Stellar Astrophysics in South Africa

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A talk Outline

- A brief history of stellar astronomy research in S .Africa
- Stellar Pulsation studies
- Cataclysmic Variables
- Pulsar studies at HARTRAO
- Facilities used

A brief history

- Stellar physics studies began in 1820s with the establishment of the Royal Observatory (now SAAO)

- In 1830s Thomas Anderson, based in Cape Town, was first to measure distance to Alpha centauri

Discovery of Proxima Centauri

- In 1915 Robert Innes discovered Proxima Centuari at the Union Observatory in JhB

South African Astronomical Observatory

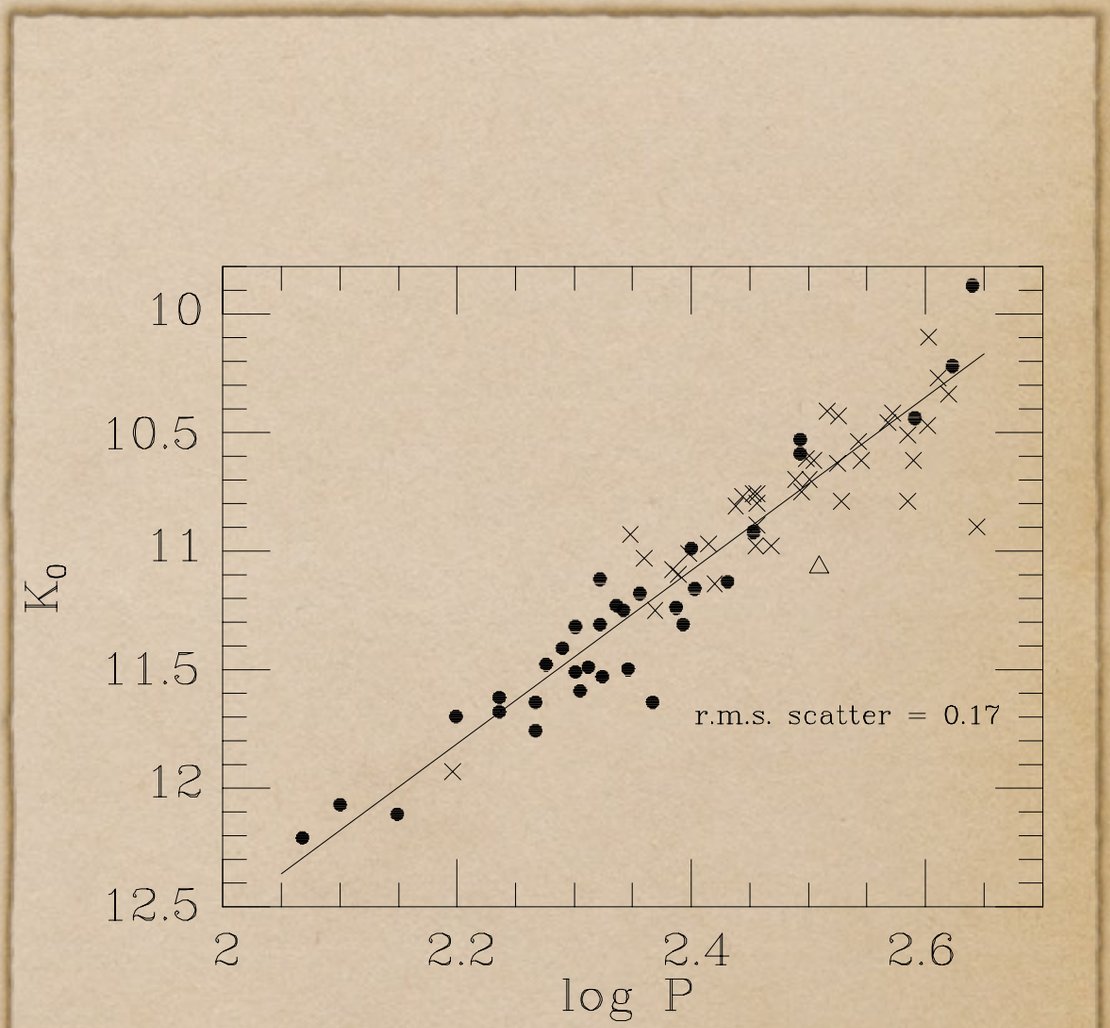
- In 1972 the old Royal Observatory (Cape) and, Union (JHB) and Radcliffe (Pretoria) observatories were merged into SAAO

