Search for waves in dynamic fibrils

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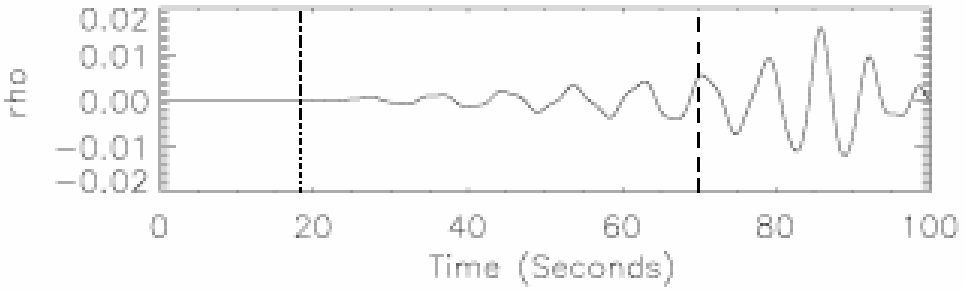
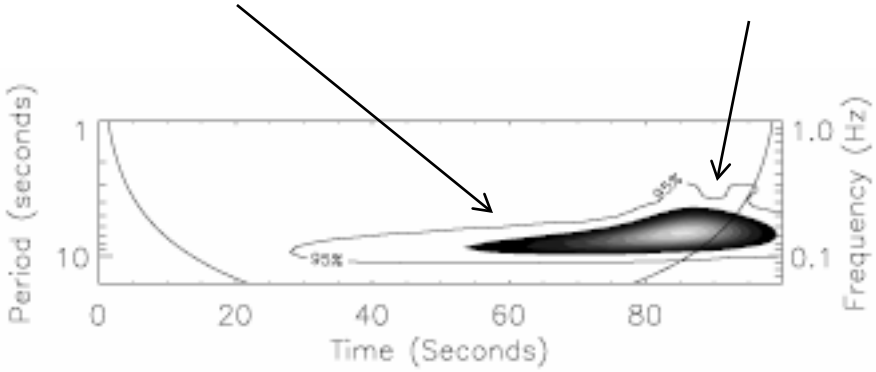
An aim: search for intensity variations in dynamic fibrils as a signature of their possible impulsive driver

An observational clue: tadpole pattern in wavelet spectra

tadpole pattern in wavelet spectra: a signature of impulsively-generated short-period fast magneto-acoustic wave train moving along a waveguide

