# Vibrationally excited states of organic molecules in space and in atmospheres - spectroscopic and theoretical studies

Initiative: Trilaterale Partnerschaften – Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der

Ukraine, Russland und Deutschland

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In previous research by the same partners novel analysis techniques have been developed, tested, and successfully applied to sulphur compounds of astrochemical relevance where the obtained results can be expected to contribute to the solution of the sulfur depletion problem. Based on those results, in the current proposed research it is intended to exploit those new opportunities in order to investigate a wider range of astrophysically and atmospherically relevant organic molecules. In particular, the consortium wants to address such ubiquitous interstellar molecules as e.g. methanol and methyl formate meeting all criteria to be characterized as what astronomers call "weed". For those, a number of relatively low lying torsional states of these molecules are affected by strong intervibrational interactions with non-torsional modes, which significantly complicate the spectrum analysis even for laboratory conditions. The novel analysis techniques allows to rigorously account for intervibrational interactions between torsional large amplitude and non-torsional small amplitude modes and will therefore provide the consortium with the opportunity to successfully deal with this problem. The consortium also wants to also readdress such molecules as e.g. methane and ethylene which are rather abundant in space. For reliable sensing of planetary atmospheres in addition to line positions an accurate knowledge of line intensities, broadening parameters and shifting parameters is essential. For the most part these quantities are not known at all or not well enough, so the main focus of the research will be the quantitative determination of line intensities and line parameters. It is expected that the result of the research will significantly facilitate the analysis of astronomical remote sensing data, in particular with respect to excited vibrational states of a number of well-known and abundant interstellar molecules, but also with respect to the analysis of terrestrial atmospheric soundings.

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