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An improved Nd:YAG laser pumped setup for vacuum ultra violet spectroscopy of carbon monoxide molecules

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Abstract :

Vacuum ultra violet (VUV) spectroscopy of carbon monoxide involves the generation of wavelength tunable VUV laser light and its application to high resolution spectroscopy of low temperature carbon monoxide molecules. The main objective of this project is the detection of the forbidden transitions of CO for which experimentally measured wavelengths are not yet available. Carbon monoxide molecules are cooled (to ~2 K) with the aid of a seeded supersonic gas jet allowed to expand into vacuum. The major advantage of the cooling of the molecules is the ability to obtain higher spectral resolution than would normally be possible with room temperature samples. A pulsed Nd:YAG laser is used to pump a single tunable dye laser (for third harmonic generation) or two tunable dye laser systems (for sum frequency mixing) in order to produce VUV laser light in a concentric heat pipe oven. In the heat pipe oven a gaseous nonlinear medium is prepared consisting of magnesium vapour, mixed with krypton gas that is introduced to control phase matching of the incident laser light and the VUV light. The dye laser beams are focussed in the medium where third harmonic generation or sum frequency mixing (depending on input parameters) occurs. The resultant VUV light is used to selectively excite single rovibronic transitions of the carbon monoxide molecules in the sample while scanning the VUV wavelength in search of known and possibly unknown spectral lines. Recently, new laser equipment, including the Nd:YAG pump laser, has been acquired which allows higher output energies of laser light. With the new equipment there is a possibility that spectral lines that were undetectable by the previous system may be detected. We present the status of the project and results to date.

Award :

Yes

Level :

PhD

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Paper :

No

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