Separation and conversion dynamics of nuclear spin isomers of gaseous molecules

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Matter is composed of molecules and all molecules possessing identical nuclei with nonzero spin, in accordance with Pauli's principle, have distinct nuclear spin isomers [1]. Can one of nuclear spin isomers of the gaseous molecules be separated from others? Is it possible that nuclear spin conversions among the nuclear spin isomers occur and can be observed spectrospically? How long can these isomers exist in real time? Addressing these question leads to interesting scientific explorations. In astronomy and astrophysics, it is widely assumed that the conversion probabilities among nuclear spin isomers for the various molecules in the interstellar matter are zero, even over time spans of millions of years [1]. However, this assumption is quite questionable. The observed values obtained in our study are good tests for the validity of this assumption.

We are performing researches on separation of nuclear spin isomers of gaseous interstellar molecules by the most reliable and powerful light-induced-drift technique [1-3] and on the conversion observations of these enriched spin isomers in long time relaxation processes via precision measurements of the spectral line intensities. Our experimental results and detailed physical explanations of the nuclear spin conversion mechanisms will be reported in the Workshop on Interstellar Matter 2010.

References

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