate Qualifications</b>			
<ul style="list-style-type: none"> <li>• Degree allowing enrolment for a PhD (such as MSc, Master 2 de Recherche, Laurea or equivalent) in chemistry, physics, materials science or closely related field of science or engineering</li> <li>• A background in computational science as well as programming experience, preferably (but not exclusively) in Python are highly desirable</li> <li>• Knowledge and experience in X-ray crystallography/powder diffraction will also be an asset</li> <li>• Interpersonal skills and the ability to work with people from different areas of expertise are important, as is English proficiency (working language at the ESRF)</li> </ul>			