LOW ENERGY ELECTRONS INTERACTION WITH ACETONE $(CH_3)_2CO$ IN THE UV-VIS SPECTRAL REGION

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Introduction

Acetone [$(CH_3)_2CO$] is an organic compound found both naturally and synthetically. The detection of significant abundances of acetone in various extra-terrestrial environments, such as comets, interstellar space, and planetary atmospheres, has significant implications for chemical processes, prebiotic chemistry, and astrobiology. For instance, Douglas N. Friedel et al. (2005) reported the detection of interstellar acetone in the Orion-KL hot core, a high-mass star-forming region [1]. Similarly, in 2017, a study on the evolution of cometary nuclei surfaces confirmed the presence of acetone and methanol through the sublimation of ice in the presence of organic volatiles [2].

Experimental results

The most prominent emission bands identified were the CH ($A^2\Delta - X^2\Pi$), CH ($B^2\Sigma^- - X^2\Pi$), and CH ($C^2\Sigma^+ - X^2\Pi$) bands, although the CH ($C^2\Sigma^+ - X^2\Pi$) band exhibited weak intensity. Furthermore, emission lines from hydrogen's Balmer series, spanning H_α to H_η, as well as oxygen emission lines corresponding to O I ($3p^5P - 3s^5S^o$) and O I ($3p^3P - 3s^3S^o$), were detected. A low-intensity signal from two features of the Swan system C_2 ($d^3\Pi_g - a^3\Pi_u$) and the Deslandres d'Azambuja system C_2 ($C^1\Pi_g - A^1\Pi_u$) was also observed as shown in Fig. 2.