tadpole wavelet signature : narrow-spectrum tail precedes broadband head

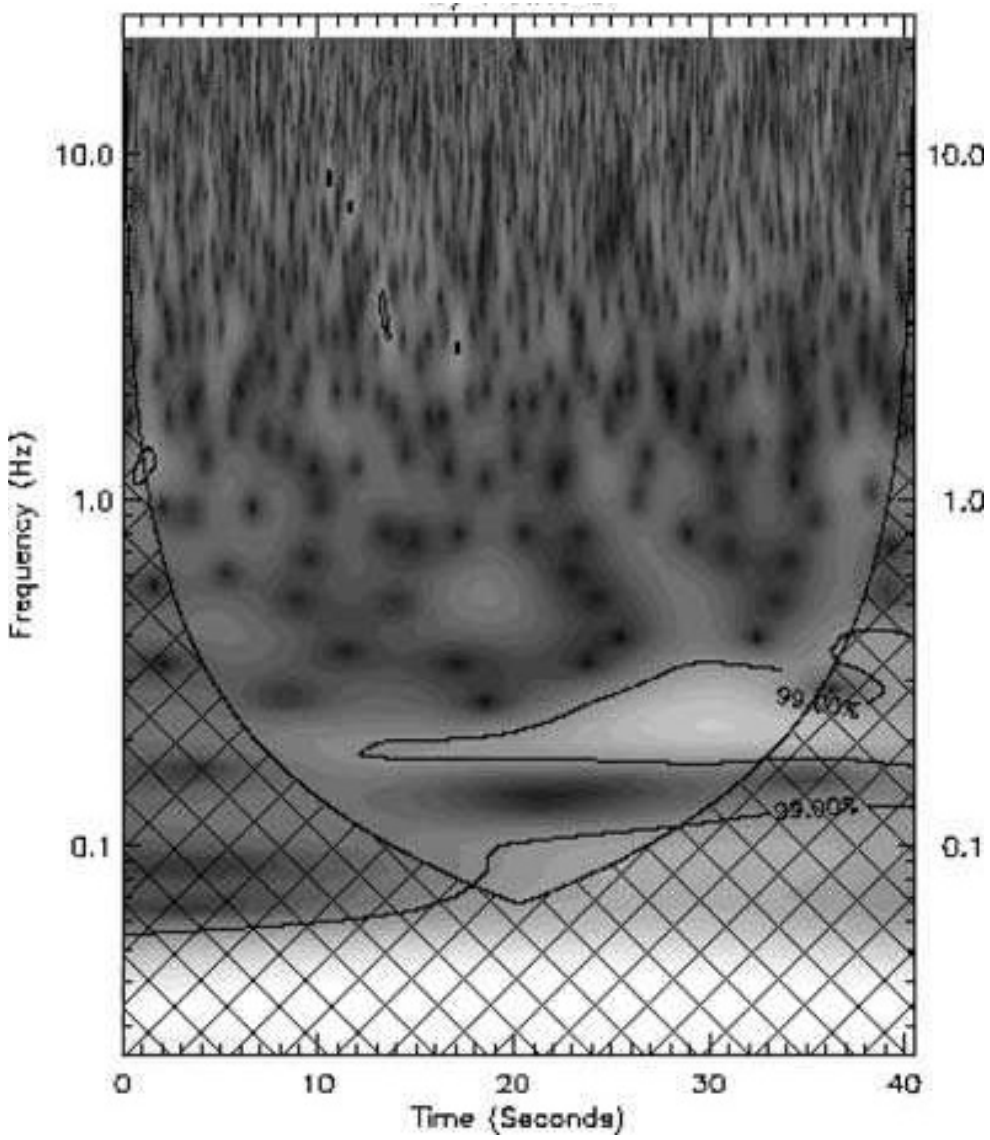




tadpoles: studied in numerical simulations of coronal loops in

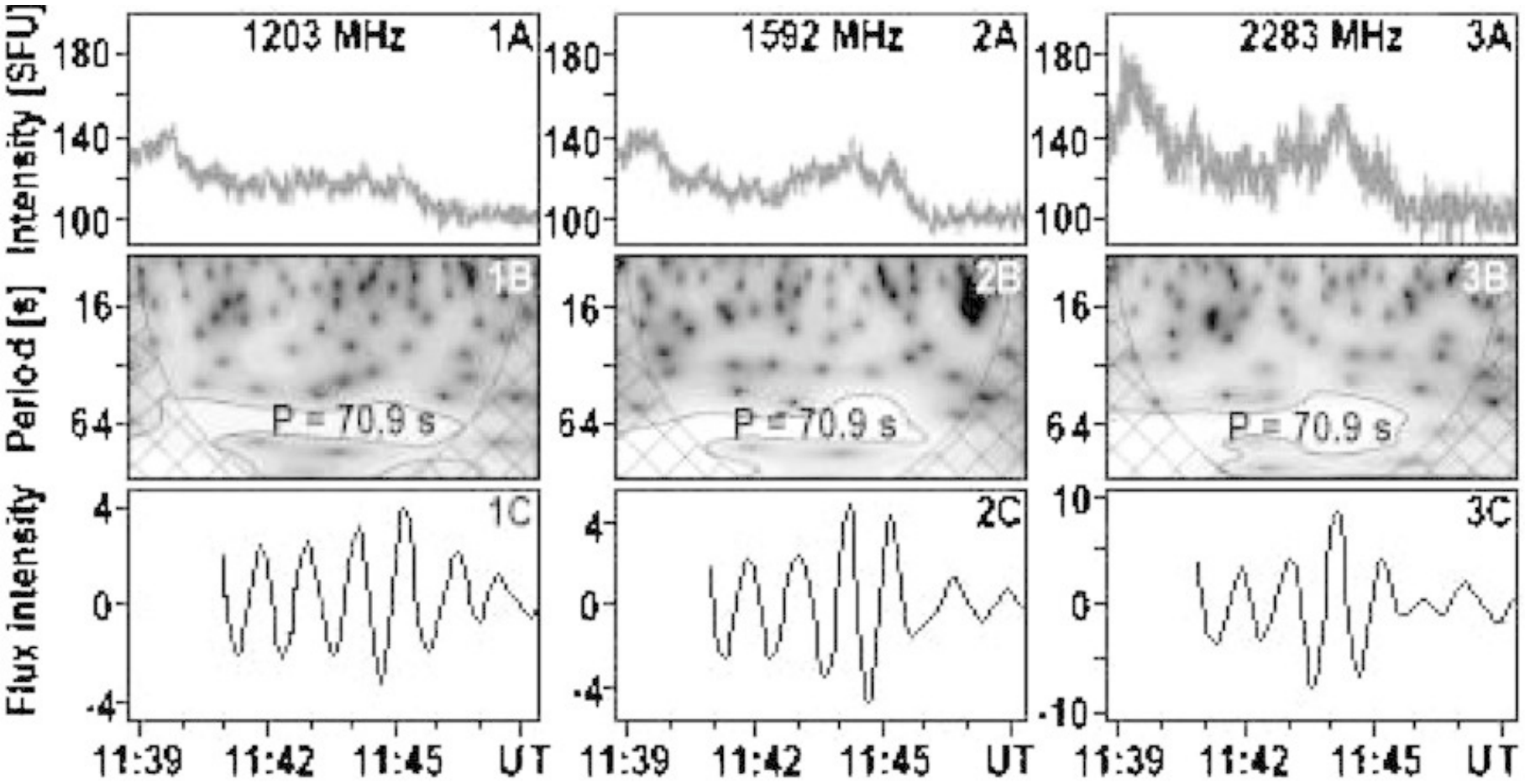
Nakariakov et al. (2004)

