

Scan of a plate from the PARI Case Western Reserve Univ. collection. This plate (#10246) was taken on November 17, 1974 (dec= +23.5, RA= 4h50m) and is part of the Tau Cloud Survey. The exposure is 72min, Emulsion 103aE, Filter = OG2, 1.8 deg prisma



Potential of Gaia BP/RP spectra and LDS sky surveys for study of high z Universe

René Hudec

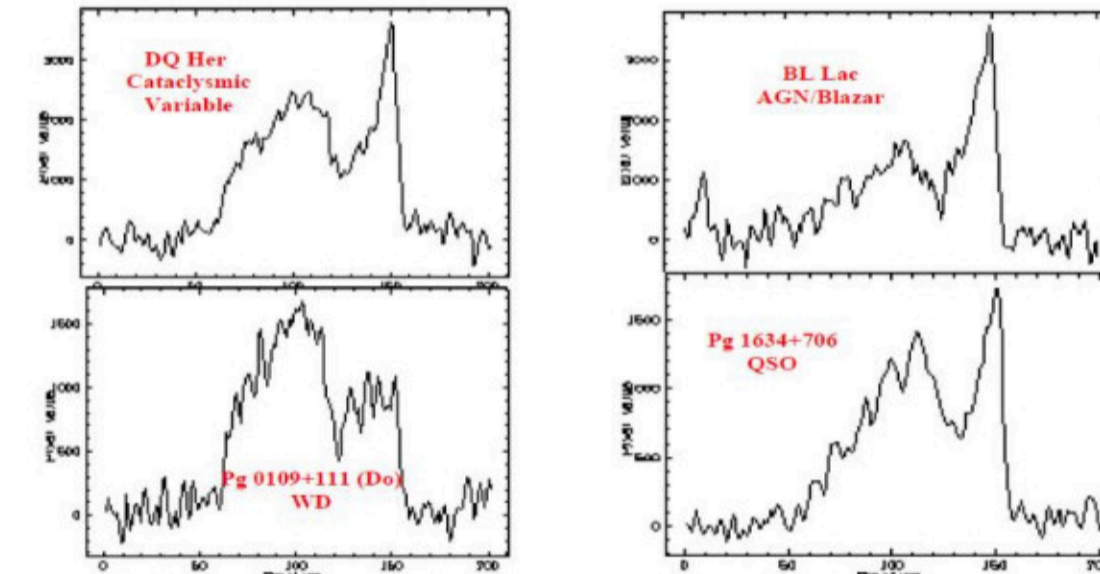
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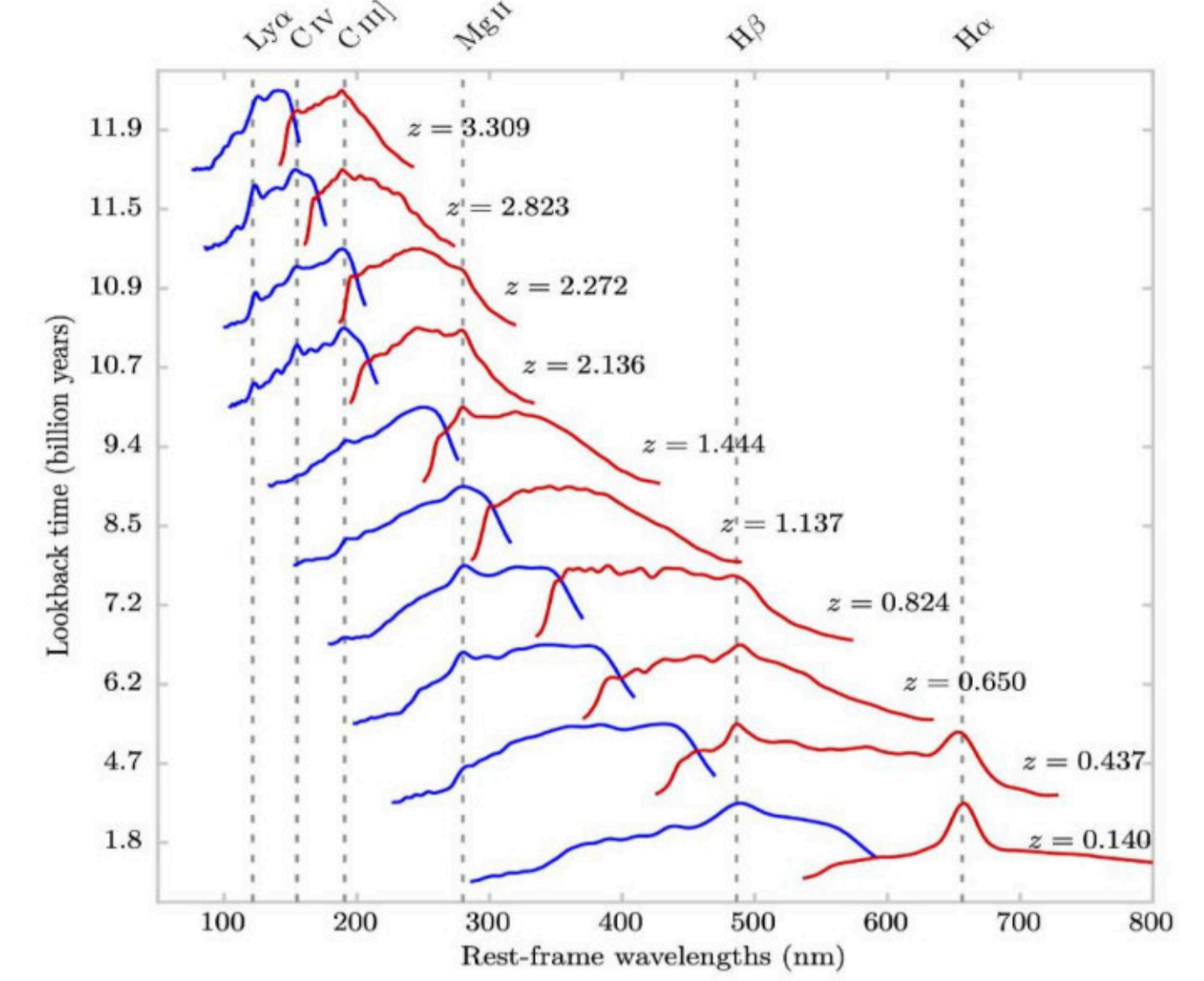
Abstract. Gaia Blue (BP) and Red (RP) Photometer low-resolution spectral data is one of the exciting new products in Gaia Data Release 3 (Gaia DR3). However, analogous LDS (low dispersive spectral data) data also available in numerous historical photographic sky surveys (access after digitization). My estimate is more than 100 mil LDS star spectra covering time period of more than 60 years in these databases. These LDS photographic sky surveys have the potential of adding historical epochs to Gaia LDS spectra. This may allow to study prominent spectral variations with time ... field so far little exploited. Both Gaia BP/RP and archival LDS data have excellent potential for recent astrophysics e.g searches for high z objects and optical counterparts of gamma ray bursts (GRBs).

