Universality in the 2-body collision physics of microwave-shielded ultracold polar molecules

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Microwave shielding is an important technique that can suppress the losses that arise from collisions of ultracold polar molecules. It has been instrumental in achieving molecular Bose-Einstein condensation (BEC) for NaCs [1]. We demonstrate that microwave shielding is universal, in the sense that the 2-body collision properties of different molecules are very similar when expressed in suitable reduced units of length and energy [2]. This applies to rate coefficients for inelastic scattering and loss, to scattering lengths, and to the properties of 2-molecule bound states. We also explore the small deviations from universality that arise at very large Rabi frequencies. In general, the collision properties are near-universal except when the Rabi frequency exceeds a few percent of the molecular rotational constant. The universality extends to elliptically polarized microwaves and to combinations of multiple fields. Our results indicate that the methods that have been used to achieve BEC for NaCs can be transferred directly to most other polar molecules.

References

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