Tadpoles in coronal eclipse data



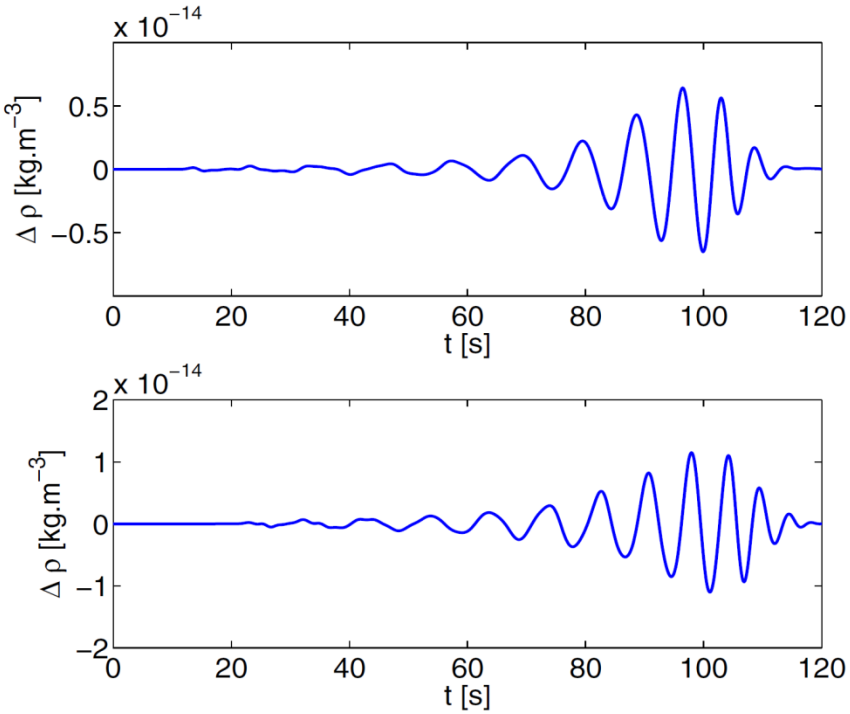
Katsiyannis et al. (2003), Nakariakov et al. (2004)

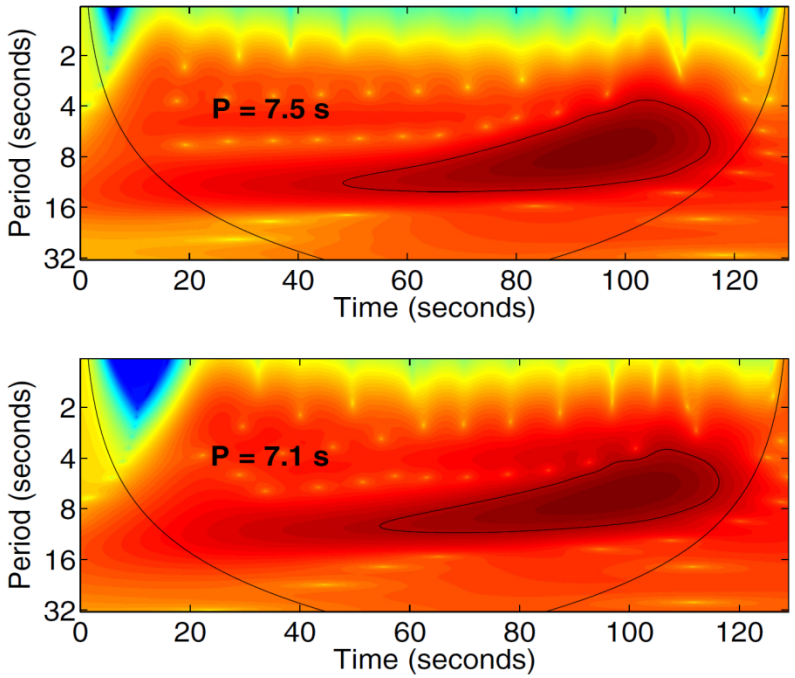
Tadpoles in the wavelet spectra of type IV radio bursts



