



	Experiment title: RIXS and dynamical diffraction in NiO	Experiment number: HC-1532
Beamline: ID20	Date of experiment: from: 18 Feb 2015 to: 24 Feb 2015	Date of report: 11/3/2017 <i>Received at ESRF:</i>
Shifts: 18	Local contact(s): Roberto Verbeni	
Names and affiliations of applicants (* indicates experimentalists): Mr. Kari Ruotsalainen* (SOLEIL), Dr. Stephen Collins* (Diamond), Dr. Marco Moretti* (ESRF), Dr. Jaakko Koskelo (Univ.Helsinki), Prof. Simo Huotari* (Univ.Helsinki)		

Report:

The results of this experiment have been published in [K. O. Ruotsalainen, A.-P. Honkanen, S. P. Collins, G. Monaco, M. Moretti Sala, M. Krisch, K. Hämäläinen, M. Hakala & S. Huotari: Resonant X-ray emission with a standing wave excitation, Scientific Reports 6, 22648 \(2016\), DOI: 10.1038/srep22648.](#)

Abstract:

The Borrmann effect is the anomalous transmission of x-rays in perfect crystals under diffraction conditions. It arises from the interference of the incident and diffracted waves, which creates a standing wave with nodes at strongly absorbing atoms. Dipolar absorption of x-rays is thus diminished, which makes the crystal nearly transparent for certain x-ray wave vectors. Indeed, a relative enhancement of electric quadrupole absorption via the Borrmann effect has been demonstrated recently. Here we show that the Borrmann effect has a significantly larger impact on resonant x-ray emission than is observable in x-ray absorption. Emission from a dipole forbidden intermediate state may even dominate the corresponding x-

ray spectra. Our work extends the domain of x-ray standing wave methods to resonant x-ray emission spectroscopy and provides means for novel spectroscopic experiments in d- and f-electron systems.

