

FORMOSAT-2 Satellite Observations of Auroral Arcs and Auroral Substorms

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Abstract

The FORMOSAT-2 satellite was launched into a polar orbit on May 21, 2004 and the scientific payload, ISUAL (The Imager of Sprites and Upper Atmospheric Lightnings), has been used to investigate auroral arcs and auroral substorms. With an altitude of 891km and an inclination of 99.1 degree, it takes images of optical phenomena from the sideway. We analyzed CCD imager data and choose 557.7nm and 630.0nm as our filter wavelengths. The 557.7nm green transition line of atomic oxygen from the 1S state to 1D state has life-time of 0.74s and is mainly produced by energetic electrons with energy $\geq 1\text{KeV}$. The 630nm red-line emission is the atomic oxygen transition from the 1D state to 1P state (triplet) with a life-time of 110s and is mainly produced by electrons with energy $\sim O(100\text{eV})$. The 630nm red auroral emission is more diffuse than the green emission at 557.7nm. Several events of auroral arcs and auroral substorms were analyzed. Typically the observation lasted about 3 minutes, and it covered ~ 1200 km wide by limb viewing. For auroral arcs, there is a thin bright enhanced layer at the bottom of the aurora arc. In the bright bottom layer, there are equally spaced brighter spots streaming from east to west. The separation between brighter spots is about 1 degree. We have also observed a variety of auroral forms, such as, substorms, vertex, etc. The conditions of aurora observations will be described and some explanations of observed auroral arcs and substorms will be given.