Mészárosová et al. (2009)

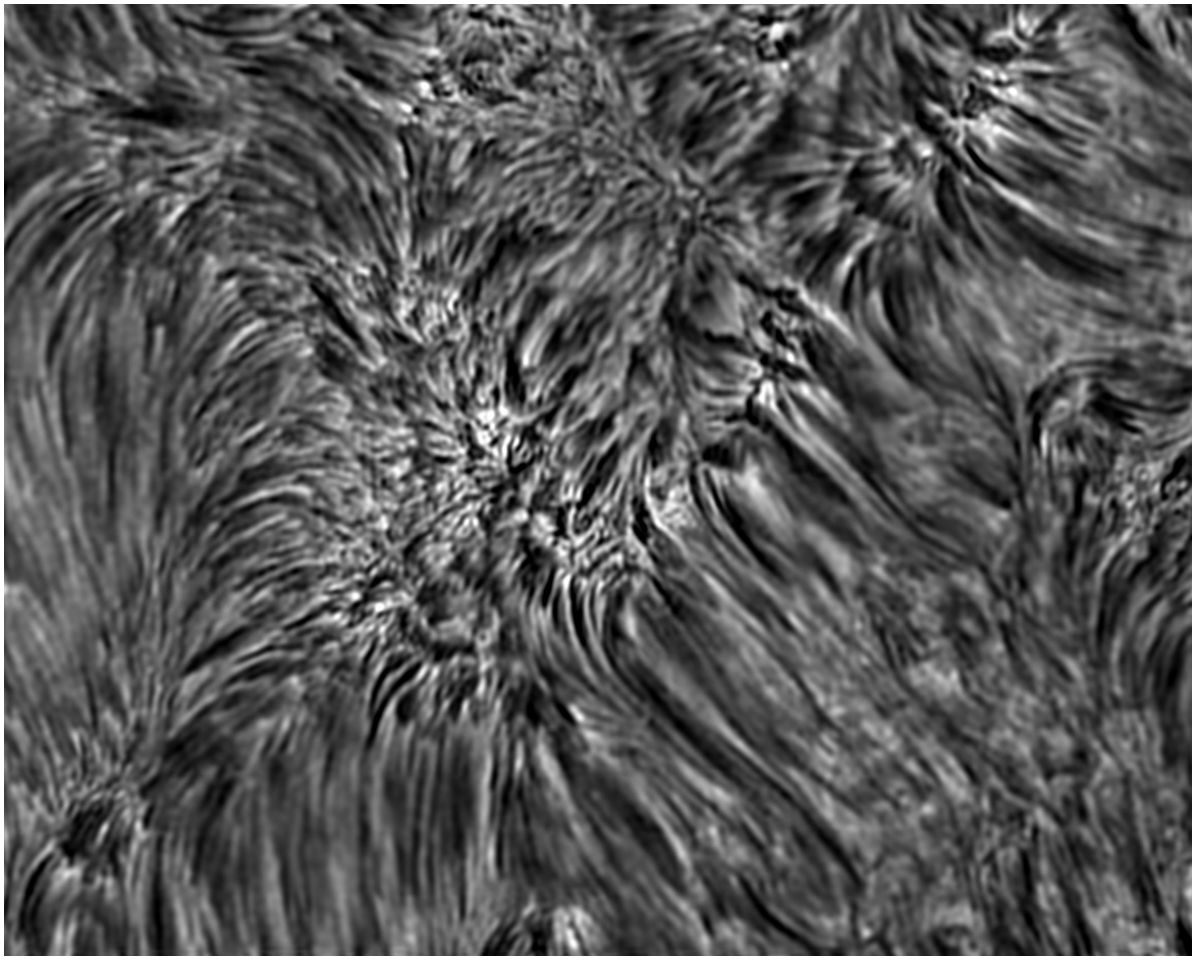
Tadpoles in MHD simulations





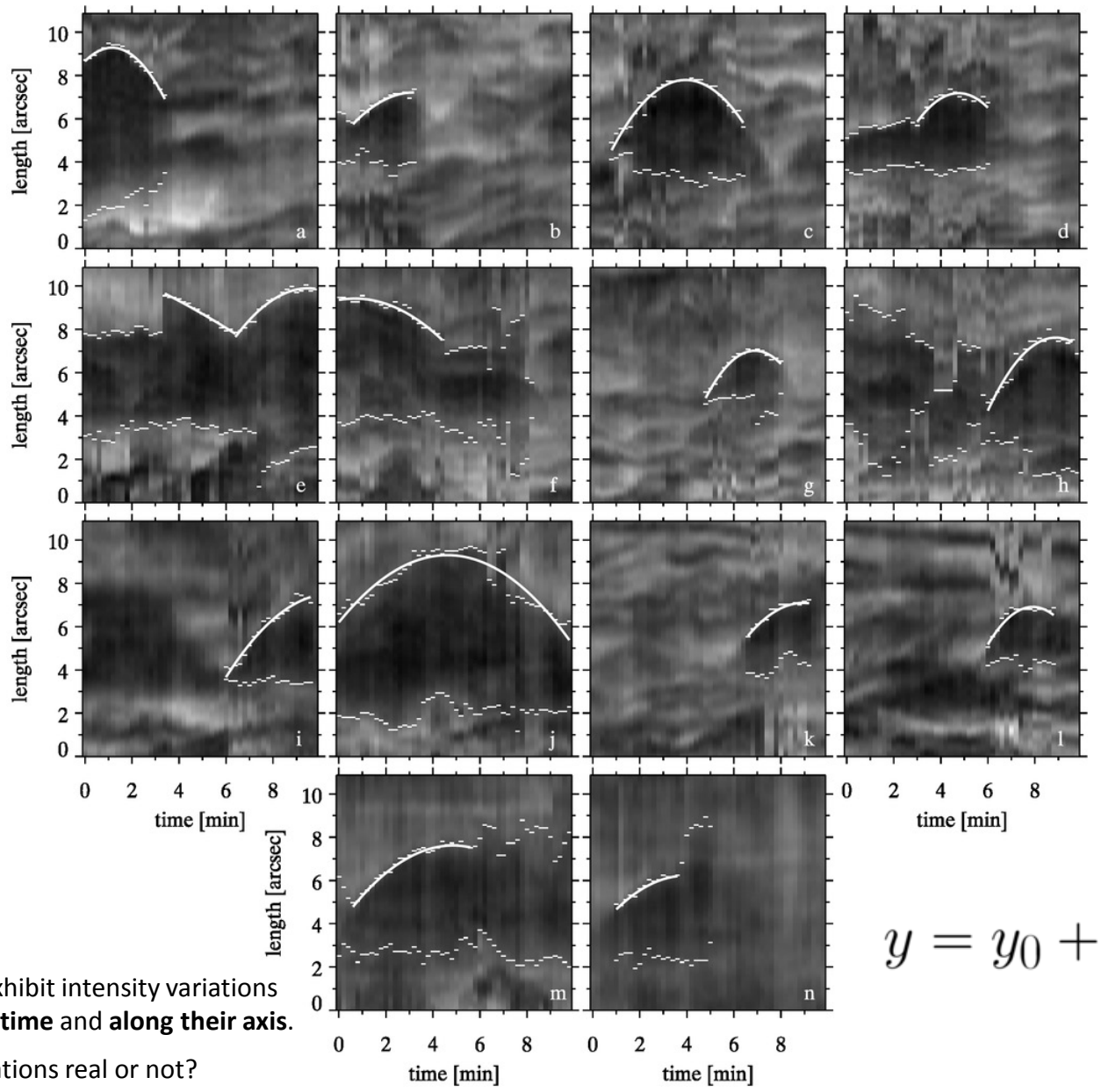
Jelínek et al. (2012)

observations on 24 April 2006



data set used:	10-min speckle-reconstructed Hα image sequences of 50 images taken – 0.3 Å off the line center
time resolution:	12 s
target:	small plage and network in quiet-Sun area 40° off the disk center
URL:	http://dotdb.strw.leidenuniv.nl/DOT/Data/2006_04_24/index.html
an aim:	an identification and measurement of dynamic fibrils