Stellar Pulsation Studies

- Before SALT telescope, South African astronomy was mainly dominated by stellar pulsation research.
- Topics of research were - Cepheid and Mira variables for distance measurements
- The idea is to use variability to infer physics of stars

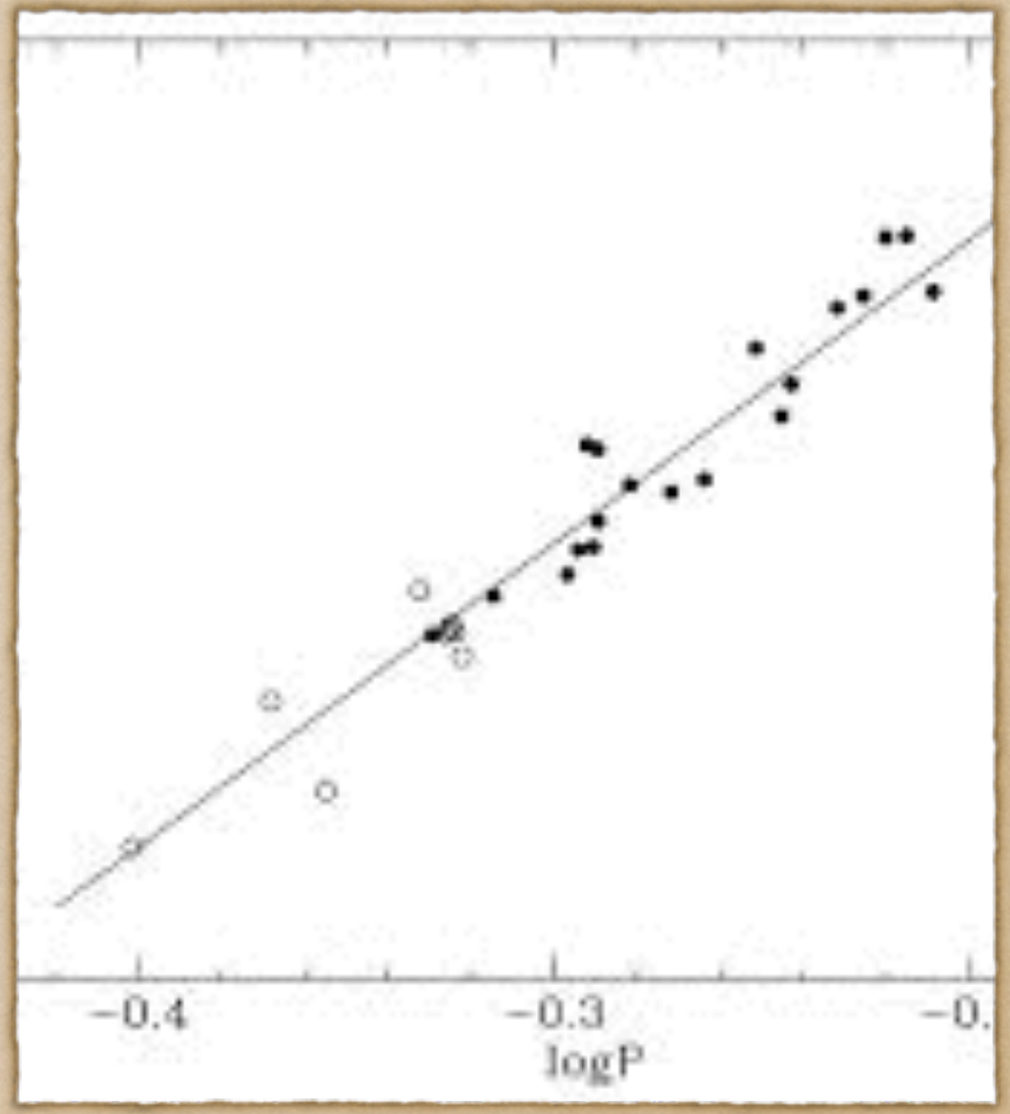
Mira Variable stars

- Used for distance measurements in our Galaxies and beyond (Megallanic Clouds)
- I Glass, et al at SAAO