Examples of prominent spectral features from Byurakan Survey

These objects will be also probably visible in Gaia BP (Optical) and RP (Near IR)



There are categories of HE sources included



Gaia low-resolution BP and RP spectra (blue and red, respectively) of ten known quasars selected with apparent G magnitudes between 17 and 18. The QSO spectra are plotted in their rest-frame https://www.cosmos.esa.int/web/gaia/iow_20201222

Comparison of Gaia BP/RP Low Dispersion Spectra Versus Spectral Low Dispersion Plates

	Wavelength range, nm	Limiting magn	Dispersion at Hg nm/mm	Spectral resolution at Hg nm
Gaia	330-660, 650-1000	-19	900	-18
Sonneberg Schmidt	340-650	18	10, 23	-3/6
Bolivia Expedition	340-650	14	9	-3/6-10
Hamburg	340-540	19	139	4.5/10
Byurakan	340-690	17.5	180	5/10-15
PARI	330-535	18	45-340	-5/10-15

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Spectral resolution for plates theoretical/real

Motivation

- Blue (BP) and Red (RP) Photometer low-resolution spectral data is one of the exciting new products in Gaia Data Release 3 (Gaia DR3)
- <https://gaia.aip.de/cms/services/spectra-access/>
- LDS data also in numerous historical photographic sky surveys (access after digitization)
- My estimate is > 100 mil LDS star spectra in these databases

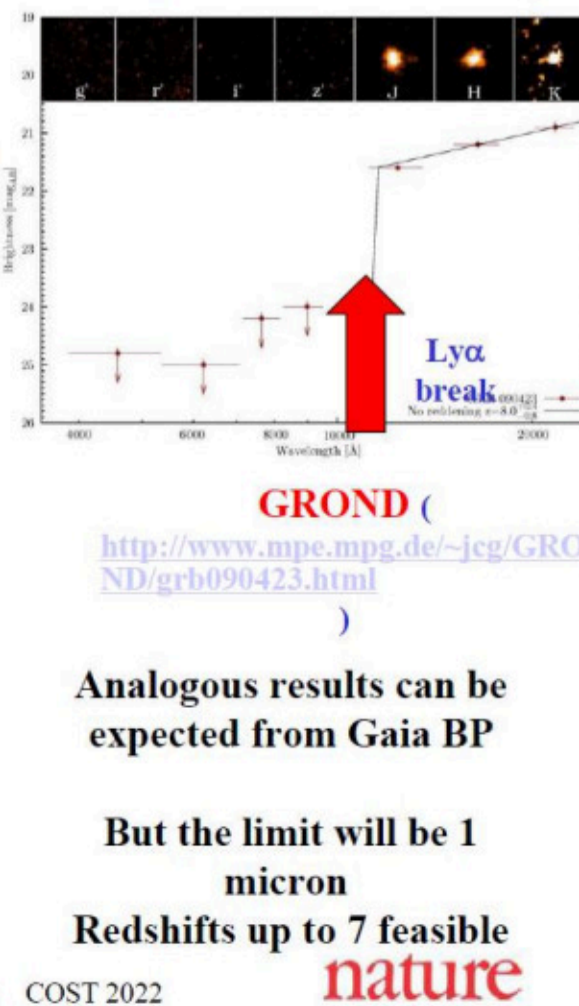
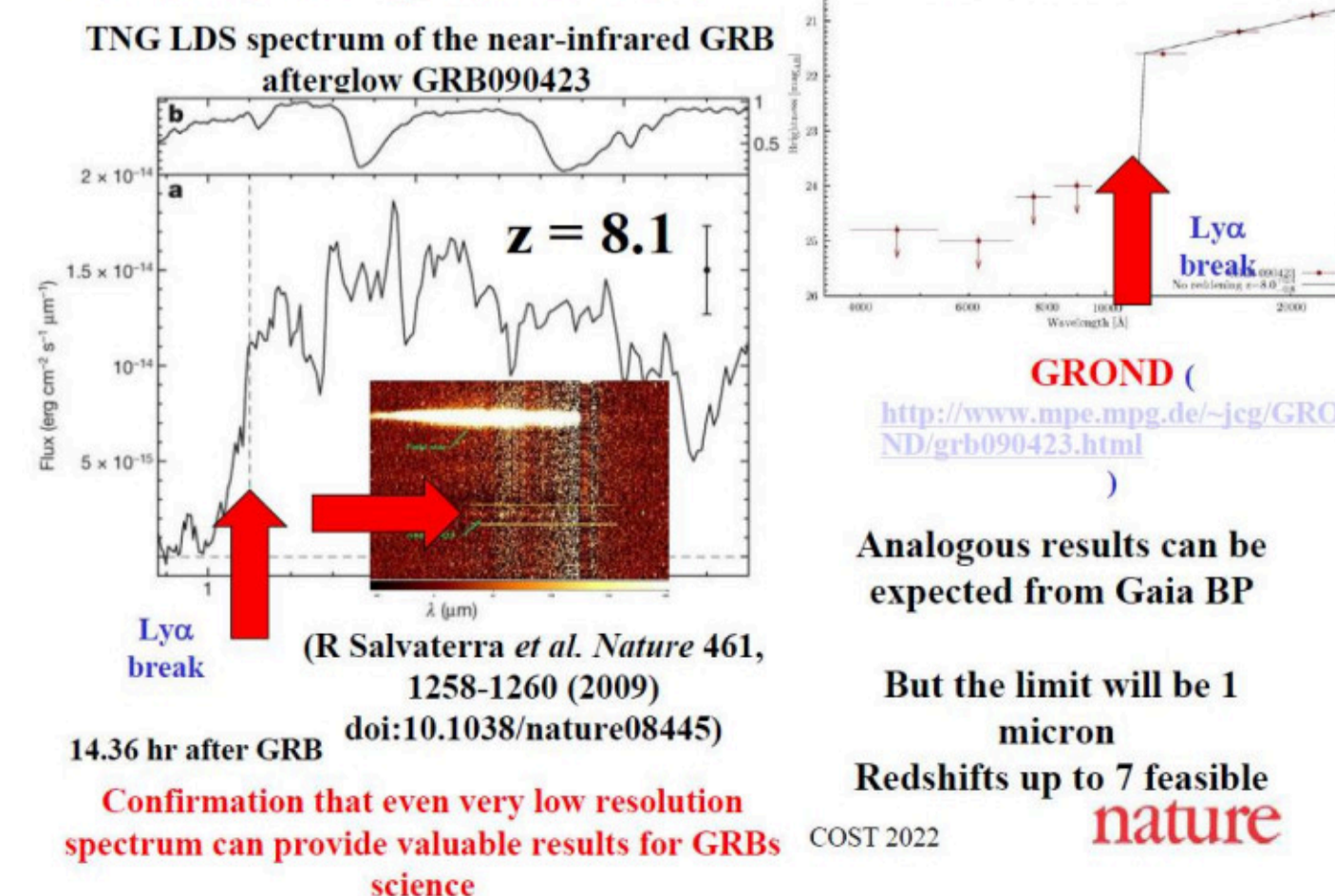
Motivation/Why historical LDS

