Preface

X-ray attenuation coefficients and cross-sections are of great significance in both applied and fundamental science. They are invaluable in many applied fields, such as nuclear diagnostics, radiation protection, nuclear medicine, radiation dosimetry, etc. In recent years, there has been renewed interest in the measurement of photon interaction cross-sections at low energies, especially energies close to absorption edges of elements.

In the present work, X-ray attenuation coefficients are determined at different energies around K-edge of few elements using $^{241}$Am source. Attenuation measurements were also done for some simple thin foil samples using radioactive source and Proton Induced X-ray Emission. Since anomalous scattering factor or of X-ray resonant scattering changes remarkably near an absorption edge of an atom in the energy region of present interest, the anomalous scattering factors $f'+if''$ were derived for few elements from the attenuation measurements.

The thesis is organized as follows: Chapter 1 gives an introduction to the basic interactions of electromagnetic radiation with matter. The elastic and inelastic scattering, photoelectric absorption, absorption edges, dispersion correction, sources for radiation interaction studies including Proton Induced X-ray Emission(PIXE) are also briefly described. Chapter 2 reviews the work already taken place in the field of X-ray attenuation measurements using radioactive sources as well as with PIXE. The related works on Dispersion correction is also reviewed in this chapter.

Chapter 3 describes the attenuation measurements carried out around K-edge of rare earth elements Sm, Eu, Gd, Tb, Dy and Er using 59.54 keV gamma
rays. The method of Compton scattering of the primary photons by an aluminum target is adopted to get continuously variable energy in the range from 49.38 keV to 57.96 keV. **Chapter 4** describes Proton Induced X-ray Emission (PIXE) and experimental determination of mass attenuation coefficients \((\mu/\rho)\) for elements Zr, Nb, Mo and Pd around their K-edges using the technique. The measurements were done at 14 energies in the range 15.744 – 28.564 keV using secondary excitation from thin Zr, Nb, Mo, Rh, Pd, Cd and Sn foils at their K\(_\alpha\) and K\(_\beta\) energy values.

**Chapter 5** deals with the experimental determination of mass attenuation coefficients \((\mu/\rho)\) for elements Zr, Nb, Mo and Pd around their K-edges for the energy range 15.744 – 28.564 keV, using \(^{241}\text{Am}\) source. **Chapter 6** gives a brief theoretical background of the theory of anomalous scattering. The real and imaginary parts, \(f'\) and \(f''\) of the dispersion corrections for the elements Zr, Nb, Mo and Pd have been determined by a numerical evaluation of the dispersion integral.

A summary of the results obtained and the future prospectives of the work are included at the end of the thesis.
List of papers published/presented/communicated:


3. Attenuation studies near K-absorption edges using Compton scattered $^{241}$Am gamma rays (*Accepted in Pramana Journal of Physics*)

4. X-ray attenuation around K-edge by Zr, Nb, Mo and Pd: A comparative study using PIXE and $^{241}$Am gamma rays (*Communicated*)


