P35
Absorption of near IR in molecular oxygen between 0 and 4 Bar

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Absorption of light by molecules at ambient pressures is affected in multiple ways. Elastic collisions induce lifetime broadening as well as Dicke narrowing, inelastic collisions induce line mixing. Moreover, during a collision the dipole moment is highly time-dependent. Using cavity ring down spectroscopy these processes are quantified to a 1% accuracy level for oxygen-oxygen and for oxygen-nitrogen collisions. This accuracy is required to avoid systematic errors to occur in the retrieval of trace gasses from satellite data.

The extreme sensitivity of the cavity ring down technique in combination with a tuneable pressure cell makes it possible to measure the absorption in a forbidden transition in the far wings of the individual absorption lines.

P36
Optimizing the optimization – Performance of evolutionary strategies for quantum control

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Evolutionary algorithms act as engine drivers in the closed-loop experiments for coherent control; they interpret the feedback signals obtained from different experiments and, based on this information, generate new pulse shapes to be tested as the loop proceeds.

Due to their versatility, evolutionary algorithms are widely in use in the field of coherent control. In our work, two different novel evolutionary strategies (DR2 and CMA) are compared using second harmonic generation (SHG) as a test bed. To convert the abstract numerical output of the algorithm to a physical phase pattern on the SLM, a parameterisation of the phase is required. We have studied several different parameterisations and their impact on the algorithm. Furthermore, we present a novel parameterisation offering a 30% improvement in optimization efficiency.