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Conversion from HST ACS and STIS auroral counts into brightness, precipitated power and radiated power for H_2 giant planets

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Abstract

The STIS and ACS instruments onboard HST are widely used to study the giant planet's aurora. Several assumptions have to be made to convert the instrumental counts into meaningful physical values (type and bandwidth of the filters, definition of the physical units, etc…), but these may significantly differ from one author to another, which makes it difficult to compare the auroral characteristics published in different studies. We present a method to convert the counts obtained in representative ACS and STIS imaging modes / filters used by the auroral scientific community to brightness, precipitated power and radiated power in the ultraviolet (700-1800 Å). Since hydrocarbon absorption may considerably affect the observed auroral emission, the conversion factors are determined for several attenuation levels.

Several properties of the auroral emission have been determined: the fraction of the H_2 emission shortward and longward of the HLy-α line is 50.3 % and 49.7 % respectively, the contribution of HLy-α to the total unabsorbed auroral signal has been set to 9.1 % and an input of 1 mW m^{-2} produces 10 kR of H_2 in the Lyman and Werner bands.

A first application sets the order of magnitude of Saturn's auroral characteristics in the total UV bandwidth to a brightness of 10 kR and an emitted power of ~2.8 GW. A second application uses published brighnesses of Europa's footprint to determine the current density associated with the Europa auroral spot: 0.21 and 0.045 μA m^{-2} assuming no hydrocarbon absorption and a color ratio of 2, respectively.

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