Experimental study of the $4^1\Pi$ state in KCs molecule

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The heteronuclear KCs molecule belongs to the least known alkali diatomics. Only the rapid development of cold physics in the past two decades brought KCs, among other heteronuclear alkali molecules, into wider attention. However, to date only seven electronic states of KCs have been observed experimentally: the ground state $X(1)^1\Sigma^+$ and the excited states $a^3\Sigma^+$, $A(2)^1\Sigma^+$, $b^3\Pi$, $B(1)^1\Pi$, $C(3)^1\Sigma^+$, $E(4)^1\Sigma^+$, extending up to about 18500 cm^{-1} above the bottom of the ground state potential energy curve, i.e. to the atomic asymptote $K(4^2S_{1/2})+Cs(5^2D_{3/2})$.

In this contribution we present the first experimental observation of the $4^1\Pi$ state of KCs, achieved by polarisation labelling spectroscopy technique [1]. This state dissociates into $K(3^2D)$ and $Cs(6^2S)$ atoms and up to now has been known only from theoretical calculations, either as the $4^1\Pi$ state in Hund's case (a) terminology [2] or as $(15)\Omega=1$ in Hund's case (c) [3]. We demonstrate that, despite of strong local perturbations, the state can be represented with a reasonable accuracy by a single potential energy curve in case (a) representation. The molecular potential is constructed by the pointwise inverted perturbation approach (IPA) method [4] basing on measured energies of ca. 2000 rovibrational levels. Presently the $4^1\Pi$ state is the highest spectroscopically characterised electronic state in KCs molecule.

References:

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