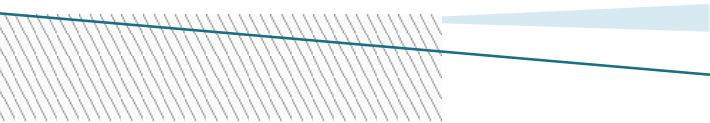
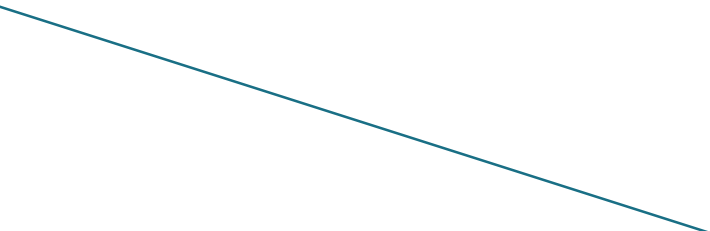


# Espectros ICATE en NOVA

Hugo Levato  
ICATE (CONICET-UNSJ)



# What we can do as a contribution to NOVA?

- We have in our archives plenty of spectroscopic plates taken since 1967 up to 1989
  - We also have several thousand of digital spectra taken since 1990
- 

# Photographic material

- Spectra taken at:
- KPNO (Kitt Peak National Observatory) USA
- Haute Provence in France
- CTIO (Cerro Tololo Interamerican Observatory ( 1.5m, 1m and 0.9m)
- CARSO (Carnegie Southern Observatory) Las Campanas, Chile.
- Helen Sawyer Hogg Telescope at Las Campanas (University of Toronto)
- CASLEO (Complejo Astronómico El Leoncito)

# IAU Resolution B3, 2000

## Safeguarding the Information in Photographic Observations

- The International Astronomical Union,

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Recognizing

- 

that unless urgent action is taken, this unique historical record of astronomical phenomena will be lost to future generations of astronomers,

- 

Recommends

- 

the transfer of the historic observations onto modern media by digital techniques, which will provide worldwide access to the data so as to benefit astronomical research in a way that is well matched to the tools of the researcher in the future.

# Some historic remarks

- Only in North America exist in the files of more than three million photographic images that are stored in dozens of observatories.
- They were taken in a period of about 120 years.
  - The collection of the Harvard College Observatory contains 500,000 plates taken between 1880 and 1989 (with a gap between 1953-68). Most are direct plates in blue, taken with several refractors with scales between 60-600 arcsec/mm. The magnitude of the best plates limit is  $B = 18$  mag. This means a record of almost 3 billion stellar objects only. The coverage is excellent in both hemispheres, but South is better.
  - The collection contains almost 1200 plates open clusters and double stars taken by Benjamin Gould in Córdoba, during 1870 to 1880.
  - The Harvard College Observatory allows all astronomers to visit and use the files.

