X-RAY PRODUCTION CROSS SECTIONS IN A RARE EARTH ELEMENT INDUCED BY Cl AND C IONS

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BACKGROUND STUDY

⇒There has been a renewed interest characteristics X-ray emission induced by heavy ion particles due to the inducement of larger X-ray yields employed in ion beam analysis technique such as Particle Induced X-ray Emission (PIXE), Secondary Ion Mass Spectrometry (SIMS), etc.

⇒The utilization of these heavy ion beam analytical techniques is dependent on a reliable knowledge of the ionization cross section by heavy ion (HI) impact, availability of accurate and reliable heavy ion-matter interaction database.

⇒The insufficiency of experimental data of heavy ion X-ray production cross sections is one of the major limiting factors in the wide scale implementation of HI-PIXE (Msimanga *et al*., 2019).

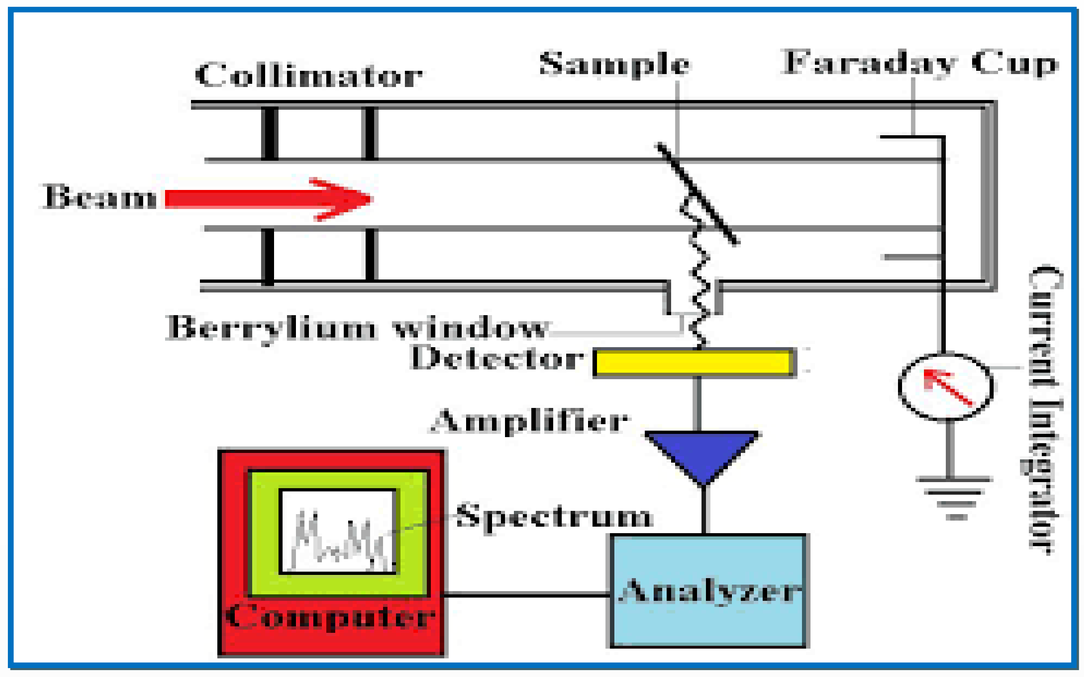

Fig.1. Schematic diagram of PIXE Set-up

STUDY FOCUS

⇒To add new experimental data of heavy ion induced X-ray production cross sections in elemental films to expand the existing global database of basic ion-atom interaction.

⇒Measurement of new L shell X-ray production cross sections in bismuth induced by $^{35}Cl^{q+}$ and $^{12}C^{q+}$ ions of 7MeV-35 MeV *and* 4MeV-12 MeV energies respectively.

⇒Experimental data are compared to ECPSSR, ECPSSR + UA and ECPSSR + EC theoretical predictions.

