Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

An X-ray standing wave study of the diluted magnetic semiconductor Ga(Mn)As SLAVOMIR NEMSAK, Forschungszentrum Juelich, CHENG-TAI KUO, UC Davis, CHRISTOPH SCHLUETER, Diamond Light Source, MATHIAS GEHLMANN, Forschungszentrum Juelich, SHIH-CHIEH LIN, UC Davis, SVEN DOERING, MARKUS ESCHBACH, EWA MLYNCZAK, LUKASZ PLUCINSKI, Forschungszentrum Juelich, STEPHAN BOREK, JAN MINAR, University Muenchen, HIDEO OHNO, Tohoku University, TIEN-LIN LEE, Diamond Light Source, CLAUS M. SCHNEIDER, Forschungszentrum Juelich, CHARLES S. FADLEY, UC Davis — We have combined the recently developed techniques of soft x-ray standing-wave angle-resolved photoemission (SW-ARPES) [Gray et al., EPL 104, 17004 (2013)] and hard x-ray ARPES (HARPES) [Gray et al., Nature Mat. 11, 957 (2012)] so as to be able to use single-crystal Bragg reflection to create the SW [Thiess et al., Sol. St. Comm. 150, 553 (2010)], thus permitting the first measurements of momentum- and element- resolved bulk electronic structure. The strengths of the SW-HARPES method are demonstrated using the dilute magnetic semiconductor $Ga_{(1-x)}Mn_xAs$. A strong SW is generated by Bragg reflection of ca. 3 keV x-rays from the (111) planes of both undoped GaAs and Mn-doped thin films with x=0.05. Due to the uneven occupancy of (111) planes by either Ga(Mn) or As atoms, the element-specific band structure can be obtained with a help of the SW modulation in core levels. Apart from the site specific decomposition of the electronic structure, the SW measurements also confirmed a substitutional presence of Mn atoms at the Ga sites. This technique should be applicable to a broad range of complex materials.

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Date submitted: 06 Nov 2015 Electronic form version 1.4