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A Solar Wind driver for the atmospheric super-rotation at Venus

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ASPERA plasma flow measurements from the ESA Venus Express mission display a strong nightside lateral flow of ionospheric ions, converging to a vortex-like structure in the Venus polar ionosphere. The flow is consistent with the lateral solar wind flow around Venus. The vortex is displaced slightly antisunward of the venusian geographic pole, the ionospheric ions moving with 3-10 km/s in the direction of the super-rotating atmosphere of Venus. The average O^+ flux in the vortex is $\approx 1 \cdot 10^{12}$ (ions/(m^2 s). The ionospheric ion vortex is a feature that dominates the ion flow pattern at Venus. In fact the flux of the ion escape into the tail is of the order one third of the total flux of ionospheric ions. The super-rotating atmosphere, the velocity increasing with height, has been an enigma in atmospheric science. The high flow velocities of ionospheric ions, in the same direction as the internal atmospheric flow, is therefore consistent with a solar wind driven atmospheric super-rotation at Venus, the topside atmospheric wind maintained by ion-neutral collisions.