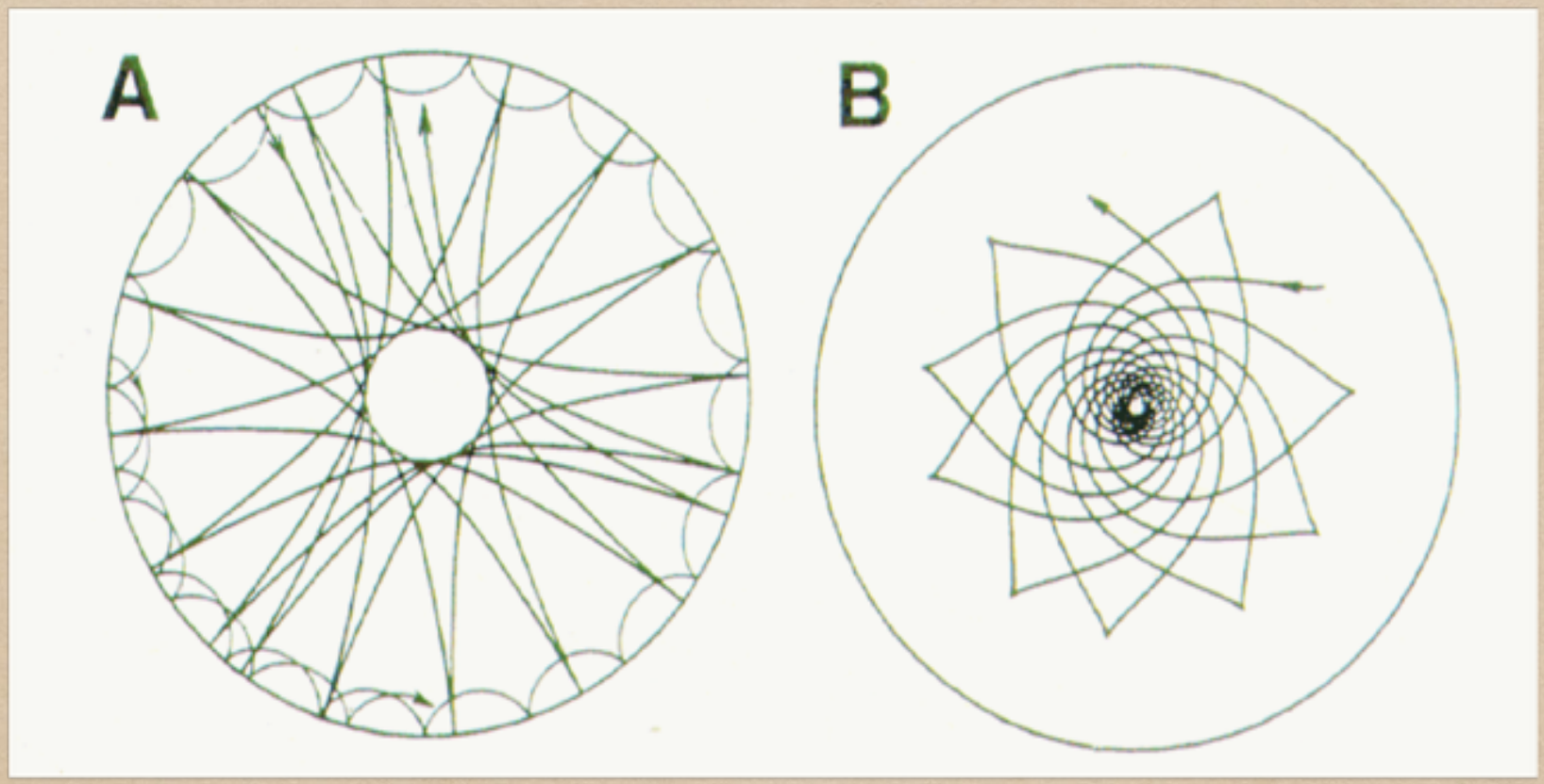


Cepheid Variables

- M. Feast et al at UCT



