Spectra extraction and analysis software for the Digitized First Byurakan Survey (DFBS) and research projects

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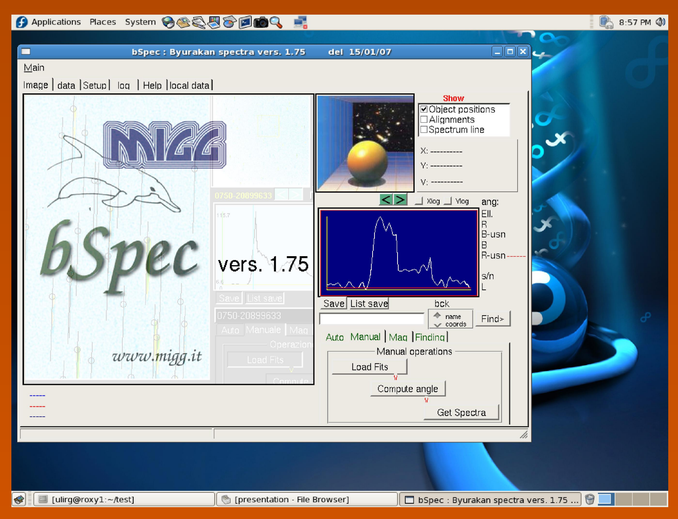
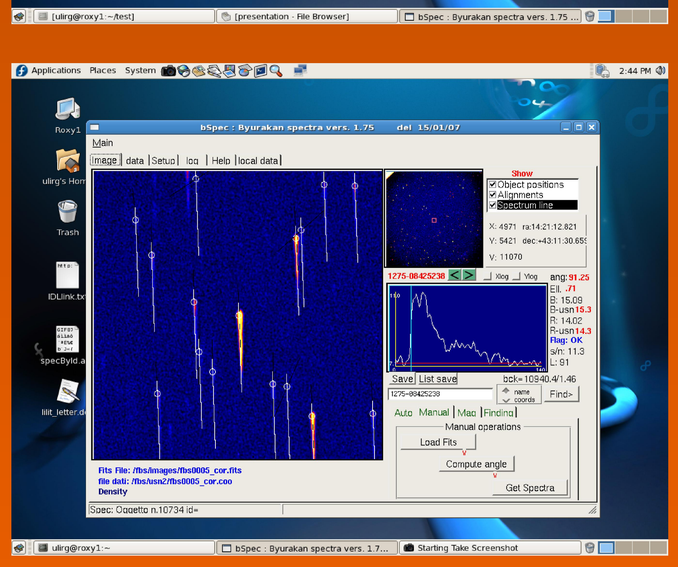
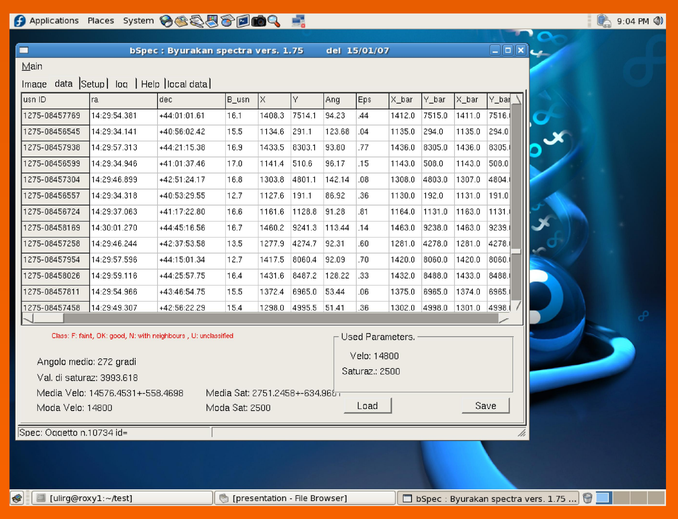
Abstract

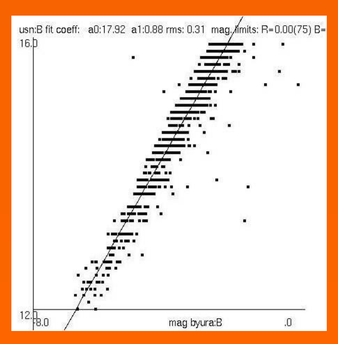
The Digitized First Byurakan Survey (DFBS) is the largest Armenian astronomical database and is unique in the world for its specific requirements to the extraction and analysis of its low-dispersion prism spectra. The project is a collaboration between the Byurakan Astrophysical Observatory, "La Sapienza" Universita di Roma, Cornell University, and VO-Paris. A dedicated software *bSpec* was created by one of the authors (GC) to extract and measure all spectra in any field of the DFBS. However, more accurate software *EXATODS* (Extraction and Analysis TOol of DFBS Spectra) was recently written by another author (AS) and have successfully been used for the extraction and study of the asteroids spectra from the DFBS. It scans full plate to find bright spectra and measures the angle of the rotation of each individual spectrum and follows the direction for the dispersion to obtain the correct wavelength calibration. We have developed a dedicated workflow in the VO framework. We will describe these software and present future research possibilities based on the DFBS spectra.

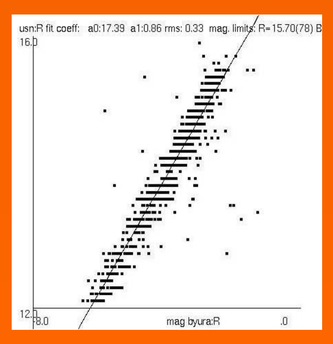
Dedicated software *bSpec*











Software *"bSpec"*: automated extraction and classification of the spectral data in a DFBS plate. Coded under Linux using the Borland Kylix compiler Performs all the operations necessary to build the DFBS database Developed by ***Giuseppe Cirimele*** *and the MIGG s.r.l. team*. A catalogue driven approach: an object list from the USNO-A2 catalogue. Starting from the USNO coordinates, each spectrum was re-centered with a combination of two parameters a) peak position, b) baricenter.

