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Remote Sensing of the Effect of the Solar Wind Abundance on the Local Wave Structure of the Earth's Bow Shock

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It is commonly known that properties of the foreshock region and the local structure of the Earth's bow shock are determined by the dynamics of the solar wind and interplanetary magnetic field (IMF). Kinetic numerical simulation provided strong evidence that collissionless shocks such as the Earth's bow shock may have local shock structure which is determined by instabilities created by backstreaming and gyrating ion populations interacting with solar wind ions streaming against the shock. Cluster spacecraft data provided many new insights into the structure of the foreshock region, the local structure of the bow shock, its downstream region, and the associated physical processes. Only recently, by using multi-spacecraft techniques such as timing analysis, Cluster data opened a new window to study the local structure of the Earth's bow shock. Now there is strong observational evidence of so-called shock ripples and shock reformation. However, there are only theoretical predictions how the wavelength or wave amplitude may change when solar wind conditions are changing but no direct of indirect observations. Recently field-aligned ion beams have successfully been used in a remote-sensing technique to investigate the local shock structure of the Earth's bow shock. Very good agreement has been achieved with available numerical and observational data. This technique has now been successfully applied to study the effect of solar wind abundance on the local shock structure. It appears that the results obtained using this technique confirm numerical predictions that abundance changes in the solar wind do impact the local structure, that is, wave length and amplitudes of local turbulence in the shock ramp of the Earth's bow shock are mediated. In this presentation we will report in detail on the results of this study.