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Magnetic topology at Venus: new insights to the Venus plasma environment

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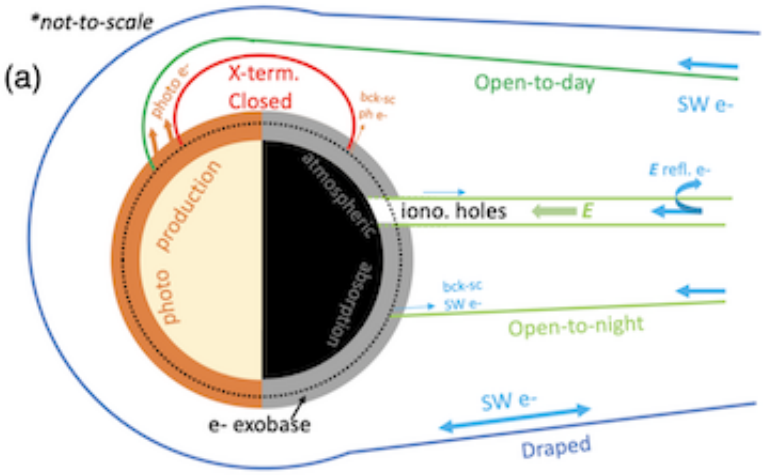
Venus lacks significant intrinsic magnetic fields and thus its atmosphere and ionosphere interact directly with the solar wind flow and magnetic fields. Interplanetary magnetic fields (IMF) can penetrate into the ionosphere when the upstream solar wind dynamic is stronger than the ionospheric plasma pressure. Magnetic topology can be inferred at Venus if it is defined as the magnetic connectivity to the collisional atmosphere/ionosphere, rather than connectivity to the planet's surface. Utilizing electron and magnetic field measurements from the Venus Express mission, this study provides the first characterization of magnetic topology at Venus by examining the pitch angle and energy distribution of superthermal (> ~1 eV) electrons. More specifically, the presence of loss cones in electron pitch angle distributions infers the connectivity to the *nightside* collisional atmosphere and the presence of ionospheric photoelectrons (identified from electron energy distributions) indicates the connectivity to the *dayside* collisional ionosphere. We show case examples of various magnetic topology types at Venus, including the most expected draped IMF, open field lines connected to the *nightside* atmosphere, open field lines connected to the *dayside* ionosphere, and, most surprisingly, cross-terminator closed field lines. More interestingly, during one of the ionospheric hole events identified by Collinson et al. [2014, JGRA], we discover not only the expected open magnetic topology but also a field-aligned potential drop, which has implications for its formation mechanism. The characterization of magnetic connectivity could provide new insights into many important topics on Venus, such as planetary ion outflow, energetic electron precipitation (possible auroral emission), and the formation mechanism of Venusian ionospheric holes.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