- Adding historical epochs
- (Large) Spectral variations with time ... so far little exploited
- Astrophysics e.g searches for high z objects and optical counterparts of GRBs

Astrophysics with Ultra LDS provided by Gaia RP/BP

- Continuum profiles – including high z objects
- Strong emission lines
- Strong variable emission lines
- Prominent spectral variability
- Possibility of spectroscopic Gaia alerts
- Follow-Up by ground based RTs with LDS
- Plate Sky Surveys can add long-term coverage and historical epochs

LDS of OAs of GRBs: determination of redshifts using redshifted Ly-alpha

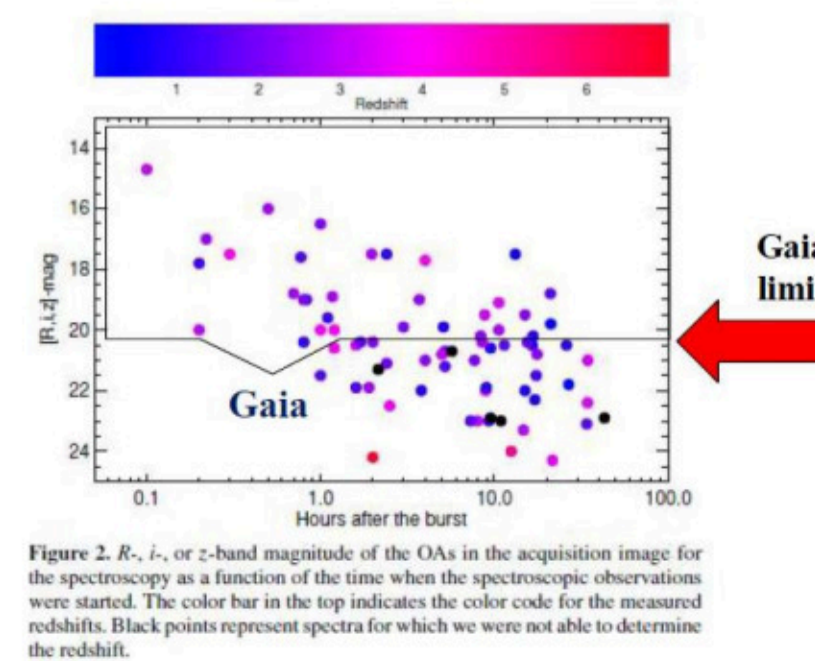


Astrophysics with LDS in the past

Terminology! Objective prism spectra = Slit less spectra

- The LDS (Low-Dispersion Spectroscopy) astrophysics was evolved and performed at numerous observatories (many in US) between ca 1909 and ~1980.
- Mostly LDS with Schmidt telescopes (plates with objective prism)
- Used for various projects e.g. QSO, emission line and H-alpha surveys, star classifications, etc.
- Little used after ~1980
- Today knowledge in astronomical community very limited

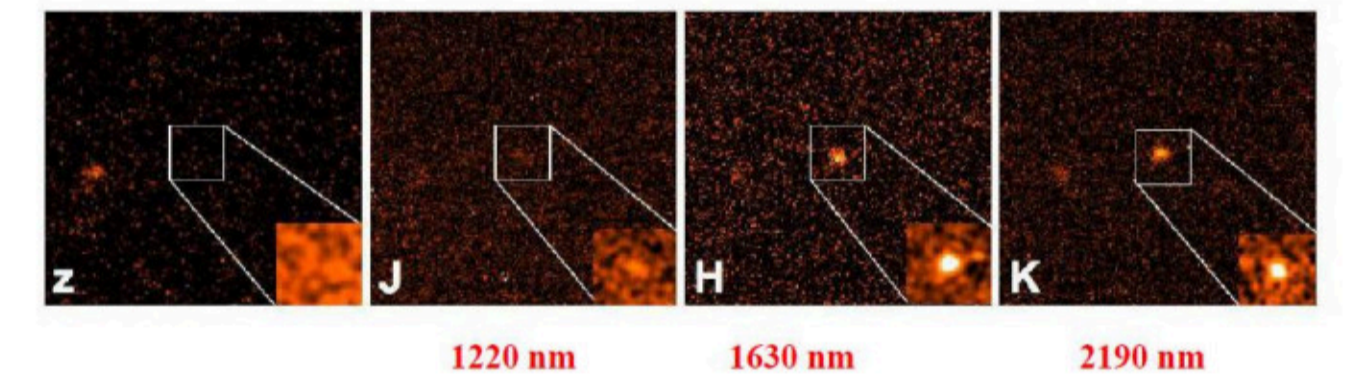
How fast are the recent LDS of GRBs?



Fynbo et al., 2009, ApJSS 285, 526

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GRB 090429B at z = 9.4



Photometric redshift of z=9.4

Cucchiara et al. 2011

R Salvaterra, 2011

Gaia RP ends at 1000 nm – z larger than 7 cannot be accessed

Conclusion: Prospects of LDS with Gaia RP/BP

- Unique chance to provide early or simultaneous LDS for GRBs (so far LDS mostly late)
- Chance to recognize/classify OAs and OTs of GRBs using LDS and/or color information
- Chance to detect/study orphan OAs of GRBs
- Study possible spectral time changes/evolution
- Chance of redshift estimation up to z~7 – Study of high z Universe

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