

# National Radio Science Meeting

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## *Laboratory Spectroscopy of Atmospheric Gases in the Millimeter and Submillimeter Wave Range*

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**Abstract:** Predicting changes in climate and forecasting human-induced changes in the environment require an in-depth scientific understanding of the phenomena. A huge amount of remote-sensing instruments, including ground-based, onboard and satellite-based radiometers, are operating all over the world, aiming at the global and continuous observation of the Earth's atmosphere. Quantitative use of the geophysical data provided by these sensors requires a thorough understanding of the underlying molecular spectroscopy. Without proper background information, satellite and field measurement data may be incorrectly utilized or misinterpreted. Note that both fundamental physical models and their numerical parameters, which can be obtained only from accurate measurements under accurately controlled laboratory conditions, are equally important. Spectroscopic errors may limit the accuracy of the data derived from atmospheric measurements more than instrumental errors. The continuous progress in remote sensing instrumentation facilitates reduction of measurement errors. Hence, still finer spectroscopic effects should be taken into account in atmospheric radiation propagation modeling. The molecular spectroscopy underlying the microwave remote sensing of planetary atmospheres will be overviewed in the lecture, including examples of the current laboratory investigations of major diagnostic atmospheric lines in the millimeter and submillimeter wave range. This provides high quality spectroscopic parameters for radiative transfer codes, and also provides a discussion of theoretical and instrument advances along with problems and goals of laboratory spectroscopy.



**Biography:** Prof. Tretyakov graduated from Gorky State University in 1980 with his MS on “Analysis of Subdoppler Microwave Spectrometer Based on Coherent Spontaneous Radiation of Molecules”. This was recognized to be “The Best Students Scientific Work” in the USSR in 1980. He received the Ph.D. degree in Physics and Mathematics in 1995 for his thesis on “Development of methods of microwave spectroscopy in Terahertz frequency range”. His Full Doctor degree was received in 2017 for the work “High accuracy resonator spectroscopy of atmospheric gases at millimeter and submillimeter waves”. From 1980 to the present he has been with the Institute of Applied Physics, Russian Academy of Sciences, where he is currently Head of the Laboratory of Microwave Spectroscopy, and member of the Scientific

Council of the Institute. He is the scientific supervisor of undergraduate and Ph.D. students and on the scientific committees and review boards of several journals including Radiophysics and Quantum Electronics, Journal of Chemical Physics, Journal of Molecular Spectroscopy, Molecular Physics, Physical Chemistry Chemical Physics, Journal of Quantitative Spectroscopy and Radiative Transfer, and Canadian Journal of Physics. His interests are in high resolution molecular spectra experimental studies in the millimeter and submillimeter wave range and the development of new microwave techniques and methods.