Two scientific themes using OPTIKA

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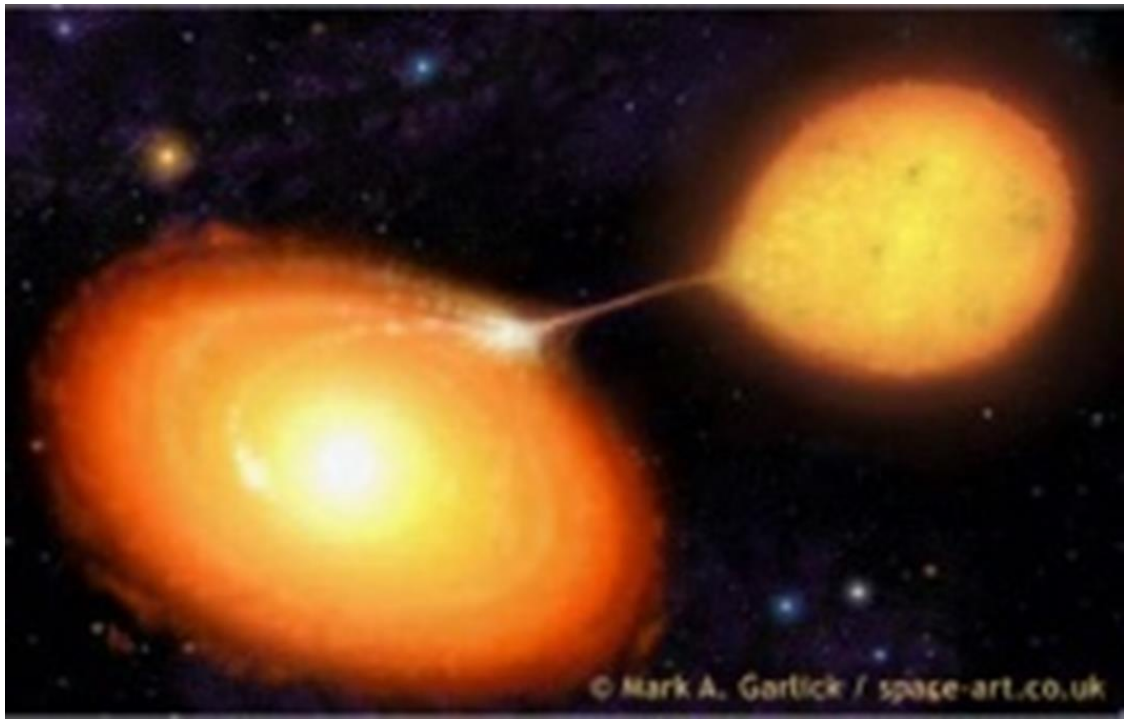
Contents

1. Disk structure in WZ Sge-type dwarf novae during the early phase of superoutbursts
2. Flare statistics of late-type stars in open clusters

1-1 Dwarf novae

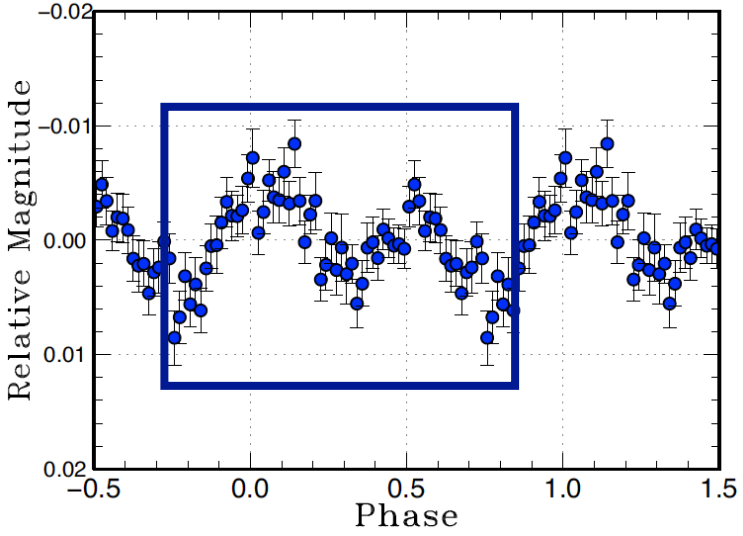
- Binary stars of a white dwarf and a late-type star
- Accretion disk
- Outbursts due to the chage of the disk temperature



