Pathways from Pro-Am Collaborations to Citizen Science via OSCAR.

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Abstract: The empowerment of amateur astronomers vis-à-vis their partnerships with the professional scientists creates a new demographic of data scientists, enabling citizen science of the integrated data from both the professional and amateur communities. The resultant product is OSCAR (Observer to Scientist Comet ARchive).

Introduction: The nature of The Pro-Am Collaborative Astronomy (PACA) project evolved from the observational campaign of C/2012 S1 or C/ISON in 2013. Following the success of the professional-amateur astronomer collaboration in scientific research via social media, it is now implemented in other comet observing campaigns. While PACA identifies a consistent 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. In 2014, two new comet observing campaigns involving pro-am collaborations have been initiated: (1) C/2013 A1 (C/SidingSpring) and (2) 67P/Churyumov-Gerasimenko (CG), target for ESA/Rosetta mission. The evolving need for individual customized observing campaigns has been incorporated into the evolution of PACA portal that currently is focused on comets: from supporting observing campaigns of current comets, legacy data, historical comets; interconnected with social media and a set of shareable documents addressing observational strategies; consistent standards for data; data access, use, and storage, to align with the needs of professional observers. 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. The empowerment of amateur astronomers vis-à-vis their partnerships with the professional scientists creates a new demographic of data scientists, enabling citizen science of the integrated data from both the professional and amateur communities. The resultant product is OSCAR (Observer to Scientist Comet ARchive).

OSCAR, Data sets and Crowdsourcing: With the focused observing campaigns of comets such as C/ISON and C/SidingSpring and Rosetta mission target of 67P/Churyumov-Gerasimenko (CG), the two communities (professional and amateur) have unique data sets that will be helpful as references and allow more insightful analyses to the information contained in comets, when the data is crowdsourced. The fledgling OSCAR (Observer to Scientist Comet ARchive) program, is an end-to-end interactive program to convert the observations acquired by amateur astronomers into the FITS format preferred by professional observers and scientists. PACA provides a virtual meeting place for observers to share their data, observing strategy and specifications of their images. However, the amateur data besides the beautiful images that are also produced, are not of scientific value unless the amateurs utilize similar procedures, filters and proper calibrations, for the data to be scientifically viable. Following these steps, the amateur data can be analysed in several ways:

(1) The calculation of Afrho, a parameter defined by M. A'Hearn, is a proxy for the dust production/activity of the comet. Afrho is independent of the physicals differences of the observer's equipment, for a given filter. The evolution of Afrho provides an insight into the changes in dust level of the comet, which in turn provides a way to characterize comet by their activity.

(2) Correlative study/taxonomy of long- and short-period comets, based on the collective data taken by amateur astronomers over the past several decades.

(3) Focused characterization of various comets, including C/ISON, C/Siding Spring, and 67/C-G, recent high-profile targets of three separate independent observing campaigns, will be compared to the reference data base (identified in items 1 and 2).

(4) The submission of these data sets/collections into the PDS ensures the preservation, proper (re-) calibration and tools for enhanced scientific analyses.