

# The Importance of Rotational Time-scales in Accretion Variability

Gráinne Costigan<sup>1,2,3</sup>, Jorick Vink<sup>3</sup>, Aleks Scholz<sup>2,4</sup>, Leonardo Testi<sup>1,5,6</sup> and Tom Ray<sup>2</sup>

Accretion is a vital process in star formation. However there are still questions over what exact form this accretion takes.

Using the intrinsic accretion variability, we can probe the very inner regions of these accreting systems – revealing accretion flow geometry, magnetic field geometry, interaction region between the star and the disc and the stability of all these components within the system.

## LAMP: Long-Term Accretion Monitoring Program

- Using the H $\alpha$  EW as an accretion rate indicator, we measured the accretion rate of 10 low mass T Tauri stars in Chameleon.
- Sample covers timescales of ~2 weeks to 15 months.
- We found ALL objects but one, had reached their maximum amplitude of accretion variations or were within 70% of their maximum after the shortest timescale in the sample.
- Average Amplitude of variations ~ 0.37 dex.

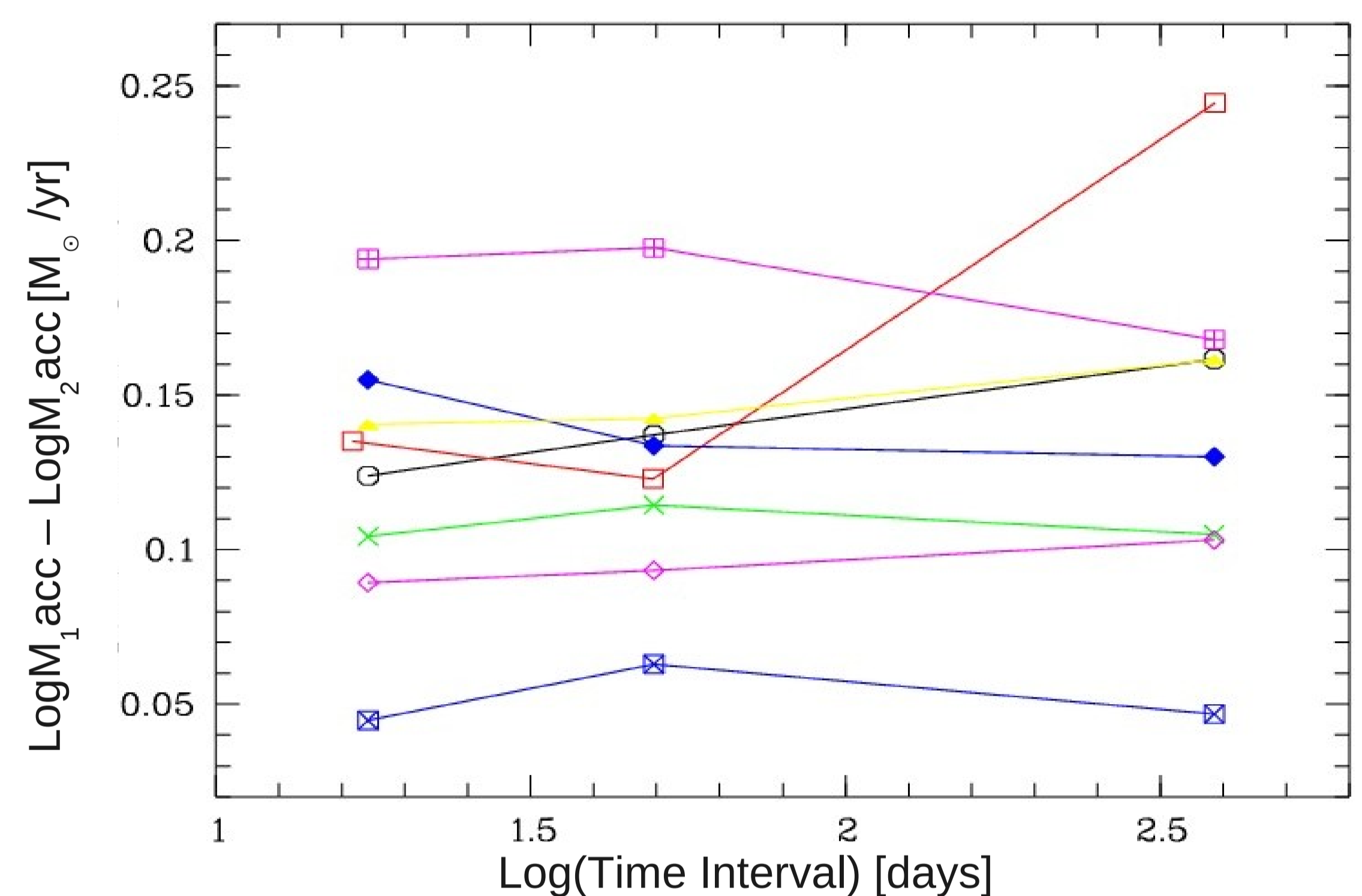


Fig 1: Differences in Accretion rate versus all time scales within the sample. Costigan et al MNRAS 2012