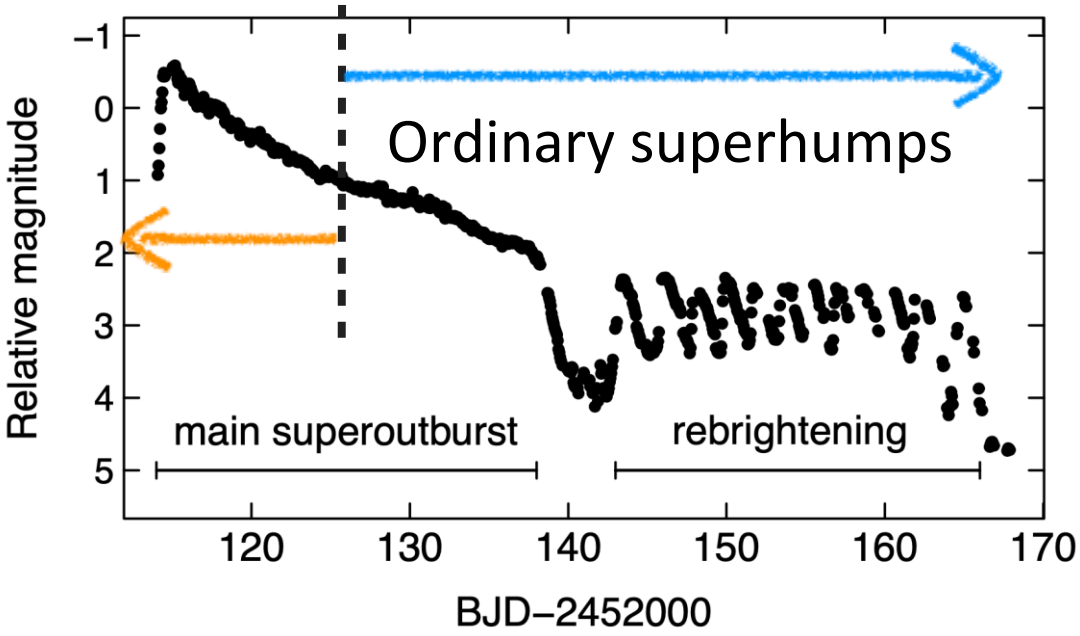
1-2 Early superhumps in WZ Sge-type dwarf novae

Early superhumps

- The period is almost equal to the orbital period
- Double-peaked



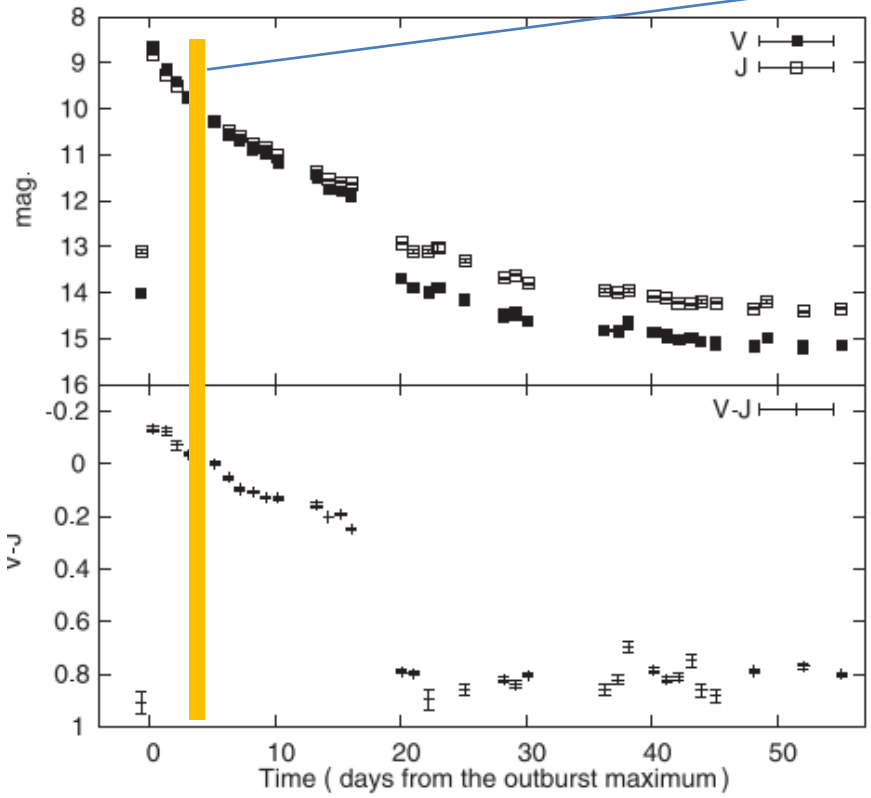
(Kimura et al. 2018)

