A study of density inhomogeneities in solar wind acceleration region based on the observation of type III solar burst spectrum

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Stria burst is emission with enhanced intensity in dynamic spectrum of type III burst. It is considered that they are caused by refraction of electromagnetic wave due to density inhomogeneities in solar corona. In order to perform remote sensing of density inhomogeneities in solar corona, it is important to study the mechanism of making stria burst.

We statistically analyzed the spectrum data of type III bursts obtained by Iitate observatory of Tohoku University and the WIND satellite, and clarified characteristic of stria bursts. The results are as follow:

1. Stria bursts appear in almost all type III burst.
2. Occurrence probability is high in a frequency range below 30 MHz.
3. Altitude width of enhanced intensity region corresponds to 0.02 Rs - 2.0 Rs and wider in higher altitude.
4. It is inferred that stria burst move to high altitude with 10 - 150 km/s.

It is clear that most of the characteristic of stria bursts coincide with the slow waves contributing coronal heating and solar wind acceleration shown by Suzuki and Inutsuka [2005, 2006]. Therefore, it is show that slow wave contribute making Stria Bursts.

Then, we examine the ray paths in solar corona with ray tracing. It is necessary that rays concentrate toward observer in order to be observed as stria burst. It has been considered that the fiber structure which is higher density region cause the concentration of rays. However, it is also necessary that rays get away from the density trough between fiber structures and are diverged from observer in order that rays are observed with deferent intensity depending on frequency.

We tried to add radial density inhomogeneities which can be caused by slow waves in solar corona. The ray tracing results show that rays are not diffused in corona with slow waves with the same phase in longitude. Observed spectrum is not reproduced. But, in corona with slow waves with different phase depending on longitude, some rays are concentrated toward observer, some rays diverged from observer, and observed spectrum is reproduced.

It is therefore suggested that there are density inhomogeneities due to slow waves in solar wind acceleration region.