INTRAFRAME IMAGES' PROCESSING IN AUTOMATICALLY ASTEROIDS SEARCH PROGRAM COLITEC. V. E. Savanevich[1], A. M. Kozhukhov[2], A. B. Bryukhovetskiy[2], V. P. Vlasenko[2], E. N. Dikov[3], Yu. N. Ivashchenko[4], L. Elenin[5], V. N. Tkachov[1], [1]Kharkiv National University of Radioelectronics, 14 Lenin Av., 61166, Kharkiv, Ukraine (vadym@savanevych.com), [2]National Centre of Space Devices Control and Test, 97419, Evpatoria – 19, AR Crimea, Ukraine, [3]Recearch and Design Institute of Micrography, 1/60 Parkhomenko Lane, 61046, Kharkiv, Ukraine, [4]Andrushivka Astronomical Observatory, 3-7 Observatorna Str., 13400 Andrushivka, Zhitomir reg, Ukraine, [5]Keldysh Institute of Applied Mathematics RAS, 4, Mius Sqr., 125047, Moscow, Russian Federation.

Introduction: The intraframe images' processing is one of the main operations of automatic asteroids detection.

Statement of a problem. The condition of asteroids' observation can be considered as difficult and characterized by: low signal strength; irregular, in time changing background of the frames; "blurring" asteroids' signals, because of the atmospheric turbulence; deformation of asteroids' signals, due to the aberration of optical system.

The series of CCD-images are formed based on the observation results. Each one includes frames showing the same part of celestial sphere.

As a criteria for the method of the intraframe processing of series of CCD-images, we chose the best precision of estimation of the asteroid's equatorial coordinates under specified conditional probabilities of the correct detection and false alarm, and under reasonable calculating expenditures.

Description ot the method. The series of frames are subdivided into subseries; the frames of subseries join the accumulation of moving object's signals, and the obtained superframes are smoothed out by the digital filter. Then we carry out a preliminary selection of celestial objects' signals. It's based on the comparison between the spatial convolution criteria of received flux (in the vicinity of image peak) and form of estimated signal. Evaluation of coordinates and signals' amplitude on superframes (marks' formation) is based on the mathematical mechanism of classified samples using a model of noise photons' decline coordinates like a flat substrate [1]. Later on, we can see the combination of superframes from same subseries received for different hypothetic velocities of objects' visible movement; evaluation of equatorial coordinates of objects using astrometric reduction with even reference stars' selection and carrying out of iteration evaluation by least-squares method (LSM), rejecting abnormal observation on each iteration. During the formation of weighting generic LSM matrix of measurement's errors, we also consider dependence of errors' value in evaluation of equatorial coordinates on visible objects' brightness level and their coordinates on CCD-frames coordinate system [2].

Obtained results are represented as set of marks. These marks include evaluation of amplitude, equatorial coordinates of estimated celestial objects and other information.

Results. The present method of the intraframe images' processing can be seen in CoLiTec program. This program is used in automatic detection of asteroids. in Andrushivka Astronomical Observatory (telescope Zeiss-600 with the 0.6-m aperture, equipped with CCD-camera FLI PL09000) and also in the Russian remotely-operated observatory ISON-NM [3], located in the State of new-Mexico (USA) (astrograph Astroworks Centurion-18 with the 0.45-m aperture , equipped with CCD-camera FLI ML09000-65). 96 new asteroids were discovered by Andrushivka Astronomical Observatory during the experiment from May 2010 till December 2011 [4]. Due to CoLiTec program, for the first time on the territory of CIS, an unknown asteroid has been automatically discovered. Application of the program in the ISON-NM Observatory has greatly increased the quantity of discovered asteroids [5], within the period of December 1 2010 – December 10 2011 768 new asteroids were discovered [4].

On December 10, 2010 with the help of the program the comet C/2010 X1 (Elenin) has been discovered [6, 7]. It became the first comet discovered by the Russian astronomer since 1990 [8]. On July 7, 2011 another comet (P/2011 NO1) was discovered [9].

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