Molecular spectroscopy and radiation processes in the atmosphere
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Principal methodical problem is the calculation of radiation characteristics integrated over spectrum under conditions of the inhomogeneous atmosphere and overlapping bands of different greenhouse gases. Three periods in the development of this problem can be separated with confidence.

<u>The period before computers</u>: models of the absorption bands (the asymptotic cases are the equally spaced lines equal in intensities and the statistical model, dispersive line shape) as a way of qualitative analysis and of the extrapolation of measurements of the absorption function.

<u>The first period of computers</u>: the line-by-line scheme seemingly should solve the questions, really, technically the problem at hand is simply the numerical integration. However because of the great number of spectral lines and the uncertainties in non-resonance absorption the problem appeared overgrows to the rank of not nearly technical ones.

Hence the renaissance of analytical ideas in combination with the possibilities of computer technologies follows in <u>the present period of computers</u>. The central part is played by the Dirichlet series due to the capability to change the "palisade" of spectral lines for the smooth function with the evident simplifications of the process of calculations. Among them are the reduction of calculations during the analysis of the aerosol – molecular medium and the notation of the transfer equations immediately for quantities integrated over spectrum.

As for the physical aspects the two very significant problems should be noted. First, the description of the periphery of the spectral line contour connected with the atmospheric transparency windows, very important for the radiation transfer. Second, the violation of the local thermodynamic equilibrium in calculations of the inherent radiation of the atmospheric gases.

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