THE C_2 SWAN ($d^3\Pi_g$ - $a^3\Pi_u$) SYSTEM REVISITED

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The well known Swan ($d^3\Pi_g$-$a^3\Pi_u$) system of C_2 has been observed in absorption in a hollow cathode discharge in a mixture of C_2H_2 and He. The measurements were carried out using a computer-controlled dye laser in the range of 16860-17060cm^{-1} at NRC Canada and Kyoto University. Three clearly identifiable bands of C_2 have been observed. However, the transition wavenumbers are found not to be quite consistent with the literature values compiled by Phillips and Davis[a].

A band system which exhibits no prominent perturbations is assigned to be the (7,9) band which was not known in the past, and moreover the upper state of this transition, the $v' = 7$, $d^3\Pi$, has never been detected in any transitions previously. Another band which has been tentatively assigned to be the (5,7) band is perturbed. The bandhead value obtained here does not agree with that obtained by Phillips and Davis, but agree reasonably well with that compiled by Tyte, Innanen, and Nicholls[b]. The bands which involve the $v' = 6$ vibrational state are often called "high pressure bands". They exhibit "double bandheads". The bandhead of a band which we think to be the (6,8) band agrees with one of the two bandhead values listed by Tyte, Innanen, and Nicholls.

In addition to these bands of neutral C_2, there are many more lines in our absorption spectra and basically all of them do not agree with the values listed in Phillips and Davis transition wavenumber table. Our effort to unravel mysteries which still exist in this well studied spectrum of the diatomic carbon will be presented.

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[a] J.G. Phillips and S.P. Davis, The Berkeley Analysis of molecular spectra, Vol.2. The Swan System of the C_2 Molecule and the Spectrum of the HgH Molecule. (1968)

[b] D.C. Tyte, S.H. Innanen, and R.W. Nicholls, Identification Atlas of Molecular Spectra, Vol.5. The C_2 $d^3\Pi_g$-$a^3\Pi_u$ Swan System. Centre for Research in Experimental Space Science, York University. (1967)