EPSC Abstracts
Vol. 8, EPSC2013-985, 2013
European Planetary Science Congress 2013

Photometric follow-up of sungrazing comet C/2012 S1 ISON from OAdM and other observatories

J.M. Trigo-Rodríguez (1), C.E. Moyano-Cambero (1), Karen J. Meech (2), D. Rodríguez (3), A.Sánchez (4), and J.Lacruz (5)
(1) Meteorites, Minor Bodies and Planetary Sciences group, Institute of Space Sciences (CSIC-IEEC). Campus UAB, Facultat de Ciències, Torre C5-2ª planta. 08193 Bellaterra, Spain, (2) Institute for Astronomy, 2680 Woodlawn Drive, Honolulu HI 96822, USA, (3) Guadarrama Observatory, Villalba, Madrid, Spain, (4) Gualba Observatory, Barcelona, Spain, (5) La Cañada Observatory, Ávila, Spain (trigo@ice.csic.es / Fax: +34-93-5814363)

Abstract

Comet C/2012 S1 ISON was discovered on Sept. 21st, 2012 by Russian amateur astronomers Vitaly Nevski and Artyom Novichonok in the framework of a monitoring program called the International Scientific Optical Network (giving the acronym ISON from which the comet has been named). At discovery the comet was at a heliocentric distance of 6.29 A.U. and its magnitude was +18.8, but the computed orbit indicated that the comet was following a nearly parabolic orbit. The current orbit brings C/2012 S1 ISON to an extremely small perihelion distance of about 1 milion km on Nov. 28th, 2013. We have set up a multiband photometric monitoring of this sungrazing comet using 0.8m Telescope Joan Oró of the Montsec Astronomical Observatory (OAdM: www.oadm.cat) and several medium-size amateur telescopes with dedicated experience in cometary photometry [1, 2]. Comet sungrazers are interesting objects as they probably originate from the dynamical evolution of long period comets that typically end their lives colliding with the Sun [3]. They are though to be fragments of primitive ice-rich bodies gravitationally dispersed during the early stages of solar system evolution [4].

1. Introduction

Comet sungrazers are usually by detected by solar monitoring spacecraft such as the Solar and Helio-spheric Observatory (SOHO) for a period of only a few hours or days, but because it was discovered so far from the sun, comet C/2012 S1 ISON provides a unique opportunity to study the decay of one of these objects until its close perihelion. It is even possible that C/2012 S1 ISON will become one of the most spectacular comets of this century. For these reasons, we have selected this comet to be studied by our team inside the CSIC-IEEC comet multiband photometric monitoring program. Observations of the apparent coma diameter and multi-aperture photometry can be very relevant to compute several physical parameters associated with the activity of this comet, particularly once the size of the comet is determined using larger instruments. Another key reason to keep our telescopes following this object is its possible primeval chemical nature that could produce episodes of unexpected outbursts in its luminosity during its approach to perihelion. Such events are extremely interesting and are sometimes associated with cometary disruptions that need to be studied carefully to infer information on the internal structure of these objects [4]. Our team has demonstrated the importance of continuous follow up of pristine comets such as 29P/Schwassmann-Wachmann 1, among others [1-2]. From our observational experience, monitoring of this type of primitive comets can give clues to their nature, inner structure, and the physico-chemical processes playing a role in driving their cometary activity. The degree to which these comets are primordial, along with their carbonaceus nature has been suggested to be associated with their bulk physico-chemical properties [7].

2. Observational data.

We are currently conducting a ground-based photometric monitoring program of C/2012 S1 ISON using standard Johnson-Cousin filters following the same methodology explained in [2]. Due to our interest in learning about the development of the coma activity we have stacked guided exposures to achieve good signal/noise ratios to determine the presence or absence of cometary activity. This is done basically from the FWHM statistics of the imagery and building the respective photometric growth curves. We are also comparing imagery using different filters, and obtaining photometry night by night. The observatories are listed in Table 1.

Table 1: Observatories involved in the follow-up.