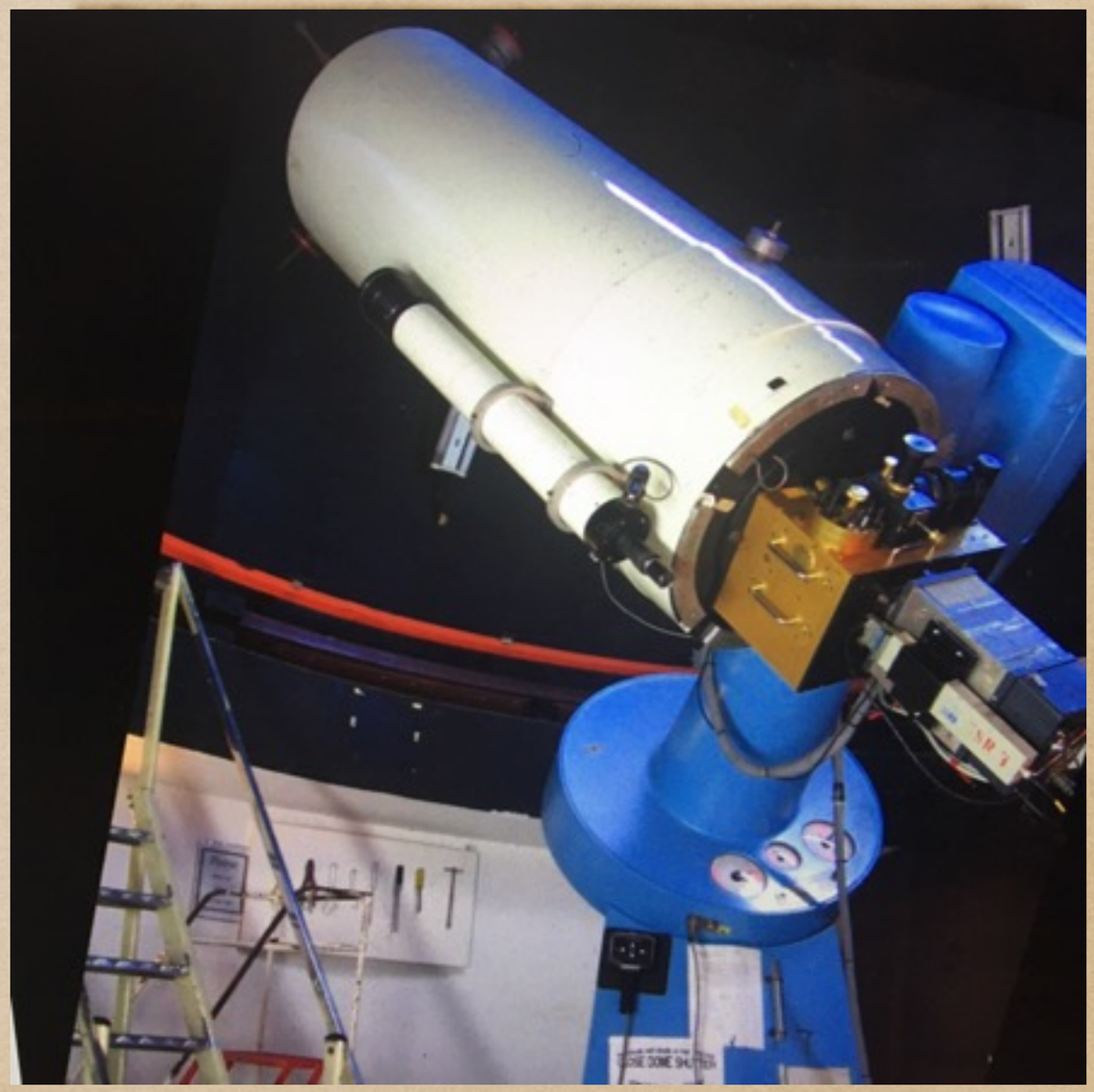
Astero-seismology

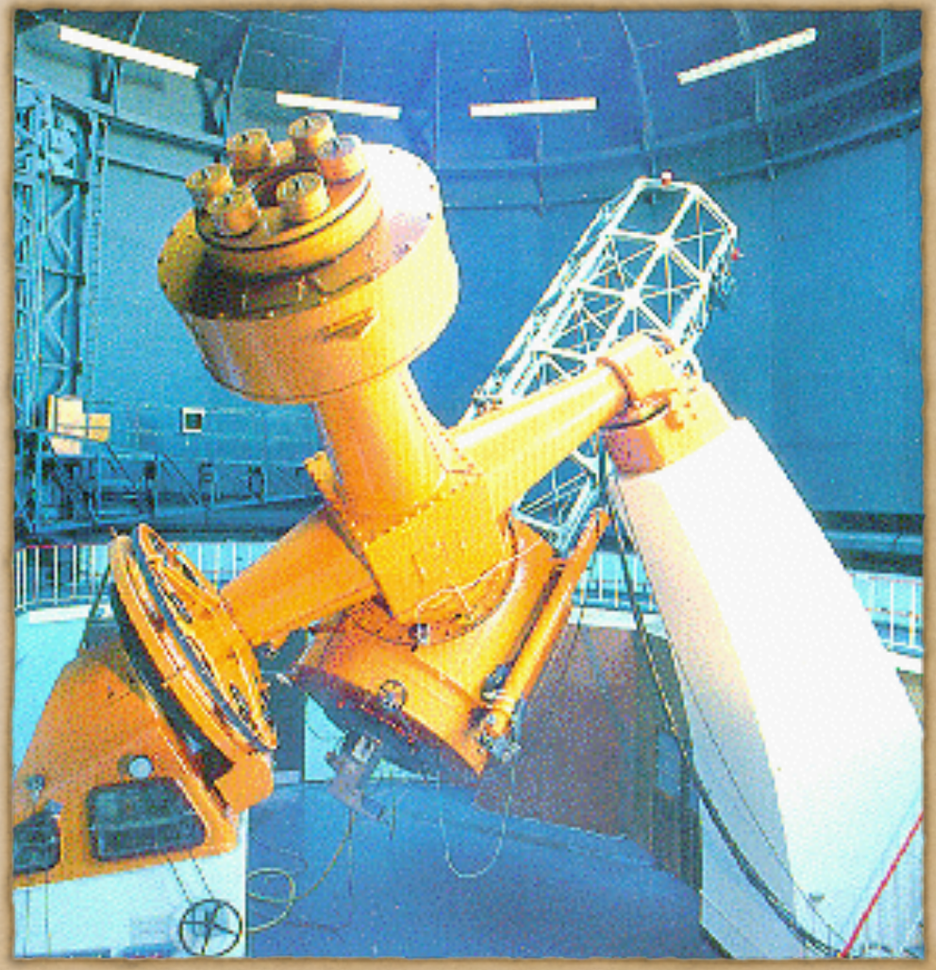


Using seismic waves generated inside stars to infer internal physics

Pulsating Stars (roAp)

