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Spins and moments of cooled and bunched neutron-rich Ga isotopes: First results using the ISCOOL-COLLAPS apparatus

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The need for increasing the sensitivity of collinear laser spectroscopy has motivated the development of ion beam manipulation techniques. The ISOLDE ion beam cooler-buncher (ISCOOL) is well suited for this purpose. It has recently been installed at the focal plane of the high resolution separator magnets and is able to reduce the beam emittance by an order of magnitude, as well as release the beam in bunches with a well defined time structure.

Laser spectroscopy using cooled and bunched beams from ISCOOL was applied for the first time for the study of neutron rich gallium isotopes, as part of the IS457 experiment. The bunched ions from ISCOOL were neutralized in a charge-exchange cell and excited with a co-propagating frequency-doubled Ti:Sa laser. The ions were Doppler-tuned as a function of a voltage applied to a retardation plate. The subsequent laser induced fluorescence decay was recorded with a blue-sensitive photomultiplier tube as a scan was taken on the retardation plate.

ISCOOL provided around 20 ion bunches per second, each bunch with a temporal length of 20 micro-seconds. A gate was set on the photomultiplier signal to accept the fluorescent photons within the time window defined by the bunch. With a resultant background suppression of up to four orders of magnitude, the hyperfine structures of 67-80Ga were measured on the 417nm and 403nm transitions. The analysis of the spectra allowed the spins, moments and isotope shifts to be determined, and a tentative interpretation of these measurements will be presented.

Author: Mr ERNESTO, Mane (University of Manchester)

Co-authors: Dr JOKINEN, Ari (University of Jyvaskyla); Dr CHEAL, Bradley (University of Manchester); Dr GEPPERT, Christopher (University of Mainz); Dr FOREST, David (University of Birmingham); Dr YORDANOV, Deyan (University of Heidelberg); Ms CHARLWOOD, Frances (University of Manchester); Dr TUNGATE, Garry (University of Birmingham); Prof. NEYENS, Gerda (Katholieke Universiteit Leuven); Prof. STROKE, Henry (New York University); Prof. BILLOWES, Jonathan (University of Manchester); Dr FLANAGAN, Kieran (IPN); Prof. BLAUM, Klaus (University of Heidelberg); Dr AVGOULEA, Malamatenia (Katholieke Universiteit Leuven); Dr BISSELL, Mark (Katholieke Universiteit Leuven); Dr CAMPBELL, Paul (University of Manchester); Mr VINGERHOETS, Pieter (Katholieke Universiteit Leuven); Prof. NEUGART, Rainer (University of Mainz); Dr NORTERSHAUSER, Wilfried (University of Mainz)

Presenter: Mr ERNESTO, Mane (University of Manchester)

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