Time Series use cases @ INAF – OATs

GAPS Exoplanets

TSRS Space Weather

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OUTLINE

- GAPS
  - Global Architecture of Planetary Systems
  - Radial velocity series of host stars
- TSRS
  - Trieste Solar Radio System
  - Polarimetric fluxes of the solar radio corona

GAPS project overview

- Global Architecture of Planetary Systems
  - a long-term program for the comprehensive characterization of the architectural properties of planetary systems as a function of the hosts' characteristics (mass, metallicity, environment)
  - 340 nights at TNG/HARPS-N since August 2012
- Prepares (as one of the products) Time Series for host's radial velocity out of HARPS-N high resolution spectra
  - Not only RV, but a bunch of other observed parameters
- Goal: follow up on most promising candidates

GAPS Time Series – Dataset description

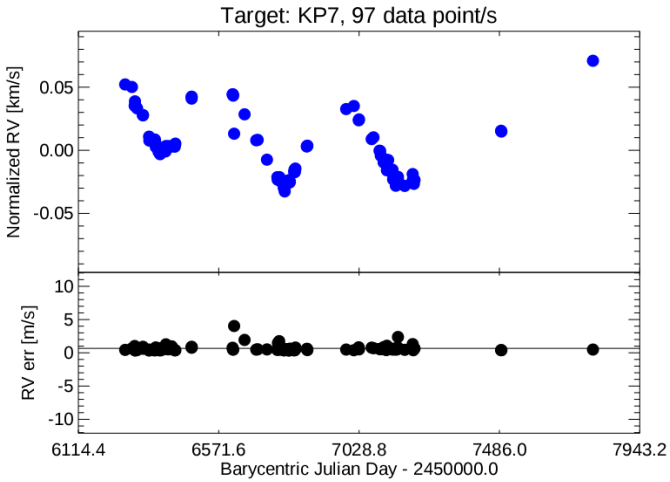
- Datasets for each followed target
  - Internal GAPS identifier annotated with
    - RA & Dec
    - Proper motion (RA & Dec components)
    - V magnitude, B-V color, spectral type (& mask)
    - Systemic RV (from literature / project calculated)
  - Values updated while analysis goes on
    - Status and update time
    - Number of data points in the series
- Data points: reduced HARPS-North spectra
- Currently focus on public datasets

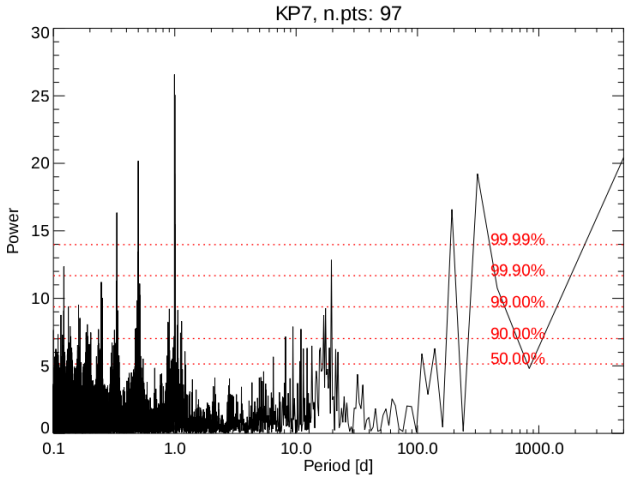
GAPS Time Series – Content Description

- Each point in the series is identified by a BJD time
  - FITS header derived and recalculated
- Plus
  - Barycentric radial velocity and RV estimated uncertainty
  - Bisector velocity span
  - Effective exposure time
  - Cross-correlation function information
  - Applied mask type
  - Barycentric Earth radial velocity
  - Used RV drift
  - Flags
  - Reference to FITS spectra the data are derived from
- Data computed after each observation night

GAPS Time Series – simple use case

- Datasets discovery
  - Date (JD/BJD)
  - RV & dRV
  - CCF parameters: FWHM, contrast, bisector, other CCF asymmetries
  - Stellar activity indexes
- Access/retrieve time series
  - Including all possible instrumental details and host star characteristics
- Link points to original/reduced spectra





