Identifying the Source Regions of the Slow Solar Wind

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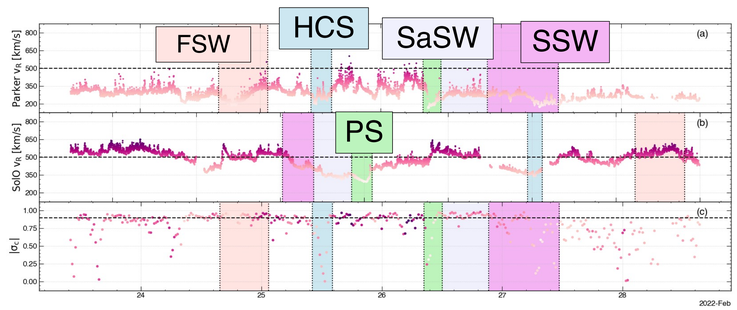
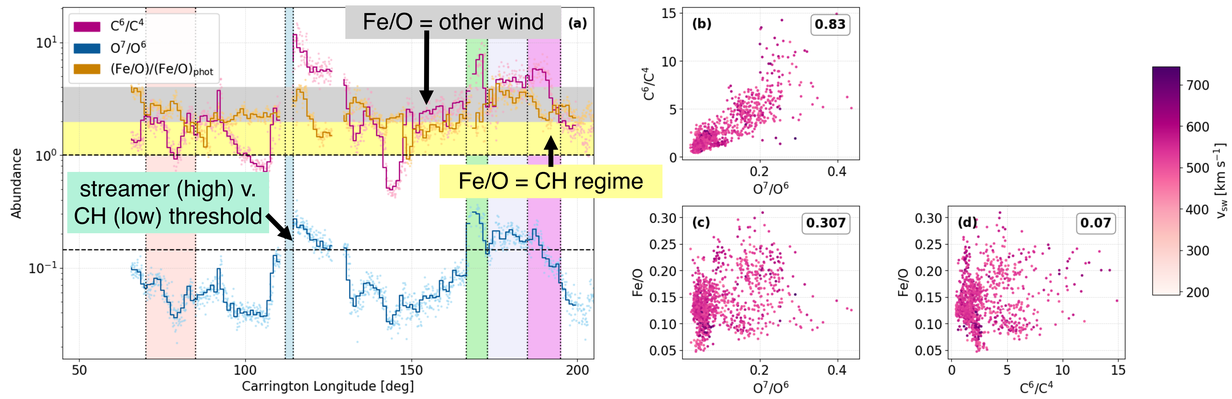
Background

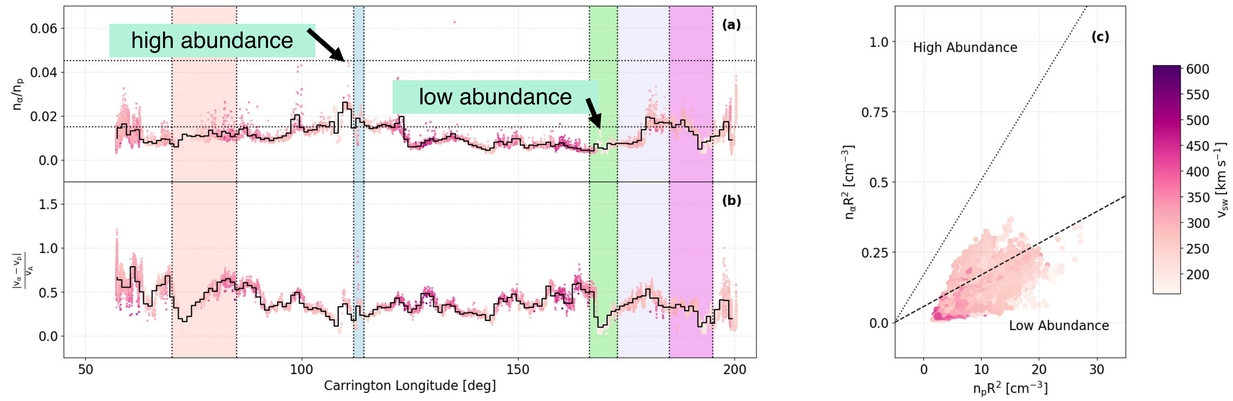
- PSP in-situ measurements of the solar wind (e.g. proton speed) are used for characterization but are unable to determine source regions
- fast solar wind (FSW; velocity above 500 km/s) is known to originate from coronal holes
- previous studies have two types of slow solar wind (D'Amicis and Bruno 2015)
  - classical non-Alfvénic slow solar wind (SSW)
    - thought to originate in streamers/active regions
  - highly Alfvénic slow wind (SaSW)
    - originates from coronal hole boundaries
- we **combine modeling and in situ measurements** to study **particle properties as a function of coronal source region** to characterize types of solar wind