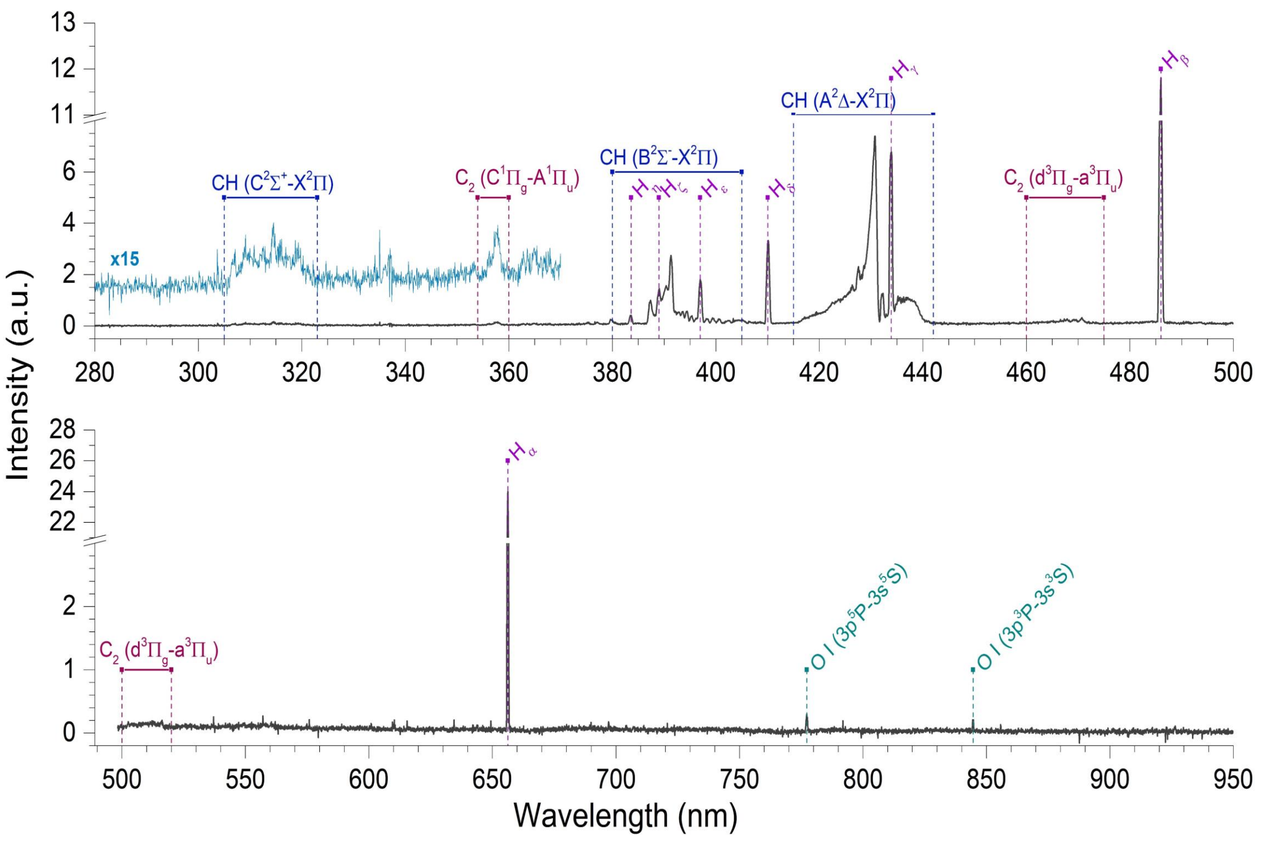

Fig. 2: The emission spectrum of acetone measured (280–950 nm) by CCD camera at 50 eV [3].

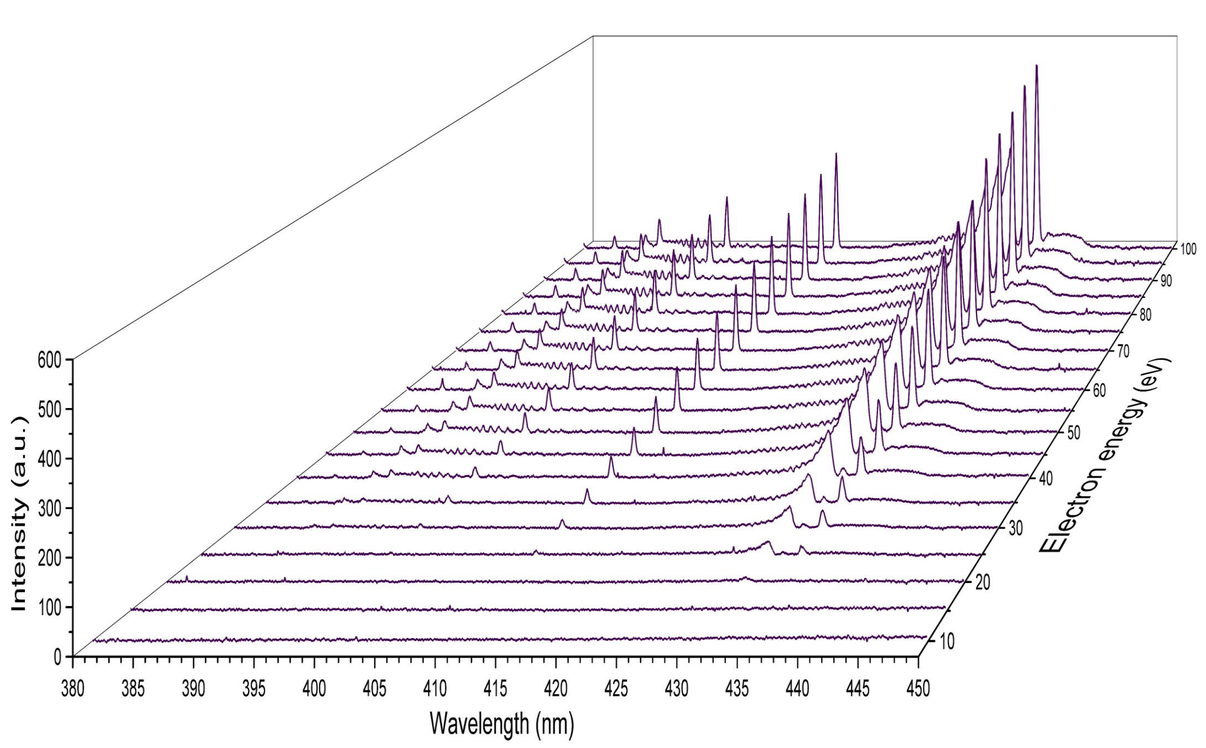

Fig. 3: The spectral electron energy graph of acetone within the wavelengths 380-450 nm [3].