TSRS – Space Weather

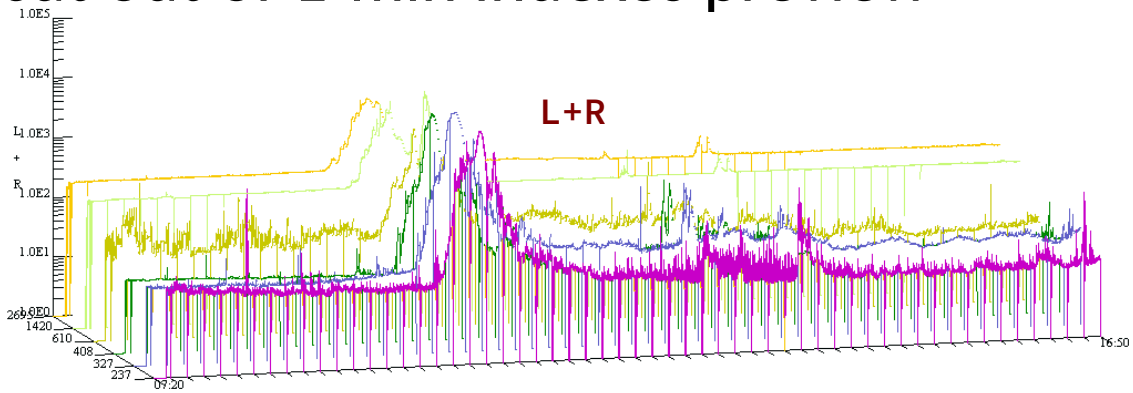
- (currently offline) solar radio corona monitoring system
  - Full daylight, 1kHz, 6 channels R+L Circular Polarization
- Millisecond resolution
- Avg/Max 1-min/1-sec indexes

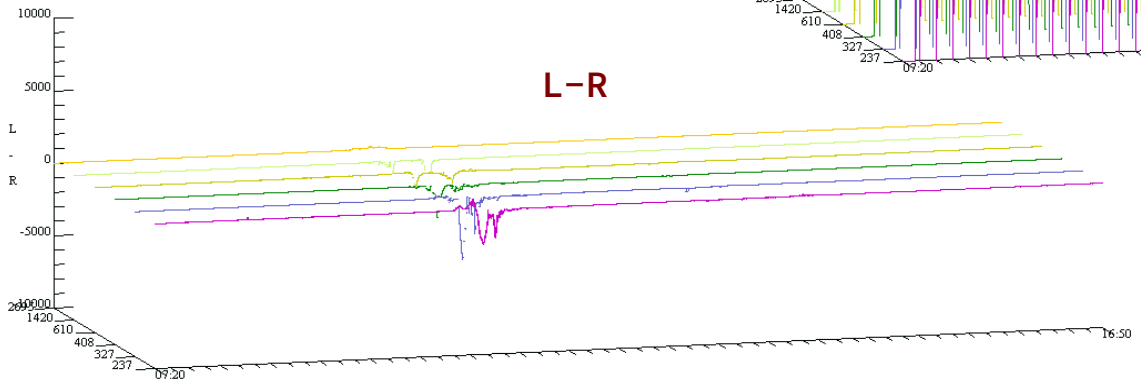
TSRS – Dataset metadata and content

- Position/Target: (radio) sun
  - Spatial resolution: $\gtrsim$1deg > (radio sun disk)
- Time: UTC
  - But really: day or event would work better
- Fixed single frequency radio channels
  - 237, 327, 408, 610, 1420, 2695 MHz
  - 1.26, 0.92, 0.73, 0.49, 0.21, 0.11 cm
  - RCP, LCP
- Sampling: 1 kHz, 1 min (10 min), 1 sec
- Values: flux density [SFU = 10^4 Jy = 10^{-22} $Wm^{-2}Hz^{-1}$]

TSRS – simple use case

- Search by observation date/time
- Retrieve/cut available data
- 1kHz data can be cut out of 1-min indexes preview





Multichannel Synoptic Map
"Bastille Day" event
2000-07-14

Summary

- 2 simple use cases
- Probably no issue at model/serialization level
- Discovery and access to check

- Thanks to
  - [GAPS]
    - Andrea Bignamini
    - Serena Benatti
    - Riccardo Claudi
  - [TSRS]
    - Mauro Messerotti

謝謝