As part of a series of new photoabsorption measurements of CO isotopologues in the vacuum-ultraviolet at the SOLEIL synchrotron, we have studied the $v = 1$ level of the $W^1\Pi$ Rydberg state. This state is crossed by an unknown perturber that strongly influences the predissociation rate of $W^1\Pi$ rotational levels. A detailed multi-isotopologue study of this interaction reveals the molecular constants of the interacting species and gives clues to its identity.

Our measurement program has astrophysical applications in mind, with CO photodissociation being a critical step in the photochemistry of interstellar clouds, protoplanetary disks, and (exo)planetary atmospheres. The careful analysis of perturbations such as this and other weak features in the spectrum of CO give critical information regarding the electronic structure of the molecule. Illuminating this structure will help translate laboratory measurements to astrophysically-relevant cross sections and predissociation rates, and is itself an interesting problem in molecular physics.