

an appreciable non-planar geometry for  $\text{QH}^+$  in the  $T_1$  state in site I. Electron–nuclear double-resonance investigations will probably clarify the structural problems.

1 *Chem. Phys. Lett.*, 65 (1979) 266.

## Photophysics of $\beta$ -carbolines

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Steady state and time-resolved fluorescence techniques were used to study the excited state behaviour of  $\beta$ -carboline and 2-methyl- $\beta$ -carboline under various conditions of solvent and temperature. In aqueous solutions these molecules exhibit quite unusual excited state acid–base behaviour. In acidic solution the  $\beta$ -carboline cation is responsible for light absorption and fluorescence ( $\lambda_{\text{max}}$ , 450 nm;  $\tau_{\text{F}}$ , 22.0 ns). However, excitation of the neutral form of the molecule in alkaline solutions leads to the formation of the  $\beta$ -carboline cation by a rapid proton transfer with water. A diffusion-controlled quenching of the excited state cation by  $\text{OH}^-$  ions produces another species fluorescing with  $\lambda_{\text{max}}$  at 510 nm ( $\tau_{\text{F}}$ , 1.6 ns) which is identified as a zwitterion. The zwitterion is also formed after excitation of the ground state anion at pH 14.  $\text{p}K$  values for the ground state and excited state acid–base equilibria are reported. In addition, studies of the temperature dependence of the luminescence have provided some insight into the excited state relaxation mechanisms occurring in these derivatives.

## A new photochromic system: absorption spectra, emission spectra and kinetics

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The interest in novel non-silver photosensitive systems has recently stimulated active research in this domain. In this context photochromic systems have become extremely attractive with respect to their use as silver-free imaging systems, as data storage, data display and photoprint systems, as photoresists and for potential solar energy conversion.