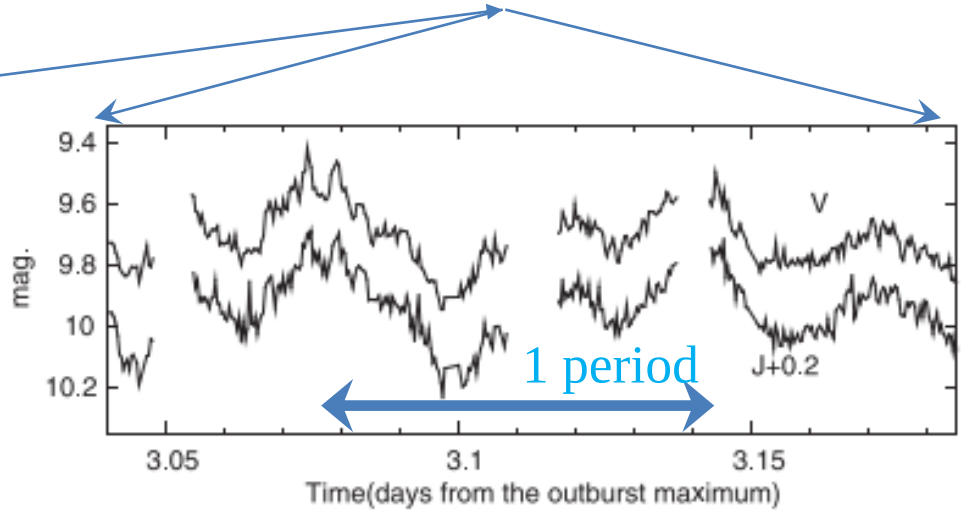


- Show **only superoutbursts** with long intervals (~ decades)
- > 6 mag amplitude & long-lasting

(Kato 2015 for a review)

1-3 Color variation

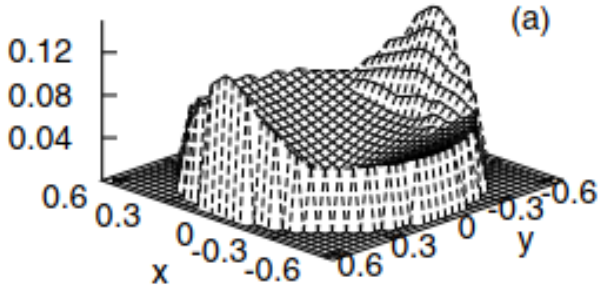




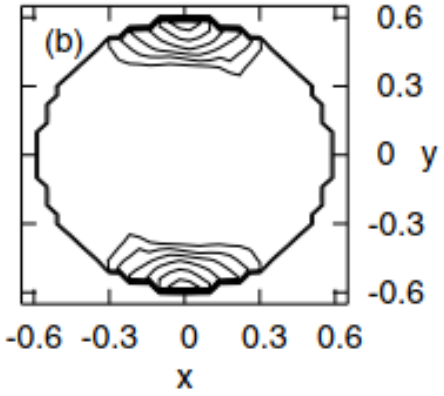
- 2007 superoutburst in V455 And (Matsui et al. 2009)
- *V, g', Rc, Ic, J, Ks* bands obs.
- Color variation during one early superhump period
  → assumption of the BB radiation
  → temperature
  → redder when brighter?

