DESCRIBING THE MATEMATICAL METHODS FOR CALCULATING BASIC PHYSICAL PARAMETERS OF THE GAUSSIAN-ROTATIONAL (GR) MODEL

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Abstract. Our research group developed Gaussian-Rotational (GR) model and A.S.T.A. software that can analyze the complex DAC/BAL (Discrete Absorption Components/Broad Absorption Lines) profiles, which we observe in the spectra of Hot Emission Stars and Quasars, to individual components. By applying a series of strict fitting criteria, we analyze each DAC/BAL to the uniquely determined number of components it consists of; our method guarantees the uniqueness of the best fit. For every absorption component, we calculate the radial (Vrad) and rotational (Vrot) velocity, the FWHM, the random velocities of the ions (Vrand), the optical depth at line center (τ_0), and the column density (N). Notice that, in the final line function, we can apply all the known distributions, which contribute to the peculiar profile of the studied spectral line. In this paper, we present the mathematical methods for applying of the Gaussian, Lorentzian, and Voigt distribution to the final line function, as well as the calculation of the FWHM and the random velocities in each of the above mentioned distributions. Additionally, we present the so-called problem of the "Partial Coverage of the Radiation" and a mathematical method of its solution.