

# **$L_3M$ - radiative resonant Raman scattering measurements in $^{59}\text{Pr}$**

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The resonant Raman scattering (RRS) spectroscopy has gained momentum in the recent past because of its significant contribution to the attenuation of x rays in matter particularly in the lower vicinity of the atomic subshell ionization threshold [1,2]. The present work reports the measurement of the  $L_3M$  radiative RRS cross sections in case of the  $^{59}\text{Pr}$  ( $B_{L_3} = 5.964$  keV) element for the Mn- $K\alpha$  ( $E_{K\alpha} = 5.89$  keV) x rays. The target consisted of the metallic and compound forms of  $^{59}\text{Pr}$ . The Mn- $K\alpha$  x rays were obtained from EC decay of  $^{55}\text{Fe}$  radioisotope. The  $^{55}\text{Fe}$  annular source (50 mCi) was used in conjunction with an  $^{24}\text{Cr}$  ( $B_K = 5.9892$  keV) foil, which selectively absorbs the Mn- $K\downarrow$  ( $E_{K\downarrow} = 6.49$  keV) x rays [3]. The measurements have been performed under vacuum ( $10^{-2}$  Torr) at an angle of  $126^\circ$  [ $P_2(\cos\theta) = 1$ ] using an LEGe (FWHM 150 eV at 5.895 keV) detector. The measured  $L_3M$  radiative RRS cross sections in Pr metal,  $\text{Pr}_2\text{O}_3$ , and  $\text{Pr}_6\text{O}_{11}$  agree within experimental error ( $\sim 2\%$ ). Precision measurements of angular dependence of the  $L_3$ -subshell radiative RRS x rays in  $^{59}\text{Pr}$  have been performed. The radiative RRS spectra were taken at different emission angles over the angular range  $90^\circ$ - $160^\circ$ , which were normalized using the isotropically emitted fluorescent  $K$ -shell ( $J = 1/2$ ) x rays measured simultaneously from a  $\text{CaF}_2$  thin target placed adjoining the  $^{59}\text{Pr}$  metallic target. The measured  $L_3M$  radiative RRS x-ray emission was found to be isotropic within the experimental error.

## **References:**

- [1] A. G. Karydas, S. Galanopoulos, Ch. Zarkadas, T. Paradellis, and N. Kallithrakas-Kontos, *J. Phys.: Condens. Matter* 14 (2002) 12367.
- [2] S. Kumar, V. Sharma, S. Kumar, M. Alrakabi, D. Mehta, and N. Singh, *Journal of Applied Physics*, accepted for publication (2009).
- [3] V. Sharma, S. Kumar, D. Mehta, and N. Singh, *Phys. Rev.* 78, (2008) 012507.