# Not only detectors change...

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Second level

Third level

□ Fourth level

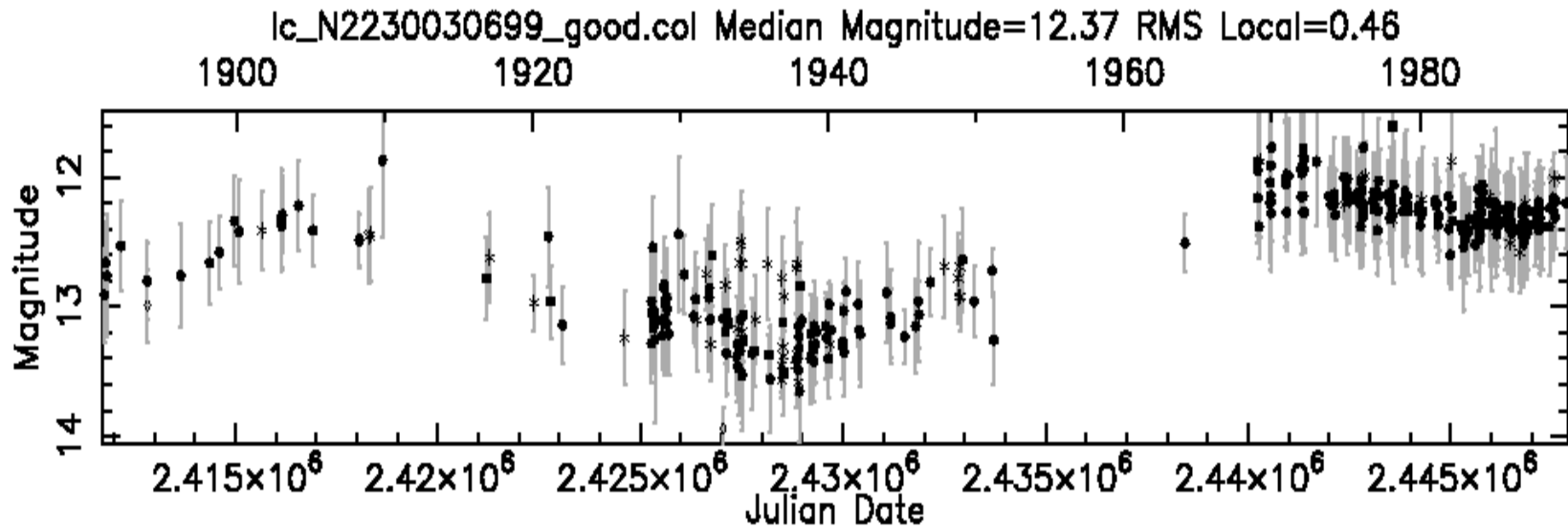
▣ Fifth level



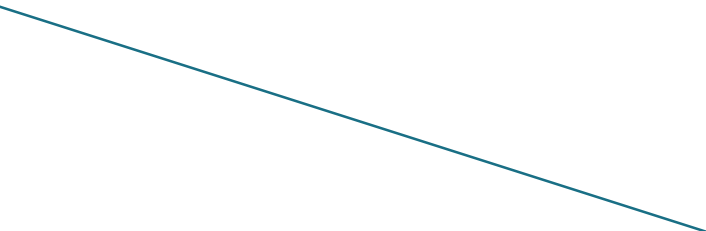
Alison Doane, is the curator of the Astronomical Plates at the Harvard College Observatory

# 12 millones de curvas de luz

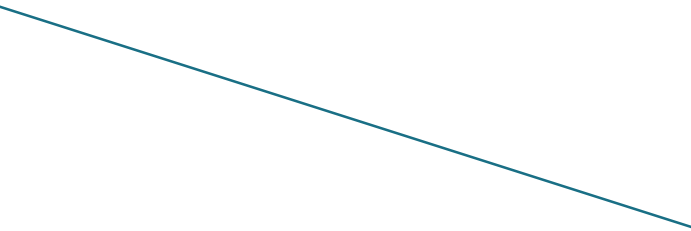
Variable with a period of almost 70 years.



# Argentina

- In Argentina there are several thousand direct and spectroscopic images stored primarily in the centenary observatories: La Plata and Cordoba but several thousand are kept by senior researchers that observed in international observatories since the 1960s: CTIO, CARSO, KPNO
  - All of them were used for their specified purposes but today: new methods, new interpretations of astronomical phenomena ensure that there are more facts that can be extracted from them.
  - There are almost 100 years of data in Argentina that must be preserved and made available to the community.
- 



- Today the CCDs (almost the only survival detector from all digital detectors that flooded the market in the late 1970s) replaced completely analog detectors and the photographic plate.
  - To make available the spectra of old plates, therefore it was necessary to count with a GRANT or a PDS.
  - The companies manufacturing these devices already do not exist in the market and it is increasingly difficult to maintain these expensive equipment.
- 

# PDS (Photometric Data System)



- The first PDS was made for Corning Glass Company in June 1969.
- The first astronomical customer was Leopold Figl Observatory in Austria, who bought one in November 1971.
- Kitt Peak National Observatory acquired one in September 1972.
- In May 1973, Boller and Chivens division of Perkin-Elmer Corporation bought Photometric Data Systems Corporation.

# Tray scanners

Obvious but important: the plate should not move in the tray

Precision in position is similar to the size of the grain of the plate (a few microns)

The PDS were "single pixel" devices and measuring the density or:  $\log_{10}[1/\text{transmission}]$ ) in one position of the plate at a time.

They were slow compared with the tested current scanners that are two-dimensional, but had better than 1  $\mu$  accuracy!

# Selected scanner

- Nikon Coolscan C9000 ED
- Probably you should modify or build new trays for plates of different sizes.
  - Nikon Coolscan 9000ED has the capacity of outofocus over a relatively large range and the emulsion may be located upside or downside on the tray.