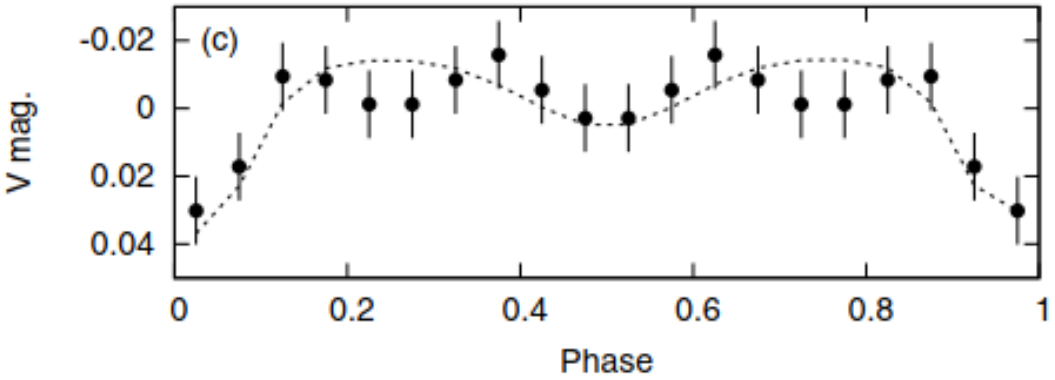
1-4 Reconstruction of the disk structure (Uemura et al. 2012)

