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PARTICIPATION OF THE CENTER OF ASTRONOMY OF THE AUTONOMOUS UNIVERSITY OF SINALOA IN THE INTERNATIONAL SCIENTIFIC OPTICAL NETWORK (ISON)

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This work describes the results obtained by the Center of Astronomy of the Autonomous University of Sinaloa (CA-AUS) from 2012 to 2017, within the ISON project.

About ∼7,000 artificial satellites have been launched to date, but only ∼1,000 are still active, the rest have significantly expanded the space debris population. Additionally, numerous explosions of satellite and rocket bodies, caused mostly by chemical batteries, residual propellant and, to a lesser extent, military tests, create thousands of pieces, most of which cannot be directly detected. The threat of collisions with space debris is the main reason for the creation of space debris tracking and surveying systems by countries having wide-ranging space programs, like the U. S., Russia and China. Passive optical observations remain the most efficient method for tracking and surveying of technogenic space debris in orbits higher than 2, 000 km above Earth's surface.

The CA-AUS carries out space debris observations in the optical range within the ISON project coordinated by the Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences. The ISON project currently consists of 44 telescopes, with apertures from 0.25 to 2 meters, at 34 observational sites in 16 countries, which ensures good coverage of geosynchronous orbits (GEO) at different longitudes. Additional detailed information on ISON can be found at `https://keldysh.ru/ckpmsot/`. The Cosala site from CA-AUS has several instruments of 22-25 cm aperture, covering 3.5-5.5 sq-deg of view. When sky is clear, automated observations are started. In surveying mode, the geostationary region at small phase angle, where GEO are usually brighter, is observed at least two times per night, before and after passing through Earth's shadow. In tracking mode, observations are also automated, according to a script containing the list of desirable GEO and high elliptical orbits objects and their observation parameters. For this purpose, the

Fig. 1. Cosala site of the CA-AUS.

TABLE 1

RESULTS OBTAINED FROM CA-AUS DATA

Year	# of nights	# observed hours	# of frames	New+ Found Objects
2012	88	794	146,612	2+0
2013	103	1030	167,473	2+0
2014	126	1027	183,229	3+3
2015	124	956	124,762	5+4
2016	159	1316	145,483	4+8
2017	164	1223	157,789	1+8
Total	764	6346	925,348	17+23

TAL-250K telescope was commissioned at the Cosala site in March 2018. For the adequate telescope operation and data processing, software toolkits using uniform script formats are implemented. Generally, about 80% of objects can be identified during automated image processing, for the remaining 20%, usually weak and/or peculiar objects, data is sent to the Processing Department of the CA-AUS for additional reprocessing of manually selected targets. Through continuous observations, since 2012 to 2017, very good results have been obtained: 925,348 images have been received during 764 nights, including observations that yielded 17 discoveries and 23 rediscovered objects. Table 1 shows the summary of such results, obtained in 5 years of observations.

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