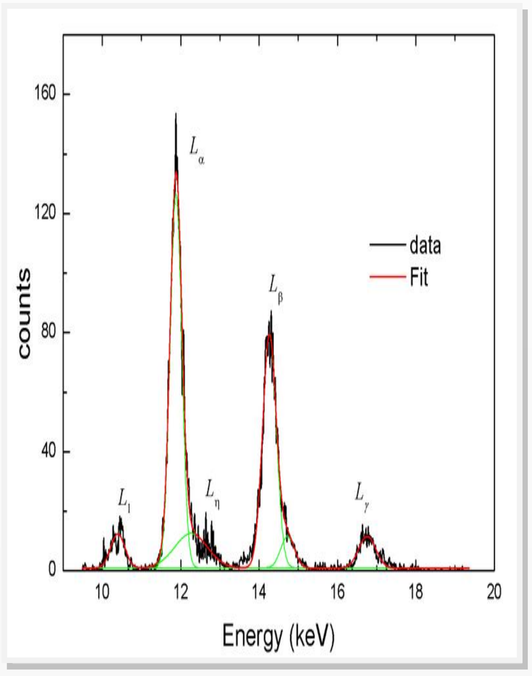

Fig.2. A typical spectrum of Bi L-shell X-rays induced by 12 MeV carbon ions.

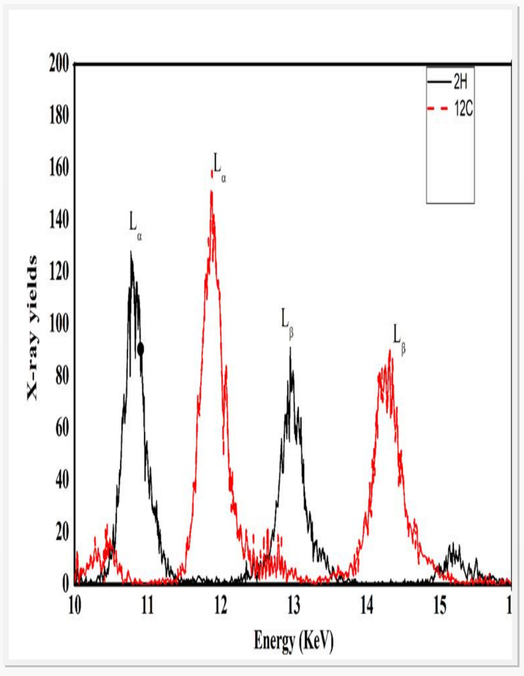

Fig.3. Multiple ionization effect on Bi L-shell X-ray energies due to 12 MeV C^{3+} ions.

RESULTS

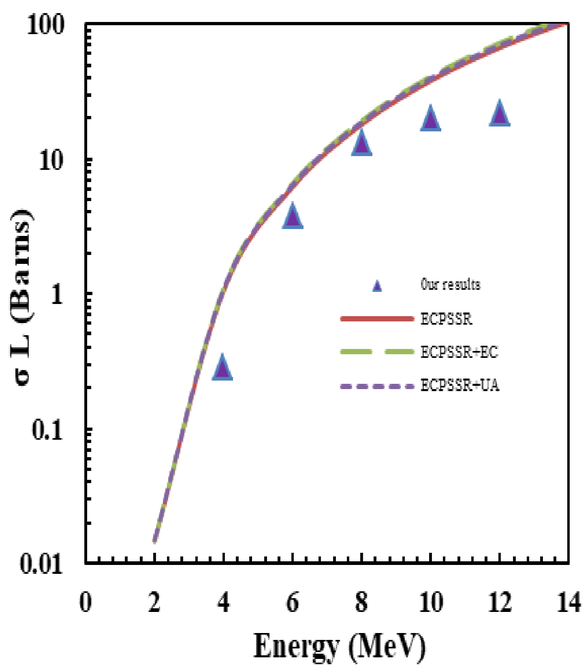

Fig.4. Experimental X-ray production cross sections induced by chlorine ions (14 MeV-35 MeV) in barns.

