Emission mechanism of meteor persistent trains at the mesosphere

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Meteors are the luminous ablation of dust particles from parent comets that enter the Earth's atmosphere at a few tens of kilometers per second. They are heated, vaporised, and even partially ionized in the upper atmosphere. Meteor emission originates from a mixture of atoms and molecules ablated from the meteoroid itself as well as from the surrounding air. The Leonid meteor shower is one of the most interesting meteor showers and have occurred roughly every 33 years at least in the last 100 years recorded in the history. This corresponds to the orbital period of the comet, 55P/Tempel--Tuttle. Comets are the surviving bodies since the genesis of our solar system. They are thought to be remnants of planetesimals at the edge of the protoplanetary disk that could not grow into planets. Through detailed meteor observations and analysis of their interaction with the Earth's atmosphere, physical and chemical properties of cometary meteoroids can be studied. Spectroscopic observations of the flash heating and evaporation reveal not only chemical composition of the interplanetary dust but also emission processes of hypervelocity impacts in the atmosphere, which are difficult to reproduce in laboratory experiments at present.

Meteor persistent trains are luminous clouds formed by meteors which persist long after the disappearance of mother meteor. It is considered that the clouds consist of a mixture of atoms and molecules ablated from the meteoroid itself as well as from the surrounding air. The best method to investigate these emitted line is spectroscopic observation. Meteor spectrography has been in existence since the end of 19th century. More than 1000 meteor spectra were observed and it has been known that the most common emission lines for Leonid meteors originate from Mg, Fe and Co, while less frequently seen are the emission lines of Na, Ca, and Mn. It is evident that short time duration trains which last several seconds at the most, emit a forbidden line of [O I] at 557.7 nm known as the aurora green line. After a rapid decay in intensity, bright meteors often leave persistent trains that last several or several ten minutes. However, the physical processes of long-lived meteor trains are still not well known. The main reason is that spectroscopic observations of the persistent trains are not easy because of its rareness phenomena. The Leonid meteors tend to leave long-lasting persistent trains because of the high entry velocity of the meteoroids, - 71km/s.

In this paper we discuss the emission mechanism of persistent trains
by means of spectra of these phenomena in UV and visible region.