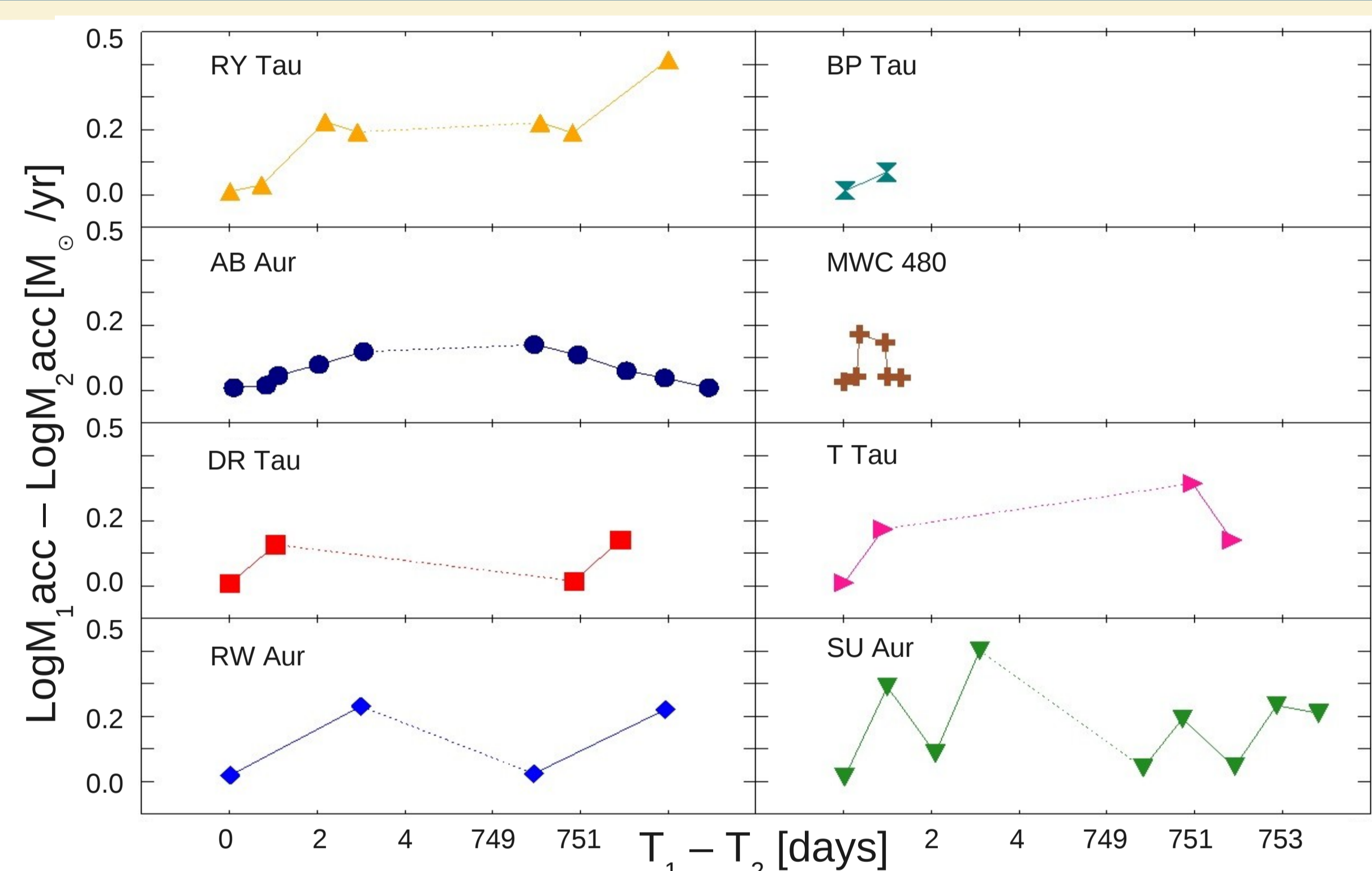


Fig 2: Differences in Accretion rate versus time scales. Costigan et al submitted MNRAS 2013

## Higher Mass and Shorter Timescales

- Using the same method and the H $\alpha$  EW, we measured accretion rates in 14 high mass T Tauri and Herbig Ae stars.
- Sample covered timescales of mins, hours, days -> years (half the sample).
- We found that after a few days accretion rate variations had reached their maximum.
- The amplitude of variations found over the full timescale is 0.15 – 0.46 dex.

