Recent high-resolution (±0.00002 cm⁻¹) photo-association spectroscopy (PAS) data of seven previously unexplored vibrational levels of the $1^3\Sigma^+_g$ state of Li$_2$ have allowed for the first ever experimental determination of the spin-spin ($\lambda_v$) and spin-rotation ($\gamma_v$) coupling constants in a diatomic lithium system. For triplet states of diatomic molecules such as the $1^3\Sigma^+_g$ state of Li$_2$, the three spin-spin/spin-rotation resolved energies associated with a ro-vibrational state $|v, N\rangle$ were expressed explicitly in terms of $B_v$, $\lambda_v$, and $\gamma_v$ in 1929 by Kramer’s first-order formulas$^b$ and then in 1937 by Schlapp’s more refined formulas$^c$. Given spectroscopic data, while it has never been difficult to extract $\lambda_v$ and $\gamma_v$ from Schlapp’s formulas, it has been a challenge to reliably predict how accurate these extracted values are. This is for two reasons: (1) the lack of a rigorous method to estimate the uncertainty in $B_v$, (2) the non-linearity of Schlapp’s coupled equations has meant that traditionally they have had to be solved numerically by Newton iterations which makes error propagation difficult. The former challenge has been this year solved by Le Roy with a modification of Hutson’s perturbation theory$^d$, and the latter problem has now been solved by symbolic computing software that solves Schlapp’s coupled non-linear equations analytically for the first time since their introduction in 1937.

$^b$ H. Kramers, Zeitschrift fur Physik 53, 422 (1929)
$^c$ R. Schlapp, Physical Review 51, 342 (1937)