



## **Long-term survey of lion roars across Earth's magnetosheath observed by the STAFF-SA instrument onboard the Cluster spacecraft**

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Intense whistler-mode emissions known as 'lion roars' are frequently observed in the magnetosheath of Earth. In this region ahead of the magnetosphere, the solar wind plasma is decelerated, compressed, and the local magnetic field increases. Plasma heating and compression at the bow shock, as well as local processes in the magnetosheath, can lead to the electron temperature anisotropy, which can result in growth of the whistler-mode waves. The lion-roars are narrow-band emissions with typical frequencies between 0.1-0.5  $f_{ce}$ , where  $f_{ce}$  is the electron cyclotron frequency. We present results of a long-term survey obtained by the Spatio Temporal Analysis Field Fluctuations - Spectral Analyzer (STAFF-SA) instruments on board the four Cluster spacecraft between 2001 and 2010. We have visually identified the time-frequency intervals with the intense lion-roar signatures. Using the Singular Value Decomposition (SVD) method, we analyzed the wave propagation properties. We show the spatial, frequency and wave power distributions. Finally, the wave properties as a function of upstream solar wind conditions are discussed.