On the FON astroplate project accomplishment

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FON – Photographic survey of the Northern Sky

Idea: four-fold overlap of the sky with instruments of the same type;
6 observatories: Kyiv(Ukraine), Kitab(Uzbekistan), Zelenchuk(Russia), Abastumani(Georgia), Zvenigorod(Russia), Dushanbe(Tajikistan)

- Instruments: Double wide-angle astrographs; D/F=40/200,40/300
- Years of observations: 1981-1998

OBSERVATIONAL DATA FOR THE COMPILED CATALOG:

- FON-KIEV: 2260 plates, 24 752 709 stars and galaxies, epoch 1988.16, B color band, sky area from -04 to +90° on declination
- FON-KITAB: 1963 plates, 13 413 268 stars and galaxies, epoch 1984.97, B color band, sky area from -20.5 to -3.5° on declination
- FON-DUSHANBE: 1560 plates, B color band, sky area from -04 to +90 ° on declination

ADDITIONAL DATA:

- 1.2m Schmidt telescope, Baldone: 779 plates, U color band
- 1.2m Schmidt telescope, Baldone: 4656 plates, V color band
COMPONENTS OF THE COMPILED CATALOG:

- **FON-KIEV**: zone DE from -4 to +90 degrees, 24.7 million objects, \( B \leq 16.5^m \), \( \sigma_{\text{RA,DE}} = \pm 0.28'' \), \( \sigma_B = \pm 0.17^m \)

- **FON-KITAB**: zone of DE from -20.5 to +2.5 degrees, 13.4 million objects, \( B \leq 17.5^m \), \( \sigma_{\text{RA,DE}} = \pm 0.23'' \), \( \sigma_B = \pm 0.15^m \)

- **FON-DUSHANBE**: in progress, preliminary estimated \( \sigma_{\text{RA,DE}} = 0.33'' \), \( \sigma_B = 0.12^m \)

PHOTOMETRIC ENHANCEMENT:

- 1.2m Schmidt telescope, Baldone: 779 plates, U color band, in progress.
- 1.2m Schmidt telescope, Baldone: 4656 plates, V color band, in progress

STAR MAPS OF FON-KIEV AND FON-KITAB CATALOGS
Photometric determinations from plate images with two exposures.

Wide-angle observational material of FON project was obtained with two exposures of different durations shifted by both coordinates. The aim was to restore the characteristic curve for photometric determinations as a compiled one from two exposures in order to achieve the same accuracy for stars on the entire range of magnitudes.

The combined characteristic curve $1'$ has been obtained by shifting the characteristic curve of short exposure 2 by $\Delta B$ in order to continue the long exposition curve 1 to the region of faint and extremely faint stars with $B>13^m$. In practice, the curve $1'$ has been used for determination of photographic $B_{ph}$ magnitudes of objects registered on all 2260 negatives of FON collection.
Photometry from plate images with a single exposure.

The photographic material of Baldone Schmidt telescope was obtained with a single exposition. Fig. 4 presents the example of the characteristic curve from the Baldone digitized astronegative and the errors of its restoration.

The errors are given as the differences between calculated U-magnitudes and their photoelectric counterparts Upe versus rectangular coordinates X and Y, the distance from the plate center R, a color index B-V, and photoelectric magnitudes Upe.
The photometric system of the catalog.

FON observational material was exposed by telescopes-refractors. Due to this, the results of the photometric processing of digitized plates comprise a color equation.

Panels a and c show the trend of differences $\Delta B$ relative to $B_{pe}$ for Kyiv and Kitab parts of FON catalog. Panels b and d give the dependences of $\Delta B$ on photoelectric data $B-V$. The numbers of compared stars for parts of the catalog are 29,776 and 6135. Rms errors $\sigma_m$ of magnitude differences are $\pm 0.140^m$ and $\pm 0.156^m$ respectively. Panels c and d for Kitab demonstrate the conspicuous color equation with the value of $0.16(B-V)$ of star magnitude.
In publications [Akhmetov, 2016; Akhmetov, 2018; Protsyuk, 2016] the results of the comparison of three obtained (FON-Kiev, FON-Kitab) or being created (FON-Dushanbe) catalogs are given. The estimation of random accuracy of stars positions from the mentioned catalogs was performed by the Wielen method [Wielen, 1995].

Final dispersions were calculated for every sub-range of magnitudes. The results of the comparison of mentioned catalogs with PMA [Akhmetov, 2017], XPM [Fedorov, 2009], UCAC4 [Zacharias, 2013], PPMXL [Roeser, 2010]are represented in corresponding publications.

The external accuracy of stars position of catalogs of FON project is in a good agreement with their internal accuracy and equal from 50 and 300 mas for brightest and faintest stars respectively.