



The ALI-ARMS Code for Modeling the Atmospheric Non-LTE Molecular Band Emissions: Current Status and Applications

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The Accelerated Lambda Iteration (ALI) technique was developed in astrophysics at the beginning of 1990s for solving the non-LTE radiative transfer problem in atomic lines and multiplets in stellar atmospheres. It was later successfully applied to modeling the non-LTE emissions and radiative cooling/heating in the vibrational-rotational bands of molecules in planetary atmospheres. Similar to the standard lambda iterations ALI operates with the matrices of minimal dimension. However, it provides higher convergence rate and stability due to removing from the iterating process the photons trapped in the optically thick line cores. In the current ALI-ARMS (ALI for Atmospheric Radiation and Molecular Spectra) code version additional acceleration of calculations is achieved by utilizing the opacity distribution function (ODF) approach and "decoupling". The former allows replacing the band branches by single lines of a special shape, and the latter treats non-linearity caused by the strong near-resonant vibration-vibrational level coupling without additional linearizing the statistical equilibrium equations. Latest code application for the non-LTE diagnostics of the molecular band emissions of Earth and Martian atmospheres as well as for the non-LTE IR cooling/heating calculations are discussed.