Composition



SWA/HIS abundance measurements (left) and correlations (right).



Helium abundance ratio (top & right panel) and differential velocity (bottom).

FSW: O^7/O^6 and Fe/O in the CH (yellow) regime; low helium abundance

HCS: abundance enhancements; low velocity differential

SSW: helium rich & helium poor plasma; high charge state ratios; Fe/O in non-CH regime

PS: enhancement in Fe/O and charge state ratios; low helium abundance; low velocity differential

SaSW: helium rich & helium poor plasma; Fe/O ratio in non-CH regime; variance in charge state ratios

Modeling

We find photospheric footpoints with PFSS (Stansby et al. 2020) and MHD modeling (Riley et al. 2021)

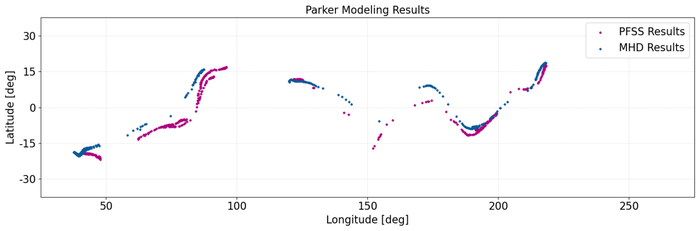
FSW: footpoints in CH regions

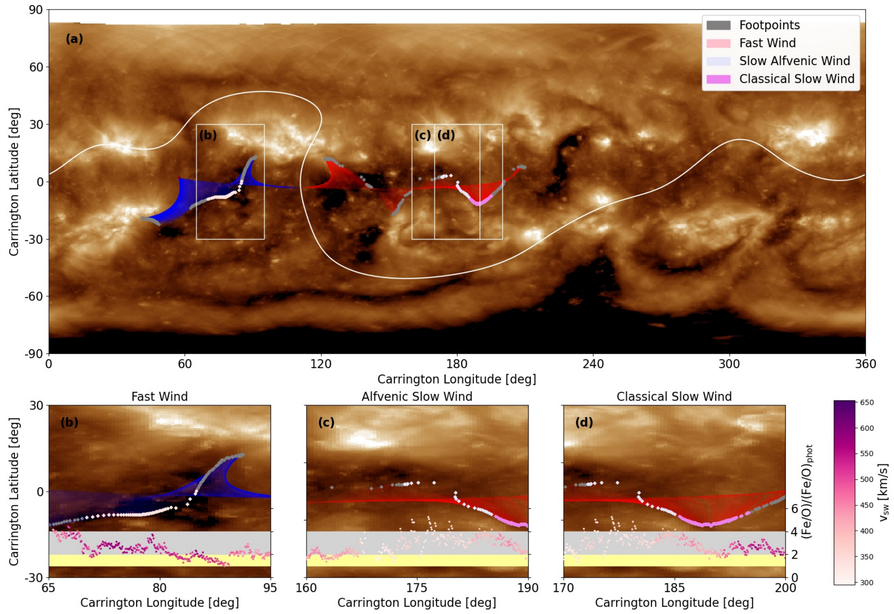
PS: footpoints jump in this region

HCS: aligns well with the PFSS model

SaSW: footpoints along CH boundary and quiet-Sun

SSW: footpoints in equatorial active region





Conclusion

FSW: originate from CH regions by both modeling and composition results

HCS: source of slow, dense, hot wind

SSW: active region origins due to high abundances & modeling

PS: important source of SSW during this time period based on composition metrics

SaSW: combination of CH and quiet-Sun origins due to composition variation and modeling

References

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