



## EPSC2014-838: Resurrecting Bobrovnikoff to produce crowd-sourced cometary light curves using DSLR photometry

Programme Group: AM2/OEP5 Citizen Science: Intersection of Professional - Amateur Astronomy  
Presented: Thursday, 11 September 2014 in Estoril, Portugal

Hello everyone, my name is Simon White. I come to this meeting not just as an amateur, but also pretty much as a complete beginner.

I was the boy who forgot he was interested in astronomy, then remembered in his mid-fifties. Please join me for the next few minutes right at my end of the Pro-Am bell curve!

### Resurrecting Bobrovnikoff to produce crowd-sourced cometary light curves using DSLR photometry



Simon White  
EPSC 2014



C/2011 L4 (PANSTARRS) 30 April 2013

My astronomy activities so far have been dominated by my interest in DSLR photography. In effect, taking pretty pictures of the night sky, especially comets, and presenting them at my local astronomy club and online.

The emphasis on comets brought me onto Padma Yanamandra-Fisher's radar screen, leading to her outrageous suggestion that I should submit a paper to the EPSC, so thank you Padma for putting me on this stage today.

I do want to progress beyond pretty pictures, so

next month I start my part-time astronomy degree, which should take about six years.

You will see from the abstract that I refer to this as a "developmental" paper, which means I have come up with an idea and would like to pursue it, perhaps as part of my studies.

Presenting comet photos to astronomy club, the most frequent question is "how bright will it become?" It turns out that comet magnitude is a tricky subject. Visual magnitude for a point object is easy to grasp, but magnitude for a diffuse object is not so straightforward.



C/2012 S1 (ISON) 15 November 2013



Searching for guidance on how to approach the subject, I stumbled across this out of print journal article.

I love the idea that the historical archive of comet magnitude data is full of readings taken using methods which, by today's standards, would seem curious if not downright crazy.

The "Bobrovnikov" method (or with slight variation, the Sidgwick method) is based on memorising the appearance of the comet, moving your telescope to one of the designated reference stars, putting it out of focus so that the star is as diffuse as the comet and then asking yourself how

it compares with your recollection of the comet that you memorised.

This seems about as unscientific a way to take measurements as it is possible to conceive, but it presents the amateur with an ideal opportunity for experimentation and study of method, and one of my aims today is to invite other amateurs to join me in this project.

I have tried to reproduce Bobrovnikov's method, using a DLSR.

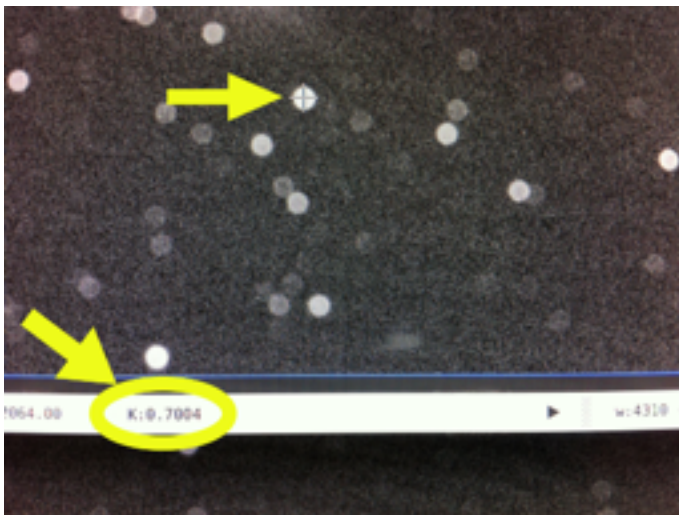
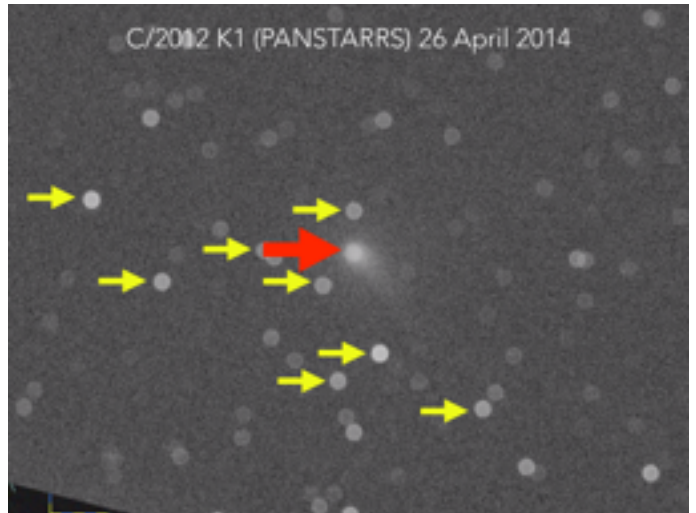
Here's my capture of C/2012 K1 (PANSTARRS) from April this year. Calibrated, stacked and ready to submit to the British Astronomical Association's comet image archives.