Parabolic fits of top trajectories of 14 DFs identified

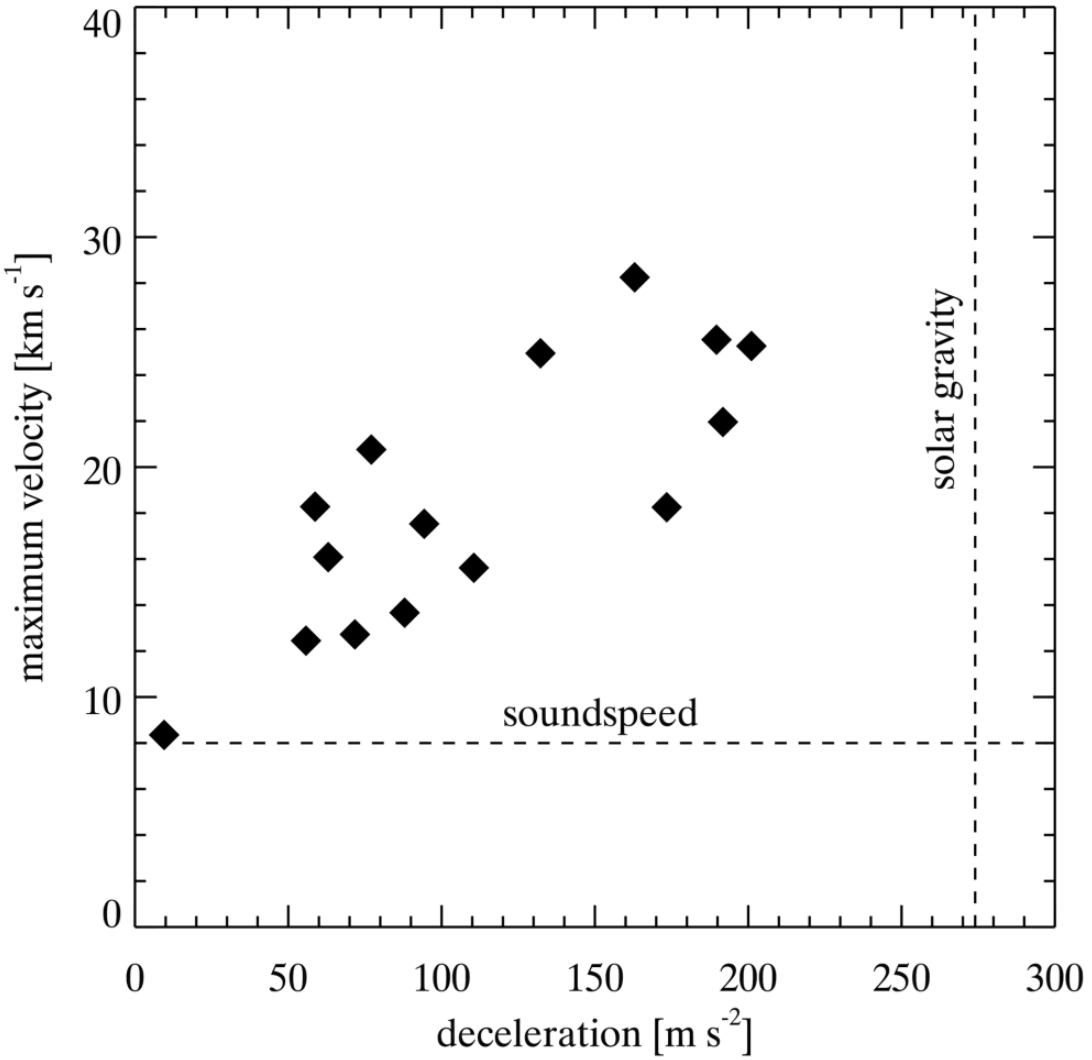


$$y = y_0 + v_{\max} t - \frac{a}{2} t^2$$

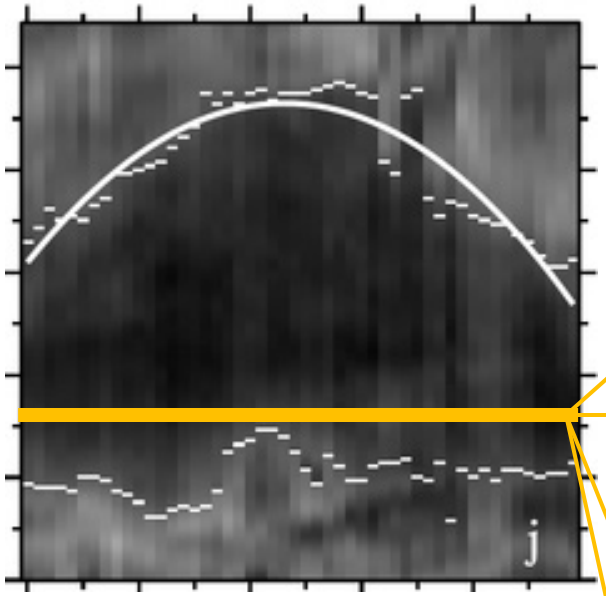
DOT DFs seem to exhibit intensity variations both **within their lifetime** and **along their axis**.

