

### Supplementary Materials

**Table S1** Total Einstein spontaneous emission coefficients ( $A_{\nu}$ ) and radiative lifetimes ( $\tau$ ) for bound-free transitions from the  $3\ ^2\Pi$  state to the lower states  $2\ ^2\Pi$ ,  $1\ ^2\Sigma^+$ ,  $1\ ^2\Sigma^-$ ,  $1\ ^2\Delta$ ,  $1\ ^2\Pi$  of the  $\text{OH}^{2+}$  species.

$\nu$	$A_{\nu} / \text{s}^{-1}$	$\tau / \text{ns}$	$\lambda_{\text{max}}$
0	36 511 360	27.39	129.87
1	30 999 160	32.26	133.33
2	25 506 420	39.21	136.05
3	20 101 200	49.75	136.98
4	14 959 295	66.85	137.98

**Table S2** Total Einstein spontaneous emission coefficients ( $A_{\nu}$ ) and radiative lifetimes ( $\tau$ ) for bound-free transitions from the  $2\ ^2\Sigma^-$  state to the lower states  $2\ ^2\Pi$ ,  $1\ ^2\Sigma^-$ ,  $1\ ^2\Pi$  of the  $\text{OH}^{2+}$  species.

$\nu$	$A_{\nu} / \text{s}^{-1}$	$\tau / \text{ns}$	$\lambda_{\text{max}}$
0	45481500	21.99	135.13
1	39104010	25.58	139.86
2	32753930	30.53	142.86
3	26485200	37.76	143.88
4	20411755	48.99	144.93

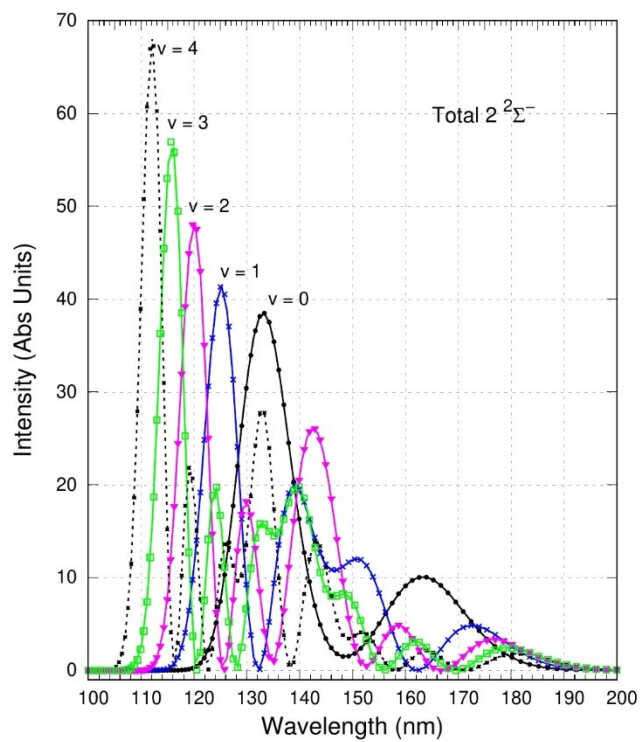
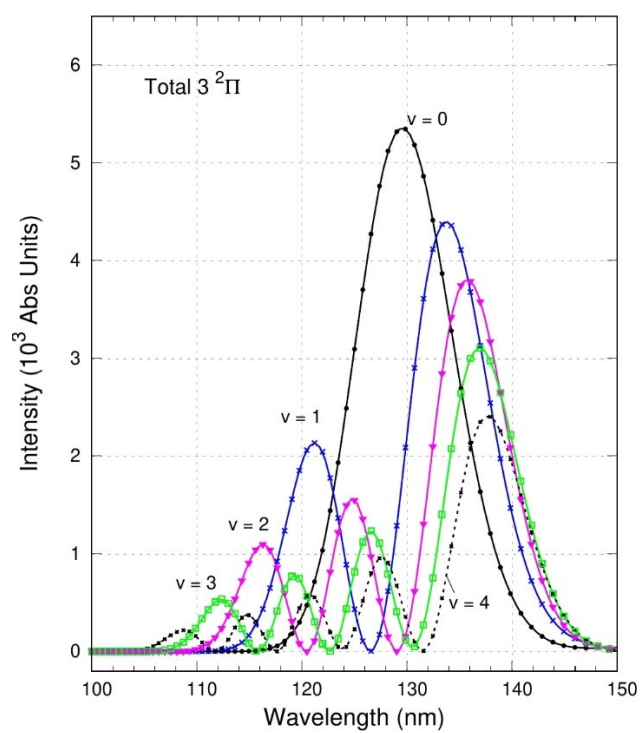


Fig. S1 Bound-free emission intensities for doublet states of the hydroxyl dication.