disk structure



h/r distribution



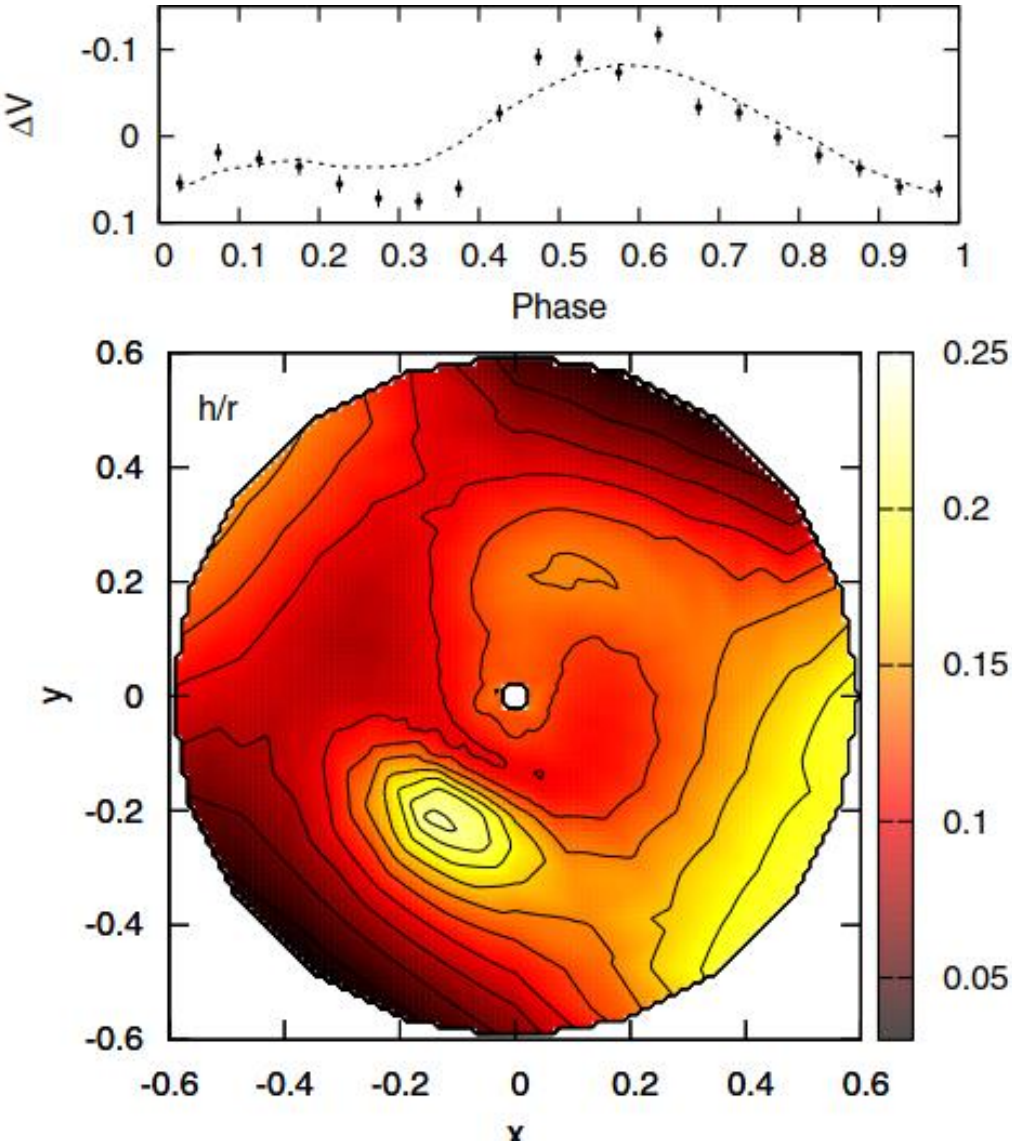


lightcurve

Model calculation

Reconstruction

Lightcurve of an early superhump



Reconstructed structure of the disk

- Reconstruction of the disk structure using multi-color lightcurves
- Daily obs. → variation of the disk structure

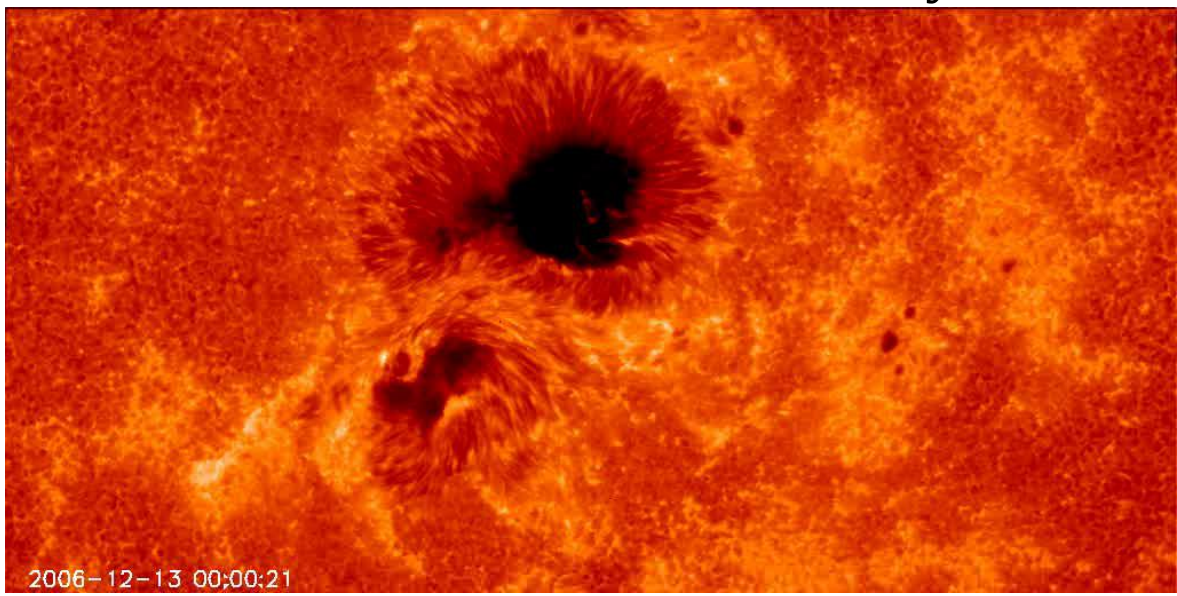
→ constraints on the mechanism of the early superhumps