Observatory (MPC code)	Instrument
Gualba, Barcelona (442)	SC 36.0 f/7
Guadarrama, Madrid (458)	SC 25 f/10
La Cañada, Ávila (J87)	RCT 40.0 f/10
Lowell Observatory (688)	C 183.0
Montseny (B06)	T 20 f/6
Montsec Ast. Obs., OAdM (C65)	RCT 80.0 f/9.6

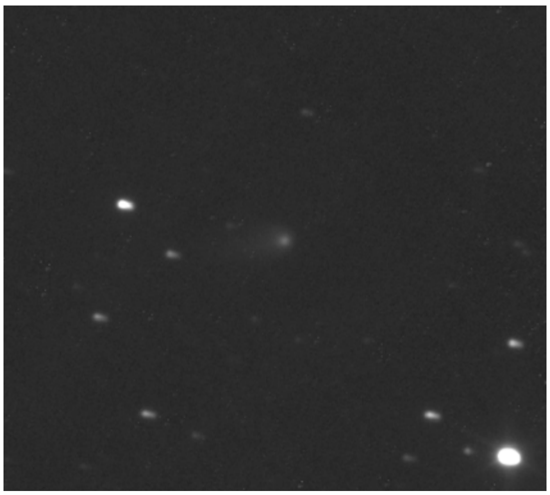

Figure 1: Image of C/2012 S1 ISON taken from OAdM Observatory on March 2.841, 2013.

3. Summary and Conclusions

So far we have monitored the comet since a month after its discovery when it was at a heliocentric distance of 6.2 AU until its approach to 5.2 AU. Little increase in cometary activity has been found so far from the study of the images. In the imagery taken during mid-Nov. 2012 we noticed an elongated coma at anti-solar-direction. During early January 2013 the coma had a small width of 15 arcsec that, taking into account the distance to Earth, is equivalent to a projected coma diameter of about 50,000 km for a heliocentric distance of 5.22 AU. A small tail has developed since then (Fig. 1). However, comet brightness expectations will be probably revisited as during the last months its magnitude has remained quite stable. For example, in the R band the photometry obtained by our group in the framework of this follow-up, the brightness exhibits a clear plateau (see Fig. 2).

References

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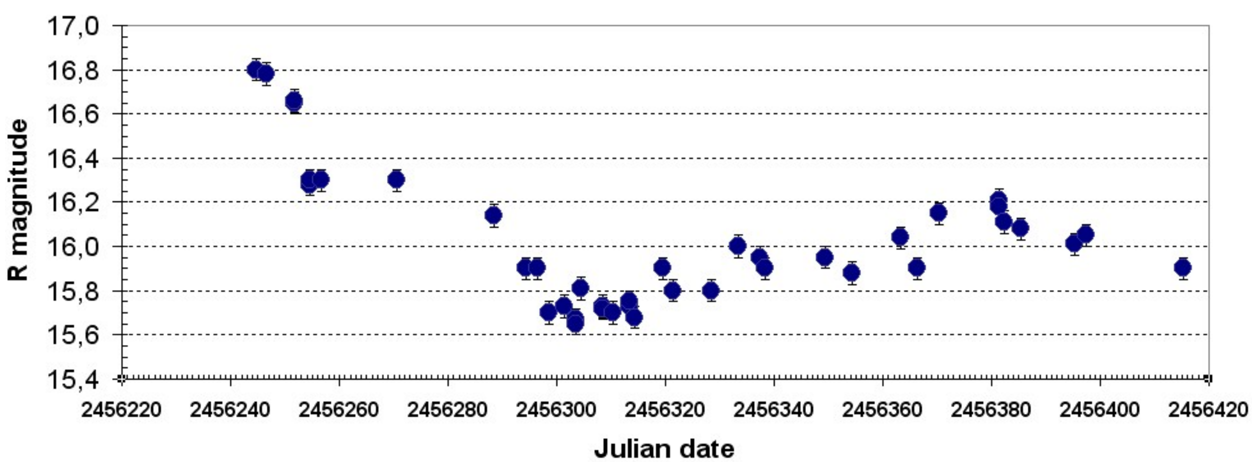

Figure 2. C/2012 S1 ISON photometry in the R band obtained for a 10 arcsec standardized aperture.