High-Accuracy Measurements of Gas Velocities in Regions of Star Formation

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High-accuracy radio astronomy measurements of interstellar gas velocities are necessary to explore the structure and physical conditions of star formation regions. To improve the accuracy of measurements, it is necessary to take into account the influence of a big number of factors, some of which are considered in this work. In order to determine gas velocities in star formation regions with high accuracy, it is first necessary to know the exact values of the frequency energy transition of gas molecules. It was suggested that the Lamb dip method would significantly improve the accuracy of laboratory measurements of the frequency of energy transitions of gas molecules. The exploration of this method was the first part of the work. For the experiment, deuterated ammonia was chosen as the gas. Based on the data obtained as a result of the experiment, it was found out that, using the Lamb dip method, the accuracy of determining the center frequency of the transition of gas molecules was increased by 15 times. The second part of the work was devoted to the calculation of the gravitational influence of the planets of the solar system on the accuracy of radio astronomy velocity measurements. Taking into account all the error values obtained in the course of operation, a new value of the accuracy of determining the velocity of interstellar gas was obtained - 3 m / s, which today meets all radio astronomy requirements. I believe that the results obtained can be used to more accurately tune the radio telescopes. More accurate values of the interstellar gas velocities may help to explain some mysterious phenomena of modern astrophysics.

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