2-1 Solar/stellar flares

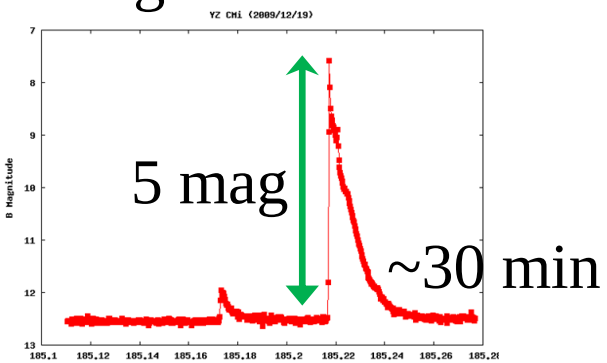
- Flare: explosion utilizing the magnetic energy stored around spots
- Dynamo mechanism: more rapid rotation → stronger magnetic fields

(e.g. Reiners et al. 2022)

A solar flare observed in Ca II K by Hinode



Large flare in YZ CMi



- Stars get older with the rotation slower due to loss of AM by stellar winds.
- Then, are younger stars more active magnetically than older stars?

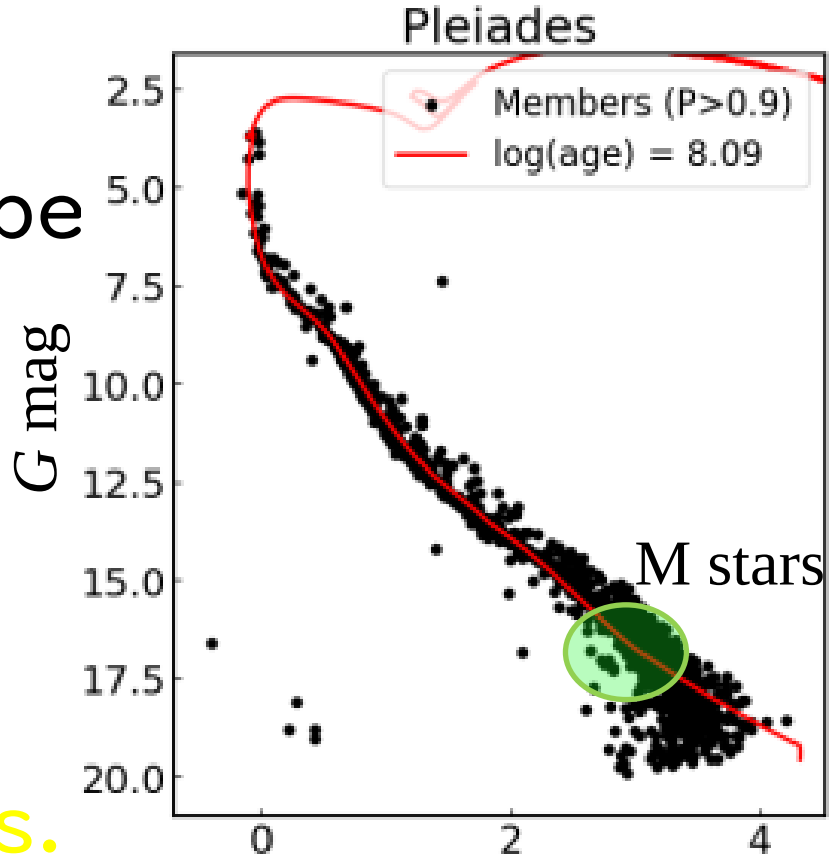
  → Basically yes, but not so clear observationally.

We need to know the magnetic activity of many stars with known age.

→ Flare statistics of late-type stars in open clusters

2-2 Flare statistics

- There are many open clusters having M-type stars brighter than 20 mag.
- Long-time obs. will detect many flares on many M-type stars.



Liu et al. (2023)

- Statistical analyses
  - Flare frequency vs flare energy
  - Flare frequency vs spectral type
  - Flare frequency vs age
  - …
- These will give new basic info. on the inner stellar structure and stellar evolution.