# Nikon CoolScan 9000 ED film scanner

- Click to edit Master text styles

- Second level

- Third level

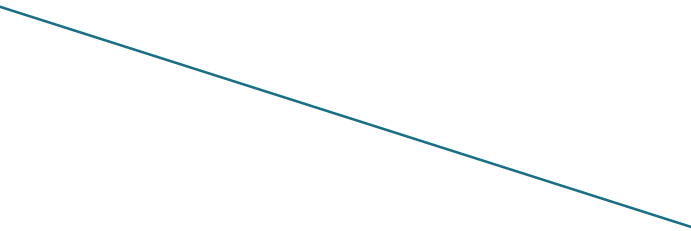
- Fourth level

- Fifth level



Able to fully measure astronomical plates on glass of dimensions up to (6 x 18 cm) with a fixed resolution of 4000 dpi (6. 35μ/pixel). A photographic plate of 8 x 6 cm is scanned in 3 minutes

# Nikon C9000

- Nikon C9000 replaces the detector of one single pixel by a linear array of three rows with 10.000 sensors de each one.
  - The tray moves in steps perpendicular direction to the long axis of the array and all pixels of the array are read simultaneously in each mechanical step.
- 

# Trays

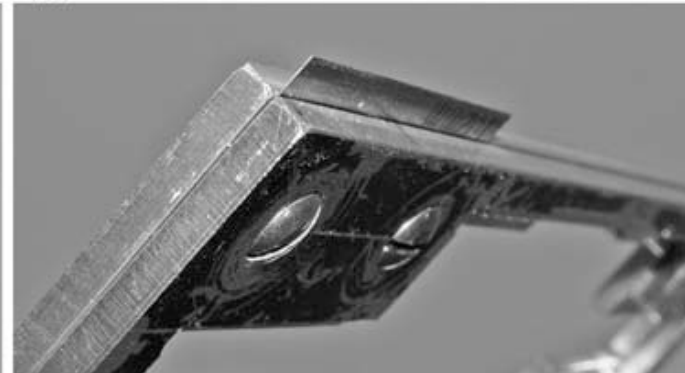


- Click to edit Master text styles
  - Second level
  - Third level
  - ▣ Fourth level
  - ▣ Fifth level

(b)



(c)



# Output

- The Nikon scanner has an IEEE 1394 port to connect to a PC but also includes a PCI-slot Firewire board for the case that the PC does not have one of those ports.
- The Nikon comes with Nikon Scan 4.0 software, which provides excellent control of all the mechanisms and possibilities of the scanner. The software runs on Windows or MacOS, and is good to have more than 2 Gb of RAM and a 1Tby disk.
- Image is recorded in Nikon-RAW or TIFF format in 8 or 16 bits per pixel for each color and also in 8 or 16 bits per pixel in monochrome mode.