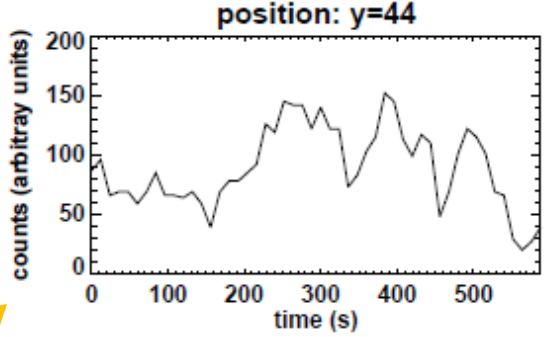
Are the variations real or not?
(e.g., due to noise or speckling)

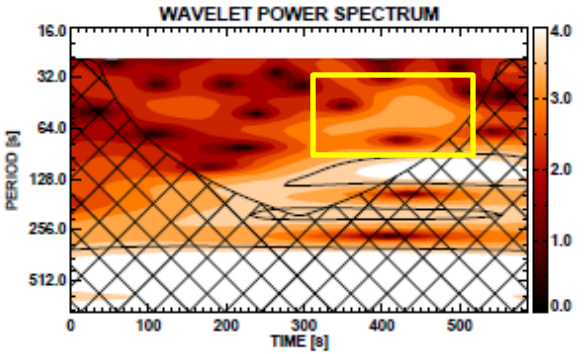
Kinematic characteristics

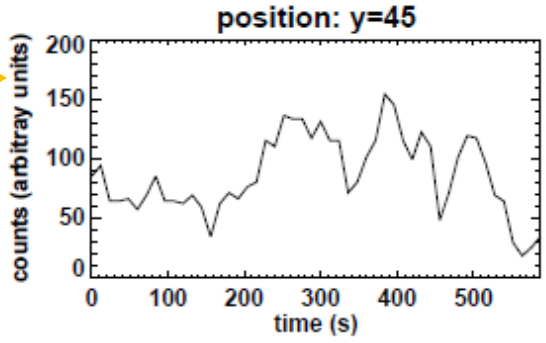


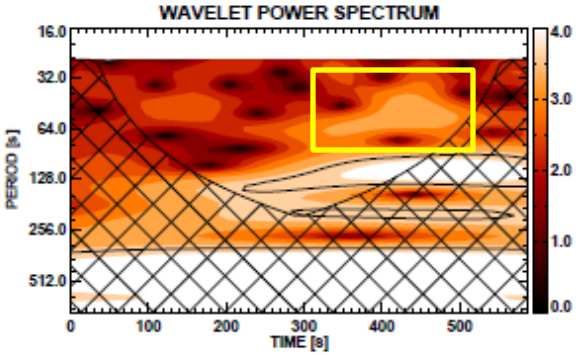
- DOT DFs exhibit the correlation between their max. velocity and deceleration
- average max. velocity ≈ 19 km s^{-1} (supersonic)
- average deceleration ≈ 110 m s^{-2} (sub-ballistic)