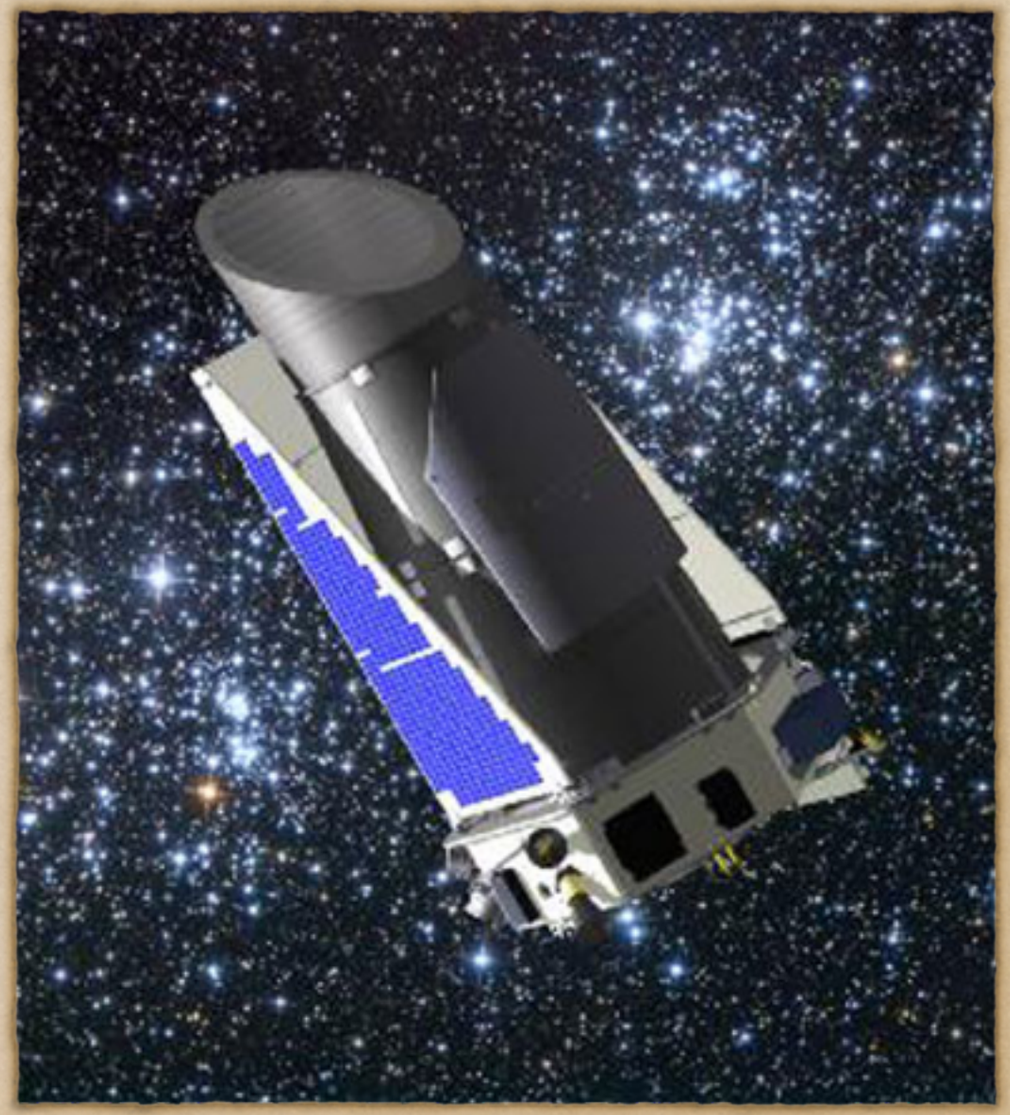
- Strongly magnetic, short period (< 21 min)
- Discovered in South Africa (Sutherland)