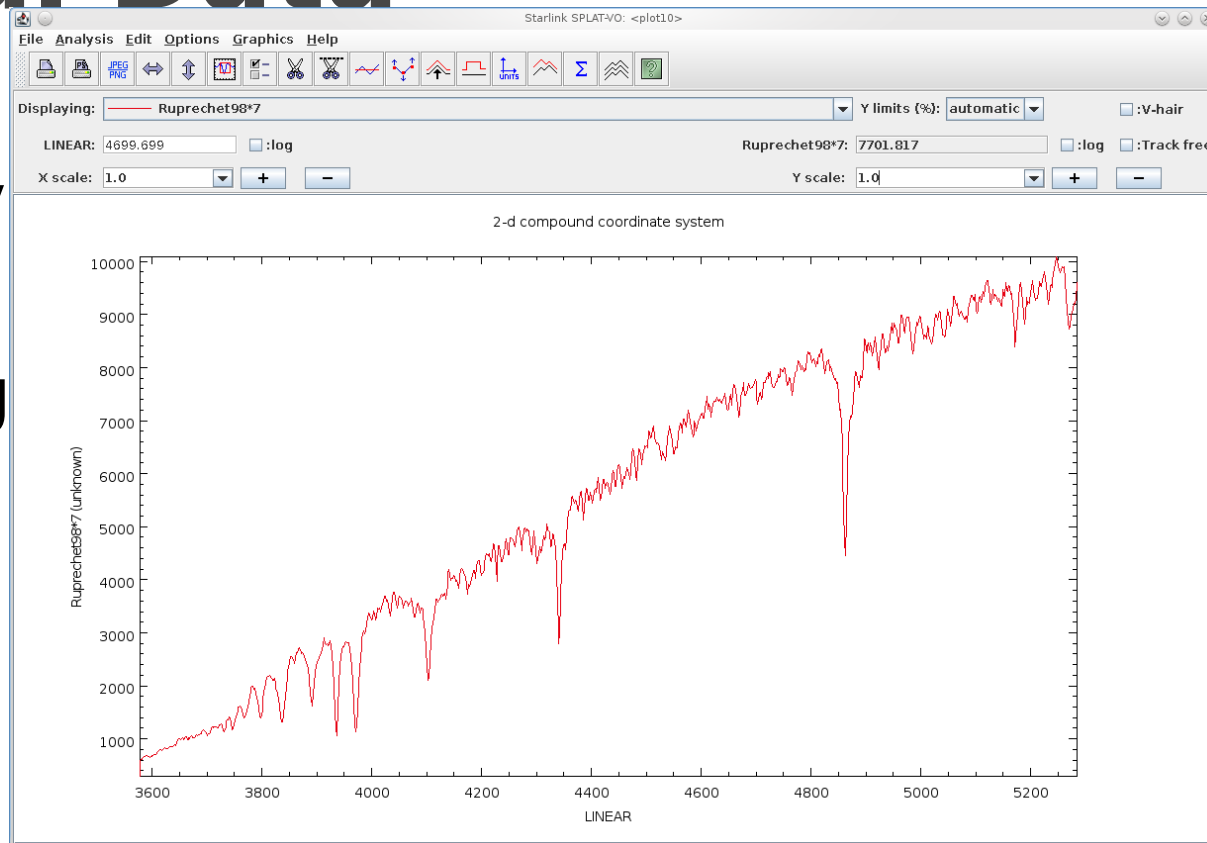


# First plate scanned at ICATE



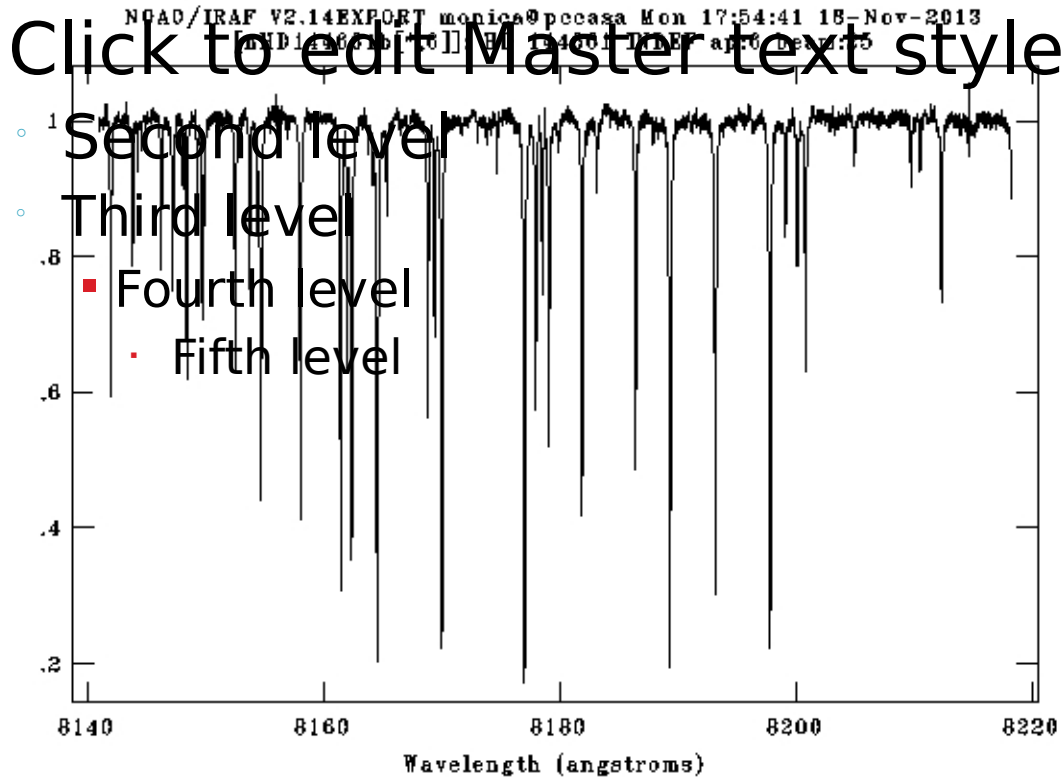
# Digital Data

- We hav
- 214 nig



# Next addition - bHROS spectra

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**Gracias**  
**Thank you**