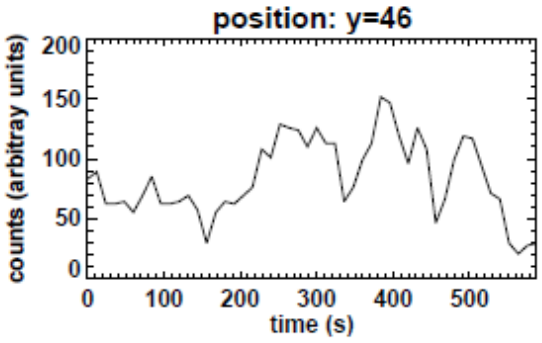


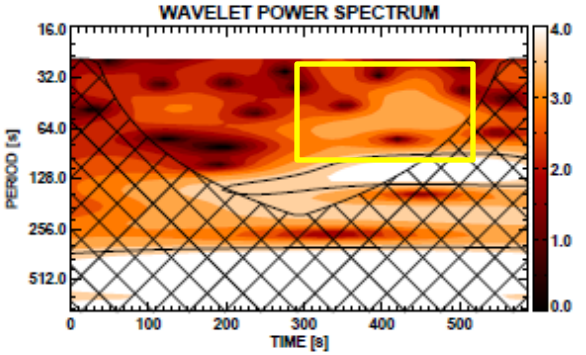


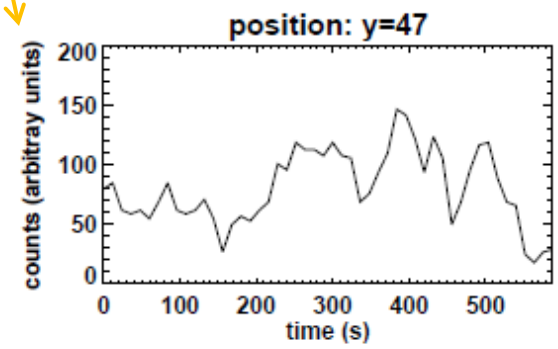


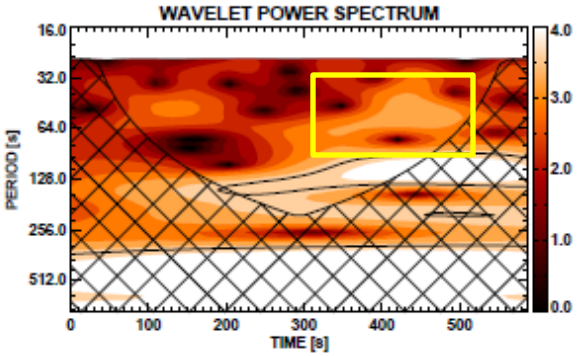












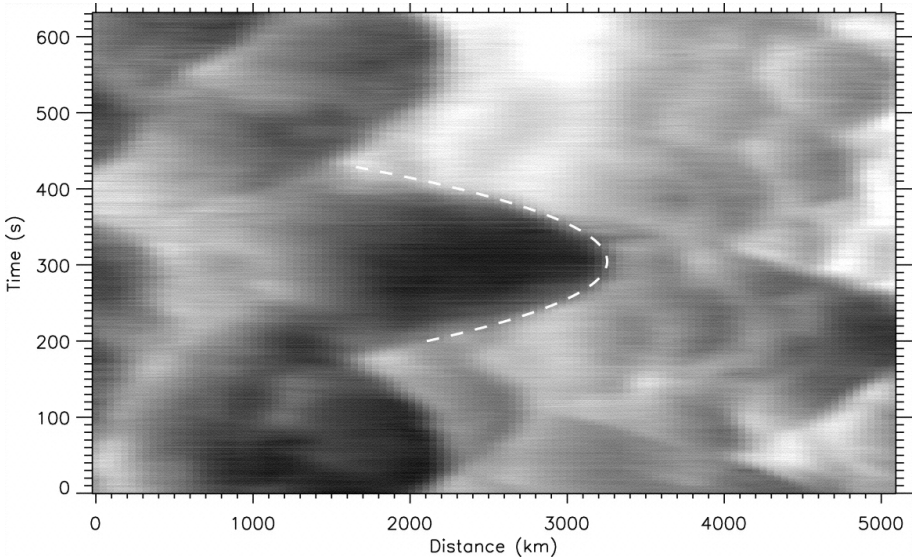
- signatures of tadpoles in the wavelets of DF “j”
- right shape and short periods from 32 s to 64 s symptomatic for fast magneto-acoustic waves
- occurence at the footpoint of DF in second half of its lifetime between 300 s and 500 s
- but bellow the level of confidence probably due to low time resolution of 12 s

Summary

- 14 DFs identified in DOT data conforming DFs standards
- moreover, the DOT DFs seem to show intensity variations
- an independent verification of the variations is needed by more reliable data of higher quality
- one DOT DF out of 14 shows signature of tadpole pattern in its wavelet spectrum. The pattern:
  - has right shape.
  - covers short periods from 32 s to 64 s symptomatic for fast magneto-acoustic waves generated by an impulsive event.
  - occurs at the footpoint of DF in second half of its lifetime.
  - is bellow the level of confidence probably due to low time resolution.

What would we need

- "intensity x-t slices" of Hα DFs of top quality with temporal resolution of 3 s or better
- possible candidate: SOUP dataset from 4 October 2005 analyzed in De Pontieu et al. (2007)



Central question: Do these DFs exhibit intensity variations?
If yes, let's search tadpoles in their wavelets.
If found, an impulsive driver of DFs can not be excluded.
If absent, non-impulsive shock driver dominates.

More challenging aim

Entering into yet unexplored realm

- waves usually better seen in Dopplershift variations than in intensity variations
- central issue:
  Can CRISP produce Dopplermaps with temporal resolution better than 10 s?
- if yes, than try to make “Dopplershift x-t slices” of DFs observed by CRISP in Hα, or better, in Ca II IR
- then search for tadpoles in wavelets of the Dopplershift x-t slices