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Pro-Am Collaboration for Support of NASA Comet ISON Observing Campaign (CIOC)

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Abstract

From the initial discovery of C/2012 S1 (ISON) by Russian amateur astronomers in September 2012 [1] to the present day, amateur astronomers provide valuable resources of global coverage, data, and legacy knowledge to the professional community. The NASA Comet ISON Observing Campaign (CIOC) has leveraged professional-amateur collaborations via web and social media as part of its mission to facilitate a multi-spectral and multi-facility observation campaign that includes an armada of NASA's ground-based facilities, orbital observatories, and spacecraft. One of the most important goals of these pro-am collaborations is the monitoring of the morphological, photometric, and activity-related evolution of the comet.

1. Introduction

C/ISON may become one of the brightest of comets if predictions of its evolution are correct. Being a sun-grazing comet, C/ISON will pass very close to the Sun and Earth, with the possibility of becoming a Great Comet (GC). A GC is known to have a large nucleus, small perihelion and very close passage to the earth (perigee), making it a bright daytime object; belongs to the Kreutz sungazer family of comets, with long-periods (> 500 yr) and fragmented from one large comet centuries ago. The super-fragments then break into smaller, newer fragments that become GCs, according to the super-fragmentation cascading model [2]. Most GCs originate in the Oort cloud, and have proven to be unique; however, this set of comets is small. Examples of GCs are: P/Halley (in year 1066 and the only periodic comet); C/Kirsch (in 1680, and first comet to be discovered with a telescope); C/Ikeya-Seki (in 1965 and the brightest comet of the millennium); and comets Hyakutake, Hale-Bopp, McNaught and Lovejoy. Therefore, a coordinated global observing campaign for pre-perihelion characterization of this unique comet is necessary; post-perihelion observations will also be necessary, if the comet survives its passage around the sun, to identify the state of the comet nucleus, coma and tail; with the possibility of meteor showers and development of noctilucent clouds (NLCs) [3].

1.1. NASA Comet ISON Observing Campaign (CIOC)

NASA has requested a small group of cometary scientists to facilitate, support and coordinate the observations of this potential bright comet. The Comet ISON Observing Campaign (CIOC) goals include: (i) detailed characterization one example member of a subset of comets (sun grazers) that are usually difficult to identify and study in the few hours before their demise; (ii) ensure that observations acquired during the long period leading to perihelion in November 2013 address the important science questions; and (iii) provide a forum to foster collaborations amongst investigators. The NASA CIOC goals and other related information are provided on their website (http://sungrazer.nrl.navy.mil/index.php?p=ison).

2. Role of Amateur Astronomers

Since the discovery and initial observations of the comet were made by amateur astronomers, it is important to involve the amateur astronomers community in the CIOC. The easy access to the web, social media and other scientific resources and tools available to any comet scientist and immediate sharing of results with both scientists and the public defines a unique role and niche for amateur astronomers. The CIOC responded by embracing social media (Facebook, in particular) and the web for collaborations; sharing of observations and results between the scientific community, the amateur astronomers and the public.

2.1. NASA CIOC via Facebook

NASA CIOC established a Facebook presence (https://www.facebook.com/groups/482774205113931/)

to bring together the professional, amateur, and EPO communities to keep each other – and the public – abreast of ISON-related developments. Many of the amateur astronomers are knowledgeable observers that provide a near-continuous, rapid-response global observing network. This approach has proven to be successful for ground-based observations of Jupiter, Saturn and recently C/Hartley2 [4, 5]. Building on this resource, the CIOC Facebook presence includes members from the scientific, amateur, science outreach/education, public from around the globe. Members, by invitation or request, provide the details of their equipment, location and observations and post their observations to both share and provide a forum for interactive discussions. Other activities facilitated are: (a) guidelines for observations and their logs are provided and updated as deemed necessary by the scientists for useful data; (b) links to recent science press releases (e.g., SWIFT and HST observations), related articles and posts are shared amongst the members; and (c) robotic telescope networks use the Facebook page to inform the members of mini-observing campaigns and outreach. This transformative approach to science and outreach has already provided interesting results about the brightening of the comet soon after its discovery to its recent steady magnitude [6,7].

2.2. Amateur Observers' Program (AOP)

Continuing the collaboration between professional and amateur observers, the CIOC will utilize the existing resources of the Amateur Observers' Program (AOP). Based at the University of Maryland, the AOP was originally structured to support the 9P/Tempel 1 observing campaign during the Deep Impact mission, and was updated to support the Vesta observing campaign for Dawn and again to observe Hartley 2 during the EPOXI mission.The AOP's longstanding objective has been to engage amateur observers in observing the target bodies of NASA's small body missions as well as other comets and asteroids of interest.The AOP web site (aop.astro.umd.edu) includes Beginner, Intermediate and Advanced Guides (tutorials on various topics in observing); star charts showing the target's location in the sky for different dates and latitudes; and a gallery in which registered observers can post their text descriptions, scanned sketches, and digital images. For the CIOC, the site was/will be updated to include other topics such as data archiving to encourage the experienced observers to submit their data to the Planetary Data Systems Small Bodies Node which is also at the University of Maryland.

3. Summary and Conclusions

The long lead time between initial discovery of C/ISON in September 2012 and its perihelion in November 2013 provides a rare opportunity for the scientific and amateur astronomer communities to study a sungrazer comet on its initial (and possibly only) passage through the inner solar system. The collaborations between professional and amateur astronomers is necessary to properly characterize the comet. These collaborations, once an occasional connection, are now becoming essential and necessary, changing the paradigm of research. Unlike Citizen Science, these interactive and collaborative activities are the equivalent of Inverse Citizen Science, with the scientific community relying on the amateur astronomer community and its data to develop research strategy for observations and an outreach bridge to the public.

Acknowledgements

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