The local background around each object was estimated using the median value of the pixel distribution in two parallel strips to the spectrum direction.

Automatic transformation from DN to I (in arbitrary units) for each plate, finding the "red head" and extraction of spectrum subtracting the local background.

A preliminary mag calibration is made using 300 objects in the central part of each plate: instrumental B & R mags are evaluated integrating the spectrum between pixels 20-40 (R) and 55-90 (B). A polynomial fit of these mags against their USNO-A2 mags provides a calibration curve > Computing DFBS mag for all objs.

For each object, the database contains: USNO-A2 ID, RA and DEC, position of the red head in pix, B and R mags (USNO-A2 & DFBS), the local background value, a quality flag, the spectrum length, and the extracted spectrum.

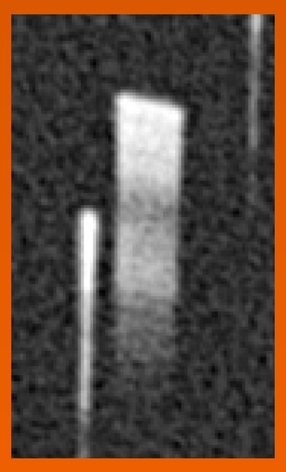
Dedicated software *EXATODS*

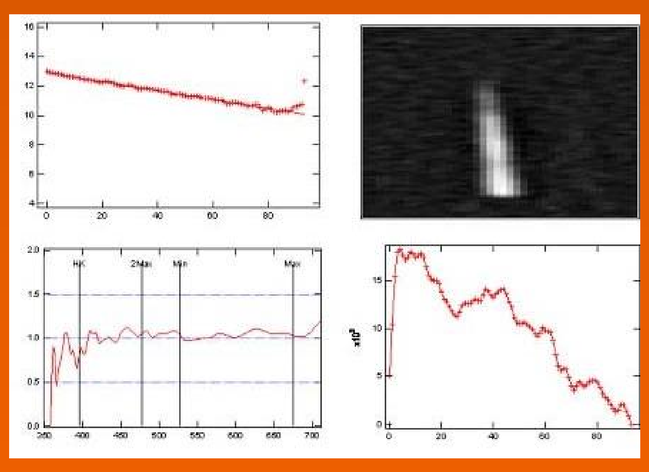
For the extraction and analysis of the asteroid spectra from the DFBS plates, dedicated software has been developed by ***Alain Sarkissian*** *"EXATODS"* - Extraction and Analysis TOol of DFBS Spectra.

It is developed to overcome the main difficulty to analyze DFBS spectra conneceted with their wavelength and photometric calibrations.

It scans full plate to find bright spectra than 2 scan each individual spectra and measures the angle of the rotation of each individual spectrum and follows the direction fo the dispersion to obtain the correct wavelength calibration. Moreover, alignment of the objective prism, the plate and the scanning direction is variable from plate to plate and within the same plate spectra look vertical and others are slightly inclined). To solve these issues, we have developed a dedicated workflow in the Virtual Observatory framework.

An extended DFBS spectrum of an asteroid is shown in Fig. 1. Fig. 2 shows how *EXATODS* works: right panels show the extracted 2D and 1D spectra, upper left panel shows inclination of the spectrum versus pixel number, and lower left panel shows spectrum relative to the solar spectrum (I_{star}/I_{sun}) verus wavelengths.





Ongoing projects based on the DFBS

- **SIA Access to DFBS images (for ALADIN, etc.)**
- **SSA Access to DFBS low-dispersion spectra (for VOSpec)**
- **Extraction and analysis of DFBS spectra**
- **Search and studies of asteroids in DFBS**
- **Search and studies of new bright AGN in DFBS**
- **Search for Blue Stellar Objects (BSOs) in DFBS**
- **Search for Extremely Red Objects (EROs) in DFBS**
- **Search and study of high proper motion stars**
- **Variability studies based on DFBS**
- **Optical identification of IR sources (IRAS, SST)**
- **Optical identification of radio sources (NVSS, FIRST, etc.)**
- **Optical identification of X-ray sources (ROSAT, etc.)**

Related papers

Mickaelian A.M., Nesci R., Rossi C., Weedman D., Cirimele G., Sargsyan L.A., Erastova L.K., Gigoyan K.S., Mikayelyan G.A., Massaro E., Gaudenzi S., Houck J., Barry D., D'Amante L., Germano P., *A&A 464, 1177-1180, 2007.*

Mickaelian A., Sarkissian A., Dubernet M.-L., Le Sidaner P., Prugniel P., Nesci R., et al., *Science with Virtual Observatories: JENAM-2007, SpS #8, Yerevan 2007.*

Thuillot W., Berthier J., Sarkissian A., Mickaelian A., Sargsyan L., Iglesias J., Vachier F., Birlan M., Simon, G., *IAU GA XXVI, SpS3, Prague 2006.*

Mickaelian A.M., Gigoyan K.S., Nesci, R., Rossi C., *Mem.SAIt. 77, 1159, 2006.*

Mickaelian A.M., Sargsyan L.A., Mikayelyan G.A., Erastova L.K., Sinamian P.K., *Heron Press Science Series, 82-92, 2006.*