

H₃⁺ 赤外発光輝線を用いた木星オーロラ電子の特徴抽出法

On the feasibility of characterizing Jovian auroral electrons via H₃⁺ infrared line-emission analysis

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Ground based telescopes can monitor Jovian infrared (IR) auroral activities continuously for an extended time interval compared to the more restricted temporal coverage of ultraviolet (UV) observations. Here we investigate the feasibility of characterizing the Jovian auroral electron energy and flux via H₃⁺ IR line-emission analysis. Since the departure from local thermodynamic equilibrium (LTE) varies with vibrational levels and altitude, measurements of the relative emission line intensities reveal the altitude of emission and hence the electron energy. The combination of three H₃⁺ line-intensity ratios is required to determine the electron energy and the background temperature. The feasibility issue is evaluated by studying how the observational error propagates into the error of the estimated electron energy. We have found several best sets of H₃⁺ lines from which the intensity-ratios can be utilized for the present purpose. Using these lines in the observed 2- and 4- micron wavelength ranges, we can estimate the electron energy and the background temperature within errors of a factor of ~3.5 and 3%, respectively, if the observation error is 1%. Since Saturnian H₃⁺ emissions vary far more substantially according to temperature variations, the method described here is not applicable to observations of Saturn. We introduce the application of our model to observation and future plan.

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