Here's a single frame, unprocessed. The stars are points, the comet is diffuse.

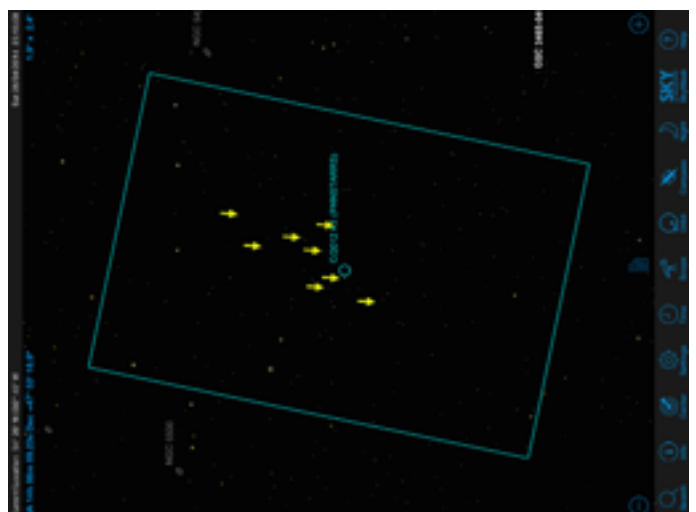
Here's a single frame out of focus so that the stars look like the comet nucleus. The image histogram has been stretched to make the task easier.

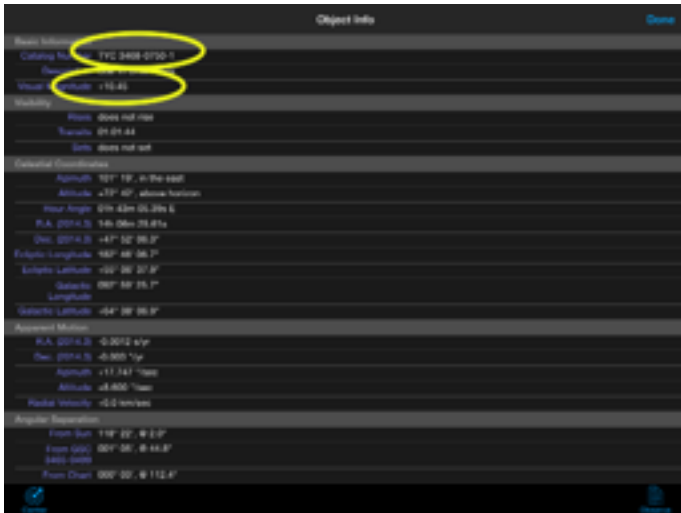
If we can identify the magnitude of these stars [YELLOW ARROWS], we can determine the magnitude of the comet [ORANGE ARROW], because...



...we can read the on-screen brightness of the pixels in these diffuse circles using just about any image processing software.

Here's the same field on SkySafari, where I can click on each star...

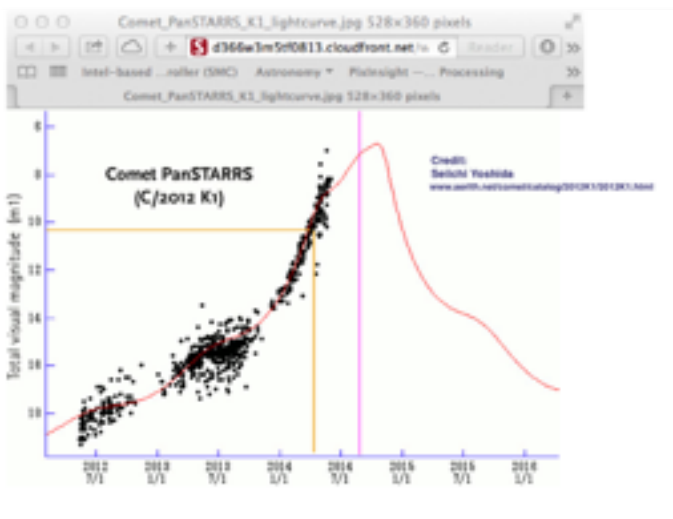
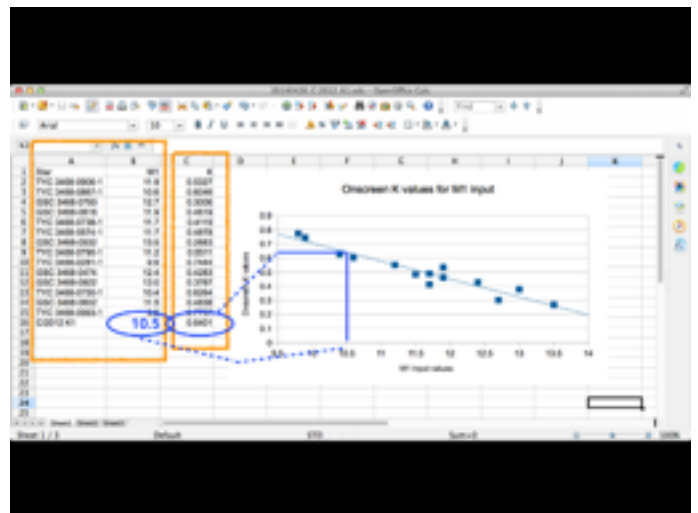