Experimental setup

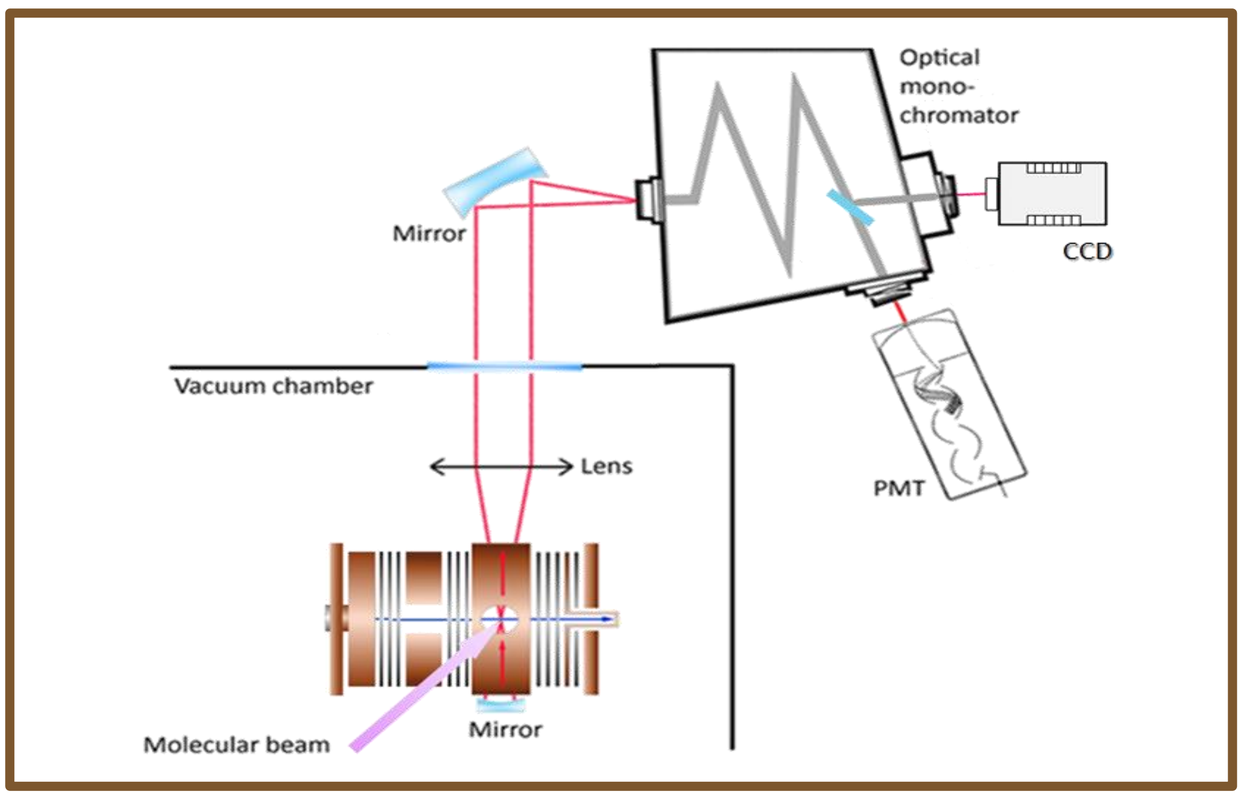

Fig.1: Scheme of electron-induced fluorescence apparatus.

The electron-induced emission spectra are measured using a Czerny–Turner optical monochromator, which provides a spectral resolution of 0.3nm FWHM and is equipped with a photomultiplier that is sensitive between 185 and 900 nm, and a CCD camera operating at wavelengths from 300 to 1100 nm.

