

# The PACA Project : Pro-Am Collaborative Astronomy

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## Abstract

The Pro-Am Collaborative Astronomy (PACA) project is the next stage of evolution of the paradigm developed for the observational campaign of C/2012 S1 or C/ISON. Four different phases of collaboration are identified, and illustrate the integration of scientific investigations with amateur astronomer community via observations, and models; and the rapid dissemination of the results via a multitude of social media for rapid global access. The success of the paradigm shift in scientific research is now implemented in other comet observing campaigns. Both communities (scientific and amateur astronomers) benefit from these collective, collaborative partnerships; while outreach is the instantaneous deliverable that provides both a framework for future data analyses and the dissemination of the results. While PACA identifies a collaborative approach to pro-am collaborations, given the volume of data generated for each campaign, new ways of rapid data analysis, mining access and storage are needed.

## 1. Introduction

The interactions of amateur astronomers with professional astronomers have changed significantly in the digital era, from an occasional exchange of individual images to a sustained collaboration. Today, amateur astronomers, with sophisticated equipment and software, provide several valuable resources to the professional observers/astronomers: a large source of manpower, or extension of the professional astronomer's group via coordinated global networks of amateur astronomers; a vast collection of data that provides both legacy and temporal information and finally, as ambassadors of science, help build bridges between the scientific and public communities. From the professional astronomer/scientist's perspective, given the vast amounts of data acquired through various projects, the natural progression to interactive collaborations between these two communities is tremendously beneficial both for developing strategies for observations and modeling of the data. This approach

has proven to be successful for ground-based observations of Jupiter, Saturn and recently C/Hartley2. These collaborations, once an occasional connection, are now becoming essential and necessary, changing the paradigm of research. The additional inclusion of various social media transforms the pro-am collaborations into coordinated observing campaigns, with science as the primary result and immediate dissemination of the results and global outreach providing latest observations and science.

## 2. Integration of Social Media

I will highlight this approach for the Comet ISON Observing Campaign in 2013, with the variety of science results and ensuing data campaigns for other scientific investigations involving the varying dust morphology of the comet and the development of long gossamer-like tails, exhibiting disconnection events and thereby, providing data for the probing and study of the structure of the heliospheric current sheet at various radial locations from the sun. The Comet ISON Observing Campaign (CIOC) goals (<http://www.isoncampaign.org>) were: (i) detailed characterization of an Oort-cloud sungrazer comet, C/ISON; and (ii) facilitate collaborations between various investigators for the best science possible. Some of the tangible products were: (a) the creation of CIOC\_ISON, a professional - amateur astronomer collaboration network established on Facebook, with members from the scientific, amateur, science outreach education, public from around the globe, (b) Pinterest board to showcase the latest and best images by the amateur astronomes; and (c) creation of slide shows on Vimeo to illustrate the evolution of comet via temporal images from around the globe. Many of the amateur astronomers are knowledgeable observers that provide a near-continuous, rapid-response global observing network. The success of this approach provided a platform to showcase both science results and aesthetically beautiful images and also provided an alternate approach for lack of dedicated missions to Oort-cloud comets.

### 3. Results

Several interesting results emerged from this campaign:

- (1) The establishment of a network of astronomers (professional, amateur, modelers, media and bloggers) that can be galvanized into action on short notice to support observational campaigns organized by professional astronomers;
- (2) assist in various science investigations pertinent to the campaign;
- (3) provide an alert-sounding mechanism should the need arise;
- (4) immediate outreach and dissemination of results via our media/blogger members;
- (5) provide a forum for discussions between the imagers and modelers to help strategize the observing campaign for maximum benefit.

(6) Four of the six winners of the US National Science Foundation (NSF) global Comet ISON Photo Contest are members of our Facebook group, CIOC\_ISON.

Some of these results will be presented to highlight the evolving role of amateur astronomers in a variety of ground-based observing campaigns, relating to comets and planets and various opportunities for future PACA campaigns will be showcased.

### 4. Summary

The integration of science, observations by professional and amateur astronomers, and various social media provides a dynamic and evolving collaborative partnership between professional and amateur astronomers. This framework, developed during the observing campaign of C/ISON in 2013 now forms the bases for two current observing campaigns: CIOC\_SidingSpring (C/2013 A1 as it passes by Mars in October 2014) and PACA\_67P (ESA/Rosetta mission target, 67P/Churyumov-Gerasimenko (CG) as it approaches perihelion in August 2015).

### Acknowledgements

I wish to acknowledge and thank the members of the CIOC Team, and CIOC\_ISON, CIOC\_SidingSpring and PACA\_67P Facebook groups for discussions and sharing of images to develop the new paradigm for pro-am collaborations.