

Total electron scattering cross sections for carbon dioxide at low electron energies

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Abstract. Absolute total electron scattering cross sections for carbon dioxide have been measured at low electron energies using a photoelectron source. The measurements have been carried out at 27 electron energies varying from 0.91–9.14 eV with an accuracy of $\pm 3\%$. The cross sections obtained in the present experiment have been compared with other measurements and theoretical computations.

Keywords. Electron scattering; total cross sections; carbon dioxide.

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1. Introduction

In recent years, there has been considerable interest in the measurement of total electron scattering cross sections of carbon dioxide, especially at low electron energies. Also, a lot of activity in the theoretical study of e-CO₂ collisions has started in the recent past. One of the reasons for such an interest lies in the fact that CO₂ plays an important role in the study of planetary atmospheres, laser fusion plasma and gas lasers. Also, this is one polyatomic molecule for which accurate low energy electron scattering cross section calculations are available.

The electron scattering cross section measurements for carbon dioxide have been carried out using various techniques. This includes the work reported by Brüche [1], Ramsauer and Kollath [2], Szmytkowski and Zubek [3], Ferch *et al* [4], Hoffman *et al* [5], Sueoka and Mori [6], Szmytkowski *et al* [7] and Buckman *et al* [8]. These measurements show an increase in cross section with decreasing electron energy below 1.8 eV and at around 70 meV, the cross sections have been found to exceed the value at the maximum of the $^2\Pi_u$ resonance at around 3.8 eV by a large factor [4]. The cross sections have also been theoretically computed by Morrison *et al* [9] using coupled channels procedure together with the adiabatic nuclei approximation. Comparison of the measured and the theoretically computed cross section values shows a general agreement in the shape of the cross section curve in the electron energy range from 0–10 eV but quantitatively, the cross section values at the peak of the resonance and at electron energies ranging between 5 to 10 eV show a large discrepancy. In view of this, more measurements are needed in this direction, possibly at higher electron energy resolution.