Recent Studies

- Precise photometry from space (KEPLER) is allowing S. African astronomers to detect ultra -low amplitude pulsators



Examples

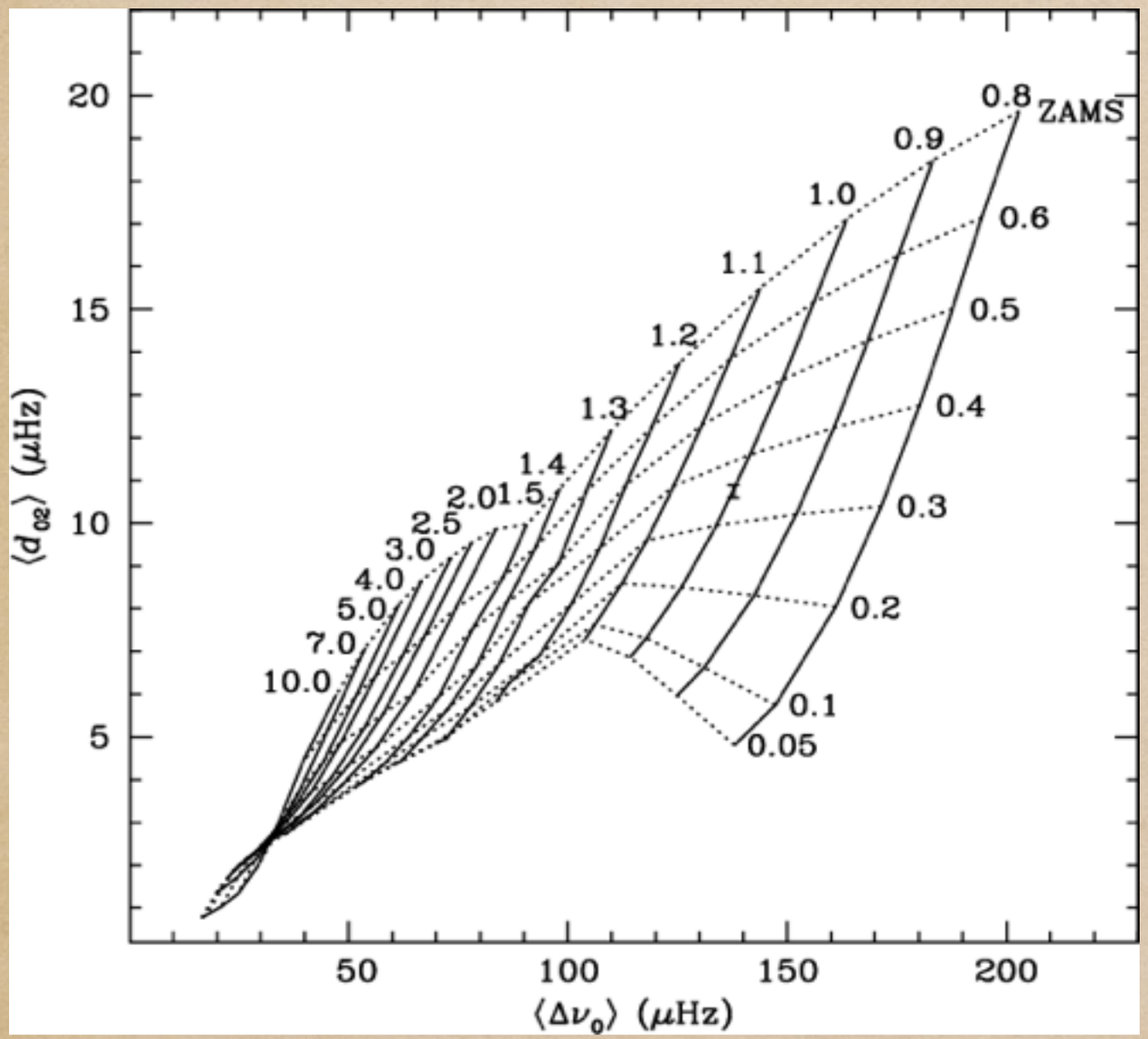
- Detection of binary stars from photometry pulsations (My PhD students)
- Estimation of rate of mass loss in post main sequence stars from their solar-like oscillations
- All above methods developed by Balona in Cape Town

