

# Deceleration, cooling and trapping of heavy diatomic molecules

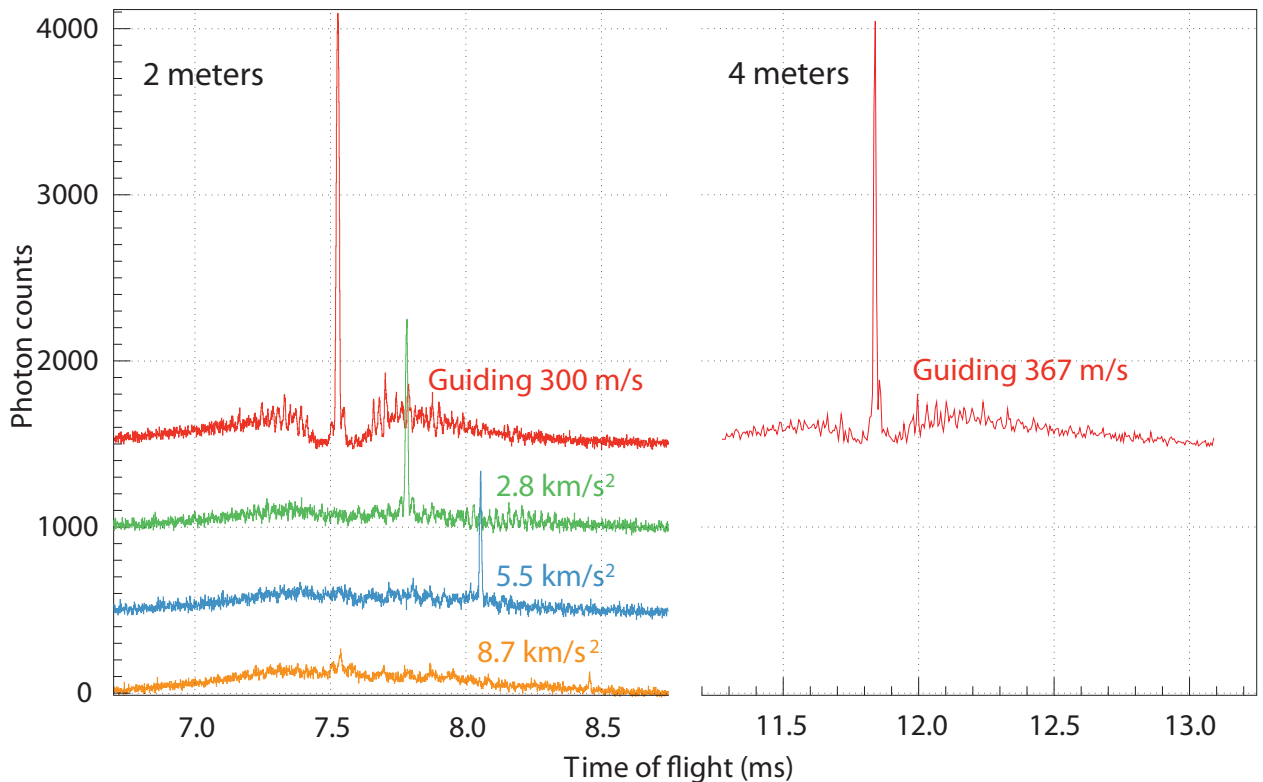
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In the recent few decades there is a great interest in cooling and controlling of neutral molecules, motivated by a wide range of possible applications. We are developing methods of deceleration, cooling and trapping of certain diatomic molecules that are suitable for study of physics beyond the Standard Model. Traditional Stark decelerator is inefficient for slowing down of heavy diatomic molecules due to overfocusing. Therefore, we are building an inherently stable 4.5m long travelling-wave decelerator [1] to decelerate strontium monofluoride molecules and bring them to a complete standstill. SrF is a sensitive probe for search of parity violation and that is the motivation for our work.

Following the deceleration, we plan to laser cool molecules and transfer them to a deep optical dipole trap. Laser cooling of SrF is possible due to highly diagonal Franck-Condon factors and a short radiative lifetime, and optical trapping can be implemented in an optical cavity. A sample of ultracold trapped molecules provides a large increase of the interaction time and is an ideal starting point for high precision spectroscopy. We report the latest results [2] and the current status of our experiment (Fig. 1).



**Figure 1:** Time-of-flight measurements of guiding and deceleration of SrF molecules for different decelerator lengths. On the left side guiding and deceleration results with 2m decelerator. On the right side guiding result with 4m decelerator. Deceleration with 4m decelerator is in progress.

## References

- [1] J.E. van den Berg *et al.* Eur. Phys. J. D **66** 235 (2012)
- [2] J.E. van den Berg *et al.* J. Mol. Spec. **300** 22–25 (2014)