The fundamental vibrational bending mode $v_2$ of disulfur monoxide, $S_2O$, and the associated hot band $2v_2 - v_2$ have been observed at high spectral resolution for the first time at the SOLEIL synchrotron facility using Fourier-transform far-infrared spectroscopy. This transient species has been produced using a radio-frequency discharge by flowing SO$_2$ over elemental sulfur. The spectroscopic analysis has been performed using an Automated Spectral Assignment Procedure (ASAP) which has enabled the accurate determination of more than 3500 energy levels of the $v_2 = 1$ and $v_2 = 2$ vibrational states. In addition to the high-resolution synchrotron study, pure rotational spectra of $S_2O$ in the $v_2 = 1$ and 2 vibrational states were observed in the frequency range 250 – 500 GHz in a long-path absorption cell.