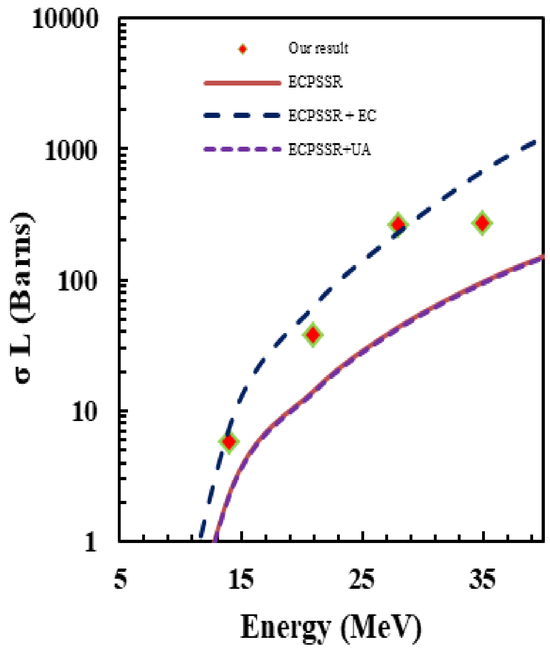

Fig.5. Experimental X-ray production cross sections induced by carbon ions (4 MeV-12 MeV) in barns.

CONCLUSION

⇒In the case of $^{12}C^{q+}$ ions, there is a fair agreement between the experimental data with both ECPSSR +EC and ECPSSR at energies above 0.5 MeV/u

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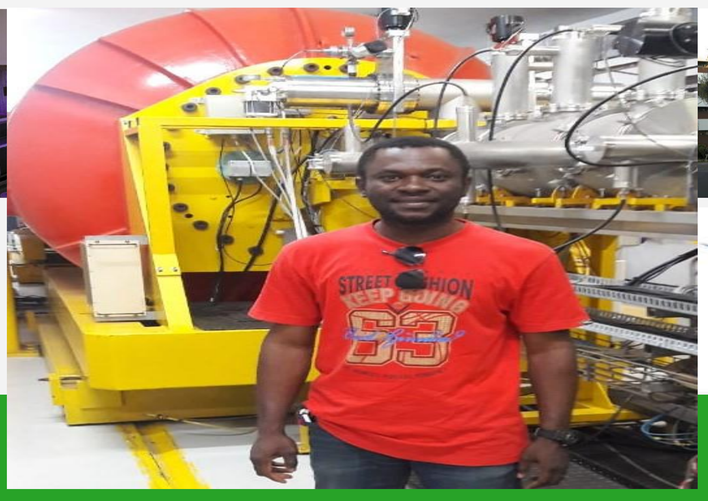
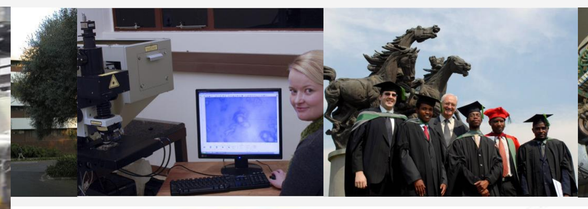
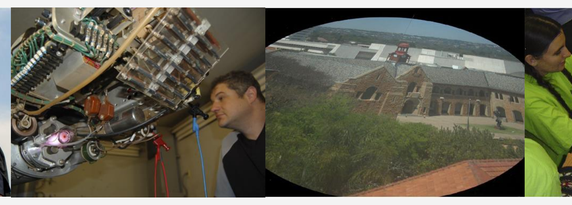
⇒For $^{35}Cl^{q+}$ ions, ECPSSR +EC agree well with the experimental while the ECPSSR predictions is seen to underestimate the experimental data.

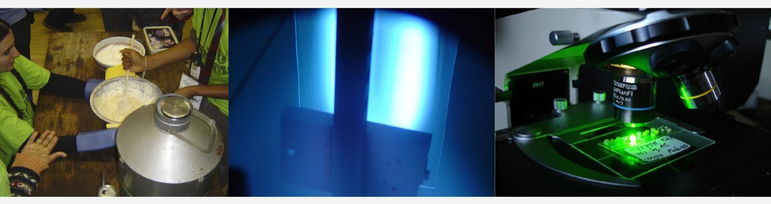
REFERENCE

1. Msimanga, M., Pineda-Vargas, C.A., Madhuku, M., 2019. L-shell X-ray production cross sections in metal oxide thin films due to 12C, 16O and 28Si ion beams at MeV SIMS energies. Nucl. Instruments Methods Phys. 440, 186–190.









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