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Chirality-sensitive microwave spectroscopy - application to terpene molecules

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Most molecules of biochemical relevance are chiral. Even though the physical properties of two enantiomers are nearly identical, they might exhibit completely different biochemical effects, such as different odor in the case of carvone. In nature and as products of chemical syntheses, chiral molecules often exist in mixtures with other chiral molecules. The analysis of these complex mixtures to identify the molecular components, to determine which enantiomers are present, and to measure the enantiomeric excesses (ee) is still one of the challenging and very important tasks of analytical chemistry. We recently experimentally demonstrated a new method of differentiating enantiomeric pairs of chiral molecules in the gas phase. It is based on broadband rotational spectroscopy and is a three-wave mixing process that involves a closed cycle of three rotational transitions. The phase of the acquired signal bares the signature of the enantiomer, as it depends upon the product of the transition dipole moments. Furthermore, because the signal amplitude is proportional to the ee, this technique allows not only for determining which enantiomer is in excess, but also by how much. A unique advantage of our technique is that it can also be applied to mixtures of chiral molecules, even when the molecules are very similar. In my lecture, I will introduce the technique and give an update on the recent developments.