

Preface

In this thesis, we provide an explanation of electron impact interactions with atoms/molecules using several advanced theories, and we compare our findings to earlier findings whenever possible. Electron scattering difficulties have been extensively investigated by both experimentalists and theorists. The outstanding work in experimental and theoretical activities may be due to developments in experimental apparatus, the availability of powerful computers, and the development of novel theoretical ideas, which enabled the investigation of complicated targets and collision processes.

We picked compounds of pharmaceutical, biological, atmospheric, industrial, and plasma importance for the application's viewpoint of electron-aided processes. We provide in this thesis an innovative and effortless approach developed in recent years by our group to give insight into elastic and inelastic (including ionization) processes for electron scattering from atomic/molecular species. We sought to analyse electron collision for an energy range of ionization threshold to 5000 eV in order to understand diverse physical processes happening at different impact energy regimes. We used the Spherical Complex Optical Potential (SCOP) approach to investigate the probability of occurrence of distinct electron-driven events. Electron-induced atomic and molecule ionization is a crucial component of numerous naturally occurring processes as well as various reactions valuable in scientific and commercial applications. We provide estimates of total ionization cross sections derived from Complex Scattering Potential-ionization Contribution (CSP-ic) approach and compare them to experimental and theoretical data.

The current thesis is divided into six chapters.

We offered an introduction and a review of the literature regarding prior investigations in **Chapter 1**. We described scattering phenomenology.

We present in detail in **Chapter 2** the Spherical Complex Optical Potential (SCOP), Complex Scattering Potential-ionization Contribution (CSP-ic), and 2 Parameters Semi Empirical Method (2P-SEM) techniques, which allow us to analyse electron interactions at intermediate to high energy levels.

For plasma-relevant molecules, the findings of several theoretical cross-sections, such as total inelastic, total ionization, excitation, total elastic, and total cross sections, are presented in **Chapter 3**. These findings are compared to theoretical and experimental cross-sections.

The current results for several hydrated DNA and Bio molecular targets are reported in **Chapter 4** in the form of numerical data and graphs. These compounds have a wide range of uses. Total inelastic, total ionization, excitation, total elastic, and total cross-sections are among the outcomes. These findings are compared to theoretical and experimental cross-sections.

Chapter 5 is dedicated to the current work's outcomes for environmentally friendly and plasma molecules. Total inelastic, total ionization, excitation, total elastic, and total cross-sections are among the outcomes. These findings are compared to theoretical and experimental cross-sections.

Finally, **Chapter 6** is devoted to the thesis summary, conclusion, and benefits and limits of our current study. We have also made an attempt to analyse the current work and its potential for the future.

The key findings of the current study have been published in reputable national and international publications and presented at several national and international conferences.