Modelling and Simulations

- 1D models of pulsations (radiation, convection) in A,F,G stars

- We are working on 3D modelling of pulsations, new high precision data (from KEPLER, COROT) demands this.

Some of the modelling results



From frequency patterns/spacing, we can get mass and core composition

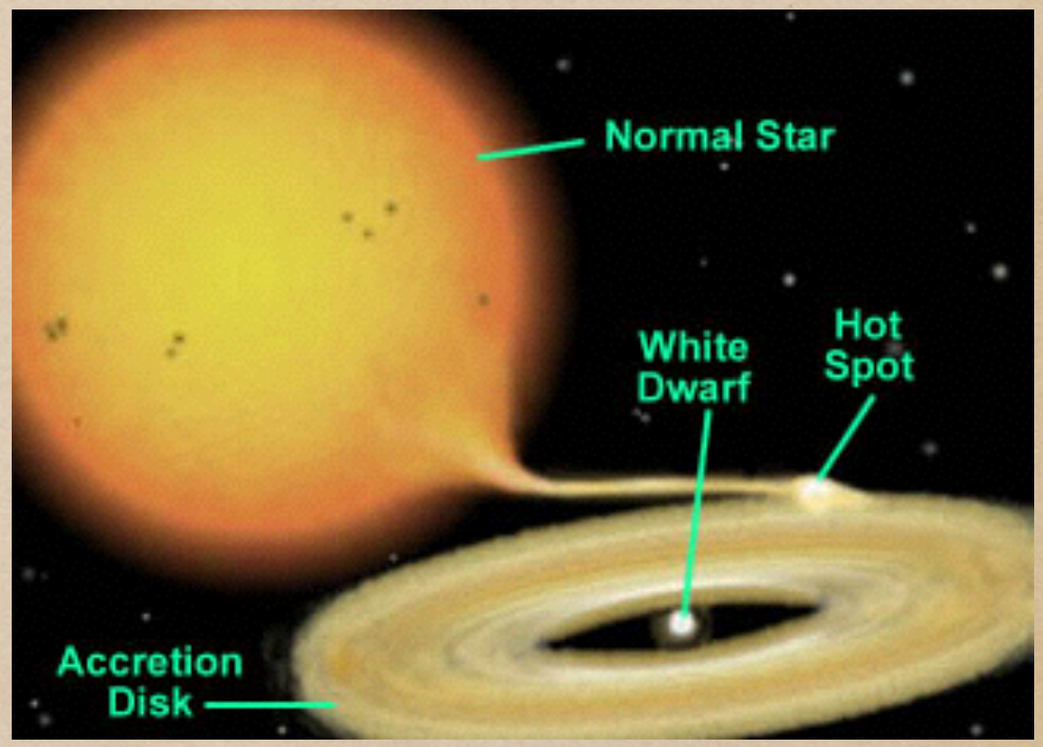
Other stellar Astrophysics Projects

- Pulsar timing (long term monitoring using HARTRAO telescope)

26m radio dish

Accretion physics in compact objects

- Observations of CVs (Cape Town)



End

- Topics of research in Stellar physics are varied and many in South Africa
- It includes theory and observations.
- We have access within South Africa to observing facilities and computational facilities (as will be shown by other speakers)
- There is plenty room for collaboration with our BRICS colleagues