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EM590237: Laboratory rotational spectrum and astronomical search for methoxyacetaldehyde

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Autonomy & Astrophysics manuscript no. aa33773-18  
October 16, 2018

ESPO 2018

Laboratory rotational spectrum and astronomical search for methoxyacetaldehyde\*

L. Kolesnikova<sup>1</sup>, I. Peña<sup>1</sup>, E. R. Alonso<sup>1</sup>, B. Tercero<sup>2</sup>, J. Cernicharo<sup>3</sup>, S. Mata<sup>1</sup>, and J. L. Alonso<sup>3</sup>

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Received 4 July 2018 / Accepted 14 August 2018

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Astron Astrophys

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ABSTRACT

Context. Methoxyacetaldehyde belongs to a group of structural isomers with the general formula  $C_3H_8O$ , of which methyl acetate and ethyl formate are known interstellar molecules. Rotational data available for methoxyacetaldehyde are limited to 40 GHz, which makes predictions at higher frequencies rather uncertain.

Aims. The aim of this work is to provide accurate experimental frequencies of methoxyacetaldehyde in the millimeter-wave region to support its detection in the interstellar medium.

Methods. The rotational spectrum of methoxyacetaldehyde was recorded at room temperature from 75 to 120 GHz and from 170 to 210 GHz using the millimeter-wave spectrometer in Valladolid. Additional measurements were also performed at conditions of super-cooled vapour between 8 to 16 K. The assigned rotational transitions were confirmed using the  $\mu$ -resonance centrifuge prior to publication.

Results. We newly assigned over 3000 lines for the most stable conformer of methoxyacetaldehyde in its ground state and five lowest excited vibrational states and precise wave of spectral transitions were obtained. We searched for spectral features of methoxyacetaldehyde in the high-mass star-forming regions Orion-KL and Sagittarius B2, as well as in the cold dark cloud Barnard 1 (B1-b). No lines belonging to methoxyacetaldehyde were detected above the detection limit of our data. We provide upper limits to the methoxyacetaldehyde column density in these sources.

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1. Introduction

Of all aldehydes interstellar molecules, very few have been observed in their isotopic counterparts, which indicate that numerous gaps in rotational data is identified, especially in the 200-300 GHz range (Cernicharo et al. 2015; Cernicharo et al. 2016; Cernicharo et al. 2017; Cernicharo et al. 2018). In the case of methoxyacetaldehyde, only one line has been observed in the 40-100 GHz range, namely, the  $\nu_2$  band at 40.1 GHz (Cernicharo et al. 2015). In this paper, we report the first rotational spectrum of methoxyacetaldehyde in the millimeter-wave region, which allows us to identify the isotopic counterparts of the observed lines and to search for new lines in the 200-300 GHz range.

Abstract

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