...to be told its magnitude.

Here are those stars and their known magnitudes, with the onscreen brightnesses of the stars and of the comet.

By plotting the stellar magnitudes against the brightnesses, we can calculate the magnitude corresponding to the onscreen brightness of the comet.



Given sufficient readings, the light curve - the line of best fit from the data, can be calculated and plotted. When I compare my reading from late April [ORANGE LINE] it's encouraging.

So why don't I just choose a comet and get on with it?

Well, I'd love to, but although I live in one of the most beautiful parts of the UK, it is cloudy, on average, about four weeks per month. So I need more enthusiasts to collect data: single frame DSLR photos, slightly out of focus.

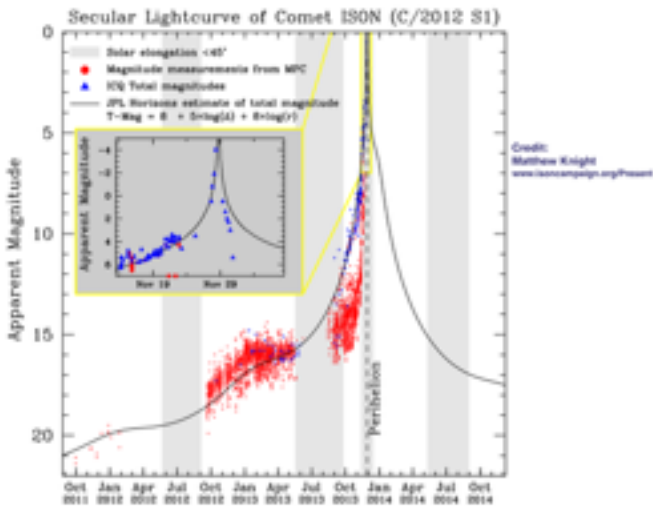


Yes, there are endless technical questions and objections. Should we calibrate the frames to eliminate the sky background? Should we extract total luminance or just the green pixels as being closest to visual? Does it matter that different cameras have different specifications of colour filter arrays? Should we standardise our reference star catalogue? Should we all use the same software to analyse the onscreen brightness?

My standard response to these questions has become "NO" or "IT DOESN'T MATTER", because by gathering a large quantity of data it should be possible to eliminate the effect of these objections.

While the professionals seek to take "more accurate measurements", I believe we might arrive at the same answer by simply taking "more measurements". If the volume of data is big enough, statistically the answer lies in the middle.

Yes, most of this has been done before, but perhaps not using DSLR photos to mimic Bobrovnikov's visual method. Various resources are also available: you can download light curves from data sets, and you can automate the reading of the on-screen brightnesses. But the purpose here is to be a learning project, so I would like to do as much as possible without these resources.



I finish with this thought: here is the light curve for C/2012 S1 (ISON). The adventure of chasing ISON was one of the steps that got me here today.

Look at the vertical spread of the readings. Not only are readings submitted to the MPC and the ICQ not in agreement with one another, but they vary by as much as 5 magnitudes in a given measurement interval. On a logarithmic scale, that's a one-hundred-fold variation. Surely we can do at least as well as this.

Resurrecting Bobrovnikov to produce crowd-sourced cometary light curves using DSLR photometry



**Simon White**

[simon.white@simoninthelakes.co.uk](mailto:simon.white@simoninthelakes.co.uk)

[www.simoninthelakes.co.uk](http://www.simoninthelakes.co.uk)

So, please get in touch with me, or help spread word of this project if you think it might be of interest. Thank you for listening!