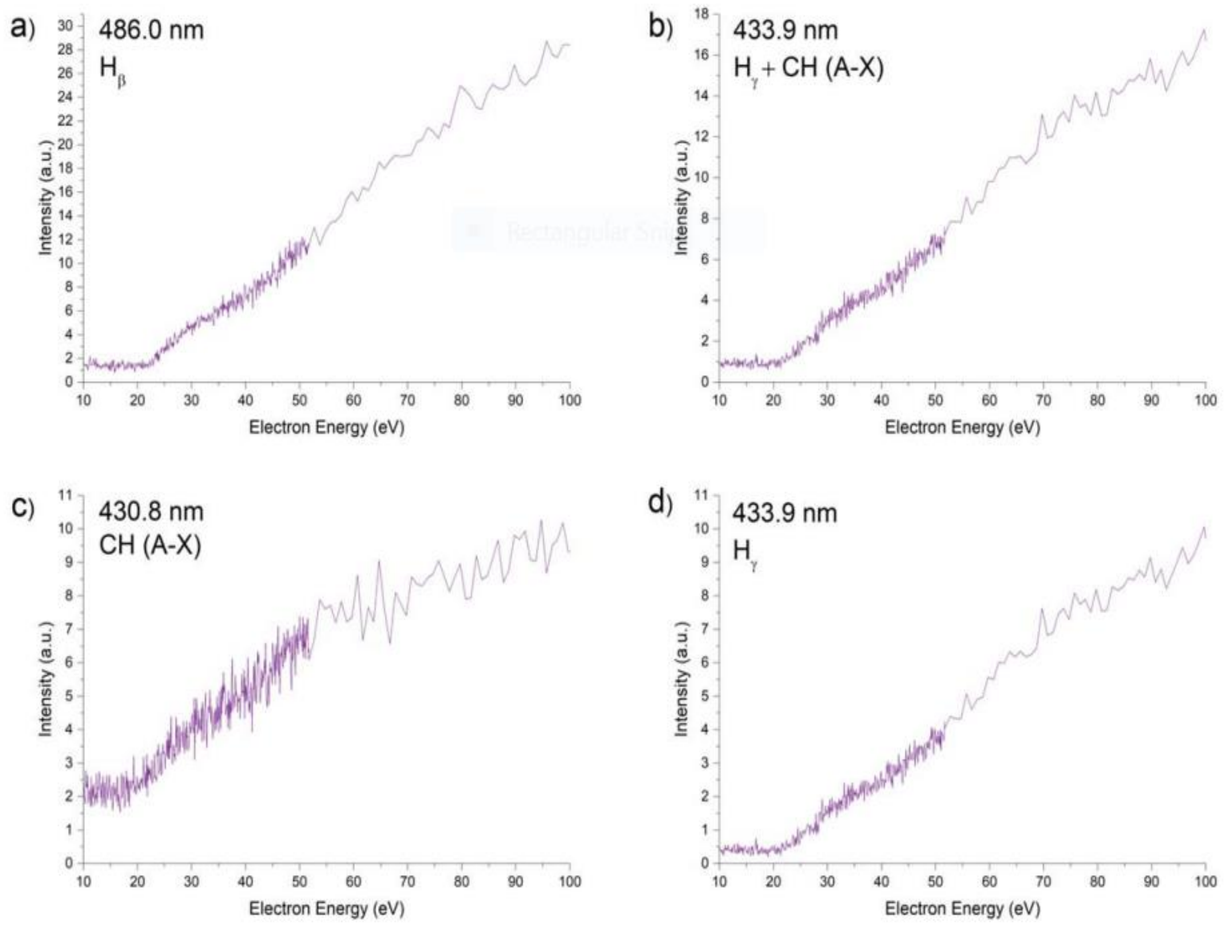

Fig. 4: Excitation-emission functions of: a) H_β at 486 nm, b) H_γ combined with CH ($A^2\Delta$-$X^2\Pi$) at 433.9 nm, c) Q1 branch of CH ($A^2\Delta$-$X^2\Pi$) at 430.8 nm, d) H_γ with subtracted signal from CH ($A^2\Delta$-$X^2\Pi$) at 433.9 nm [3].

Reference

[1] Friedel DN, Snyder LE, Remijan AJ, Turner BE 2005 *Astrophys. J.* **632** L95.

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