NEW MILLIMETER-WAVE INTRACAVITY JET SPECTROMETER BASED ON OROTRON

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A new highly sensitive millimeter-wave spectrometer has been developed for the investigation of weakly bounded van der Waals molecular complexes produced in a supersonic jet expansion. The main feature of the spectrometer is that the molecular jet expands into the high quality ($Q = 10^4$) resonator of a tunable coherent source of radiation - OROTRON (106-150 GHz). The absorption of the radiation inside the cavity is detected by the variation of the electron current of the orotron in a collector circuit. This simple method of detection and the narrow linewidth of the orotron radiation (10-15 kHz) without any frequency and phase stabilization make this spectrometer very simple and convenient for searching of new lines and for recording of weak spectra. The large effective length of absorption results in an improvement of sensitivity for more than two orders of magnitude in comparison with the existing single path schemes. The new set-up has been adjusted and tested by the observation of the isotopomers of CO in natural abundance. The rotational transition $J = 1 - 0$ of isotopic species $^{13}C^{17}O$ (0.0004%) with partially resolved quadrupole structure was observed. The measurements of the $K = 1 - 0$ high-J (10<J<20) pure rotational transitions of Ar-CO and the first observation of Ne-CO (for ^{20,21,22}Ne isotopes in natural abundance) in millimeter-wave range have been made. The analysis of these data will be presented.