

Ion phenomena in space

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The behaviour of ions in space and an atmosphere is determined by a balance of many different factors: ionisation, interaction with neutrals, and the integrated effect of electric and magnetic fields over a much larger size and time scale than that of electrons. This causes the ion behaviour to be quite different from the electron behaviour in the solar wind-magnetosphere-ionosphere interactions and magnetospheric dynamics. The less coherence with local fields for ion behaviour than electron behaviour, together with the complication of different masses of different ions, make ion phenomena difficult to analyze, and hence many ion phenomena are remained poorly understood. This lecture overviews some of these ion phenomena with particular stress on relatively less investigated areas.

- * Ion injection phenomena in the dayside magnetosphere: cusp, transient injections, returning ionospheric ions, as constrainer but not carrier of large-scale electric current.
- * Ion escape to space: destination, amount, oxidation effect, consequence of atmospheric evolution, active role in energy extraction from the solar wind.
- * Inner magnetospheric ions: multiple sources of structured sub-keV ions, relation to substorm electric field, modulation by Pc5 waves, unexpected mass-dependency, relation to aurora.
- * Exospheric origin cold ions: variable production in both space and time, influence on bow shock and foreshock, resultant Mars-Venus-Earth difference.
- * Space weather and substorm: shortest propagation path, effect on the ionosphere, long term trend, and few-min local forecast.
- * Ions by ionising radiation from nuclear accidents: new monitoring method.