

Discrepancy between ion and neutral Doppler velocities in solar prominence.

Among multi-fluid theory and radiative transfer # 345

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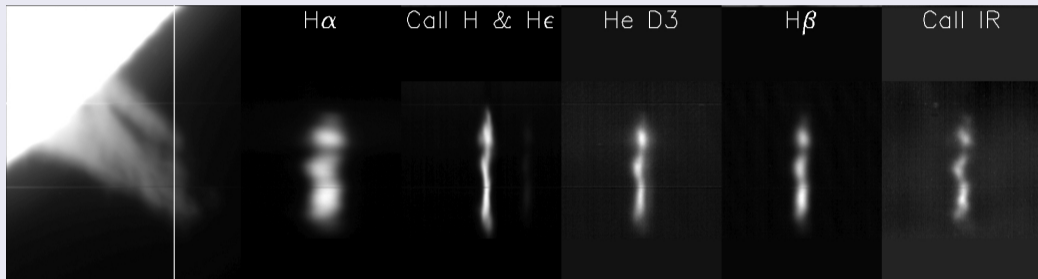
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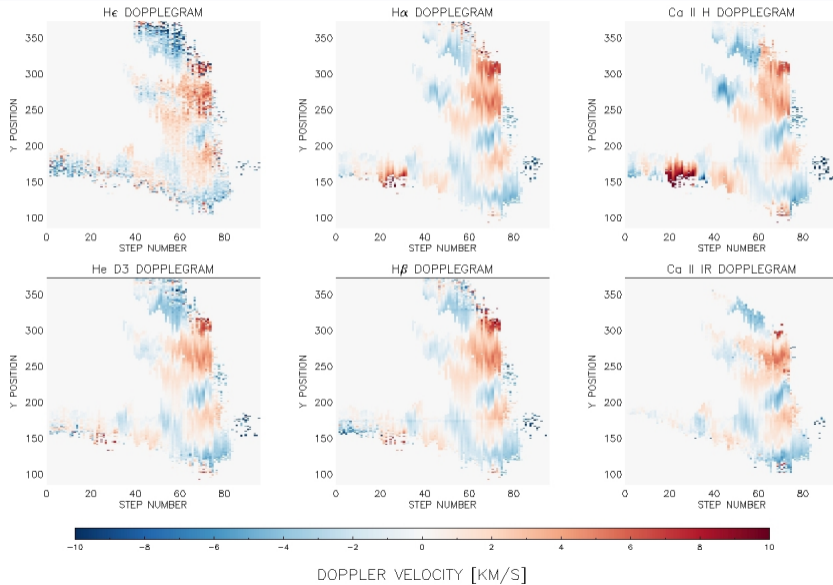
Motivation

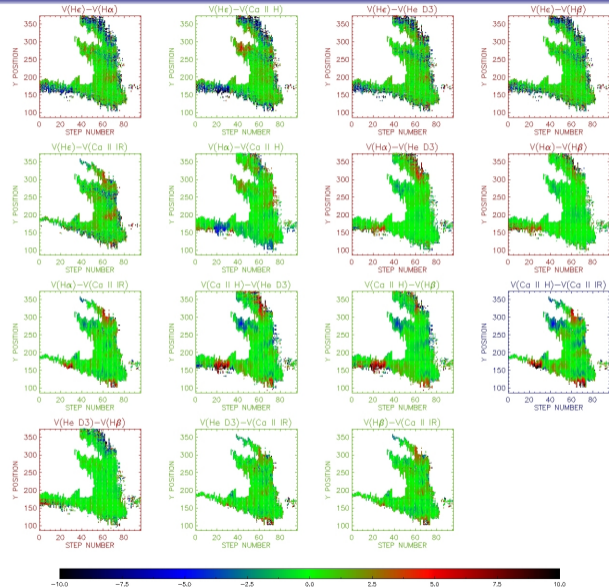
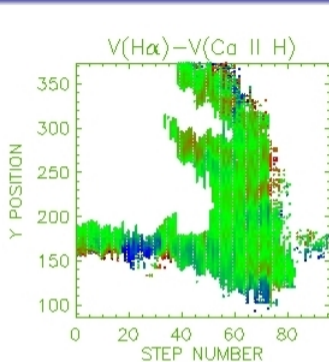
- Single fluid MHD theory is not able to fully describe observed plasma motions in solar prominences (see Popescu Braileanu et al. 2021)
- Several authors observed discrepancy between Doppler velocity measured in different spectral lines of ions and neutrals.
- However they give different answers to the question if motions of the plasma lead to decoupling of ions and neutrals as predicted by multi-fluid theory
 - Khomenko et al. (2016) - ion-neutral decoupling
 - Anan et al. (2017) - complicated radiation field
 - Wiehr et al. (2019) - ion-neutral decoupling

Observations

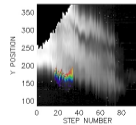
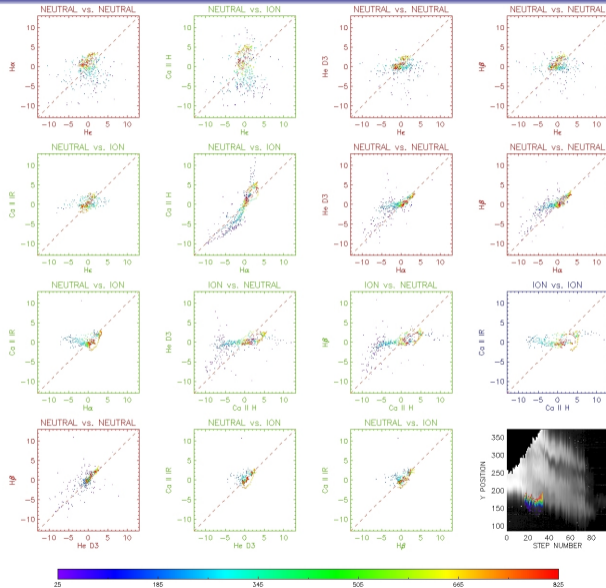
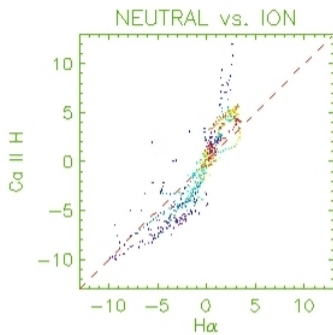


- HSFA-2 spectrograph in Ondřejov Observatory, Czech Republic
- The quiescent prominence of August 26, 2011
- Single scan 12:20:04 – 12:28:00 UT
- Ion lines: CaII H, CaII 8542
- Neutral lines: H α , H β , H ϵ , HeI D3





DIFFERENCE OF DOPPLER VELOCITY [KM/S]



Results

- $H\alpha$ vs. Ca II H - $V_{ion} > V_{neutral}$
- Ca II H vs. He D3 - $V_{ion} > V_{neutral}$
- Ca II H vs. $H\beta$ - $V_{ion} > V_{neutral}$
- Ca II H vs. Ca II 8542 - optical depth effect
- $H\alpha$ vs. $H\beta$ - optical depth effect

Conclusions

- We found clear discrepancy in Doppler velocity between ion and neutrals
- We cannot exclude radiative transfer effects on observed data
- Line opacity effect have influence on observed Doppler velocity (see Zapiór et al. 2016)