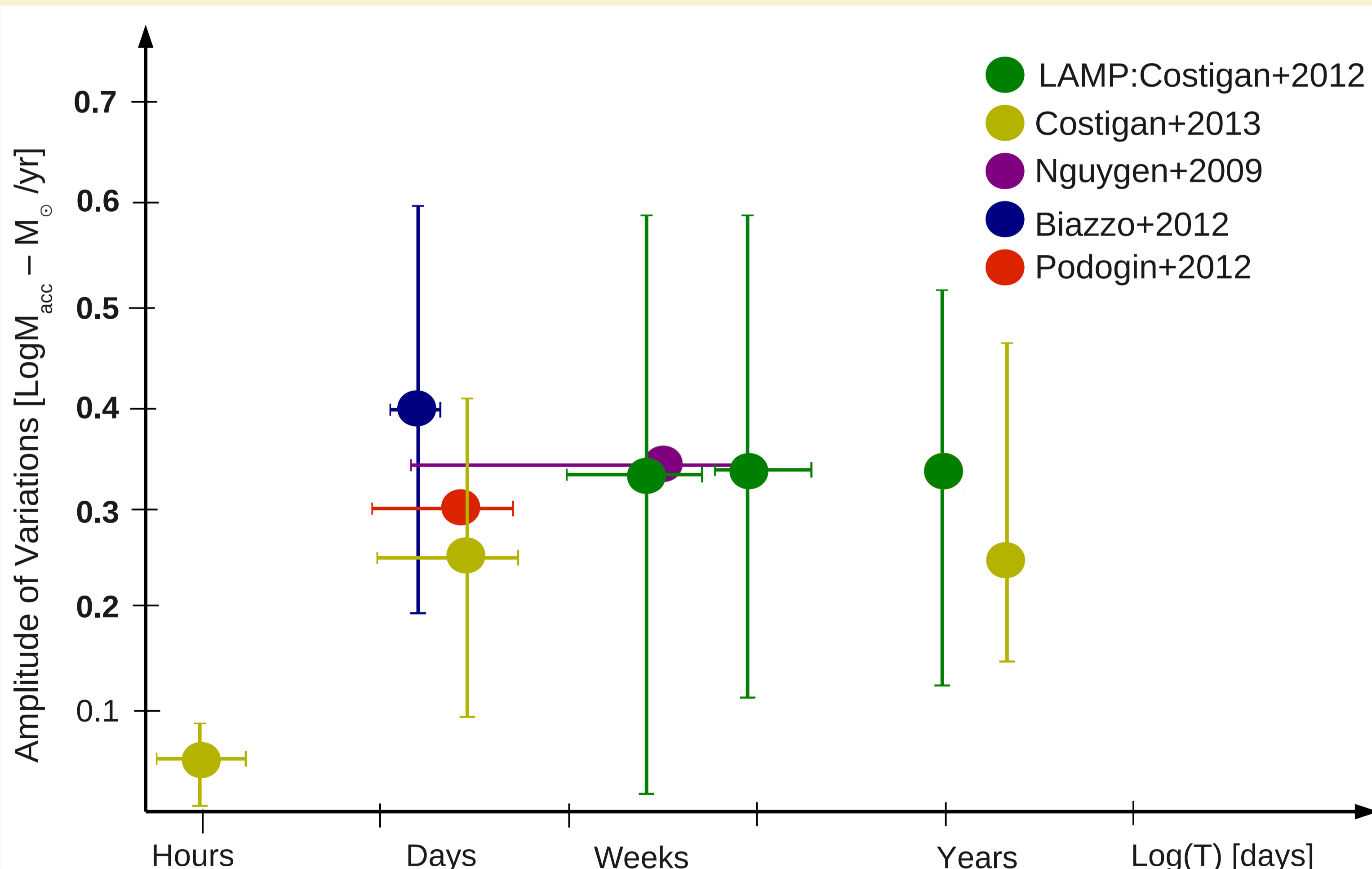


Fig 3: Comparison of the above two samples with other published work. Errors bars indicate spread in amplitudes of accretion rate variations and the timescales covered.

## Comparison With Other Samples

- We find our results to be consistent with other studies.
- Timescales of days are dominant for accretion variability – which is the rotational timescale for these targets.
- Accretion rate variations < 0.6 dex on timescales from mins to years.
- This holds for a large mass range from low mass T Tauri to Herbig Ae stars.

Rotational timescales are important suggesting rotational modulation is the dominant cause of accretion variations.  
=> Asymmetric Accretion flows are common.



Affiliations: 1: European Southern Observatory 2: Dublin Institute of Advanced Studies 3: Armagh Observatory 4: University of St. Andrews 5: INAF-Osservatorio Astrofisico di Arcetri 6: Excellence Cluster Universe EMAIL: gcostiga@eso.org