Photometry of comet 67P/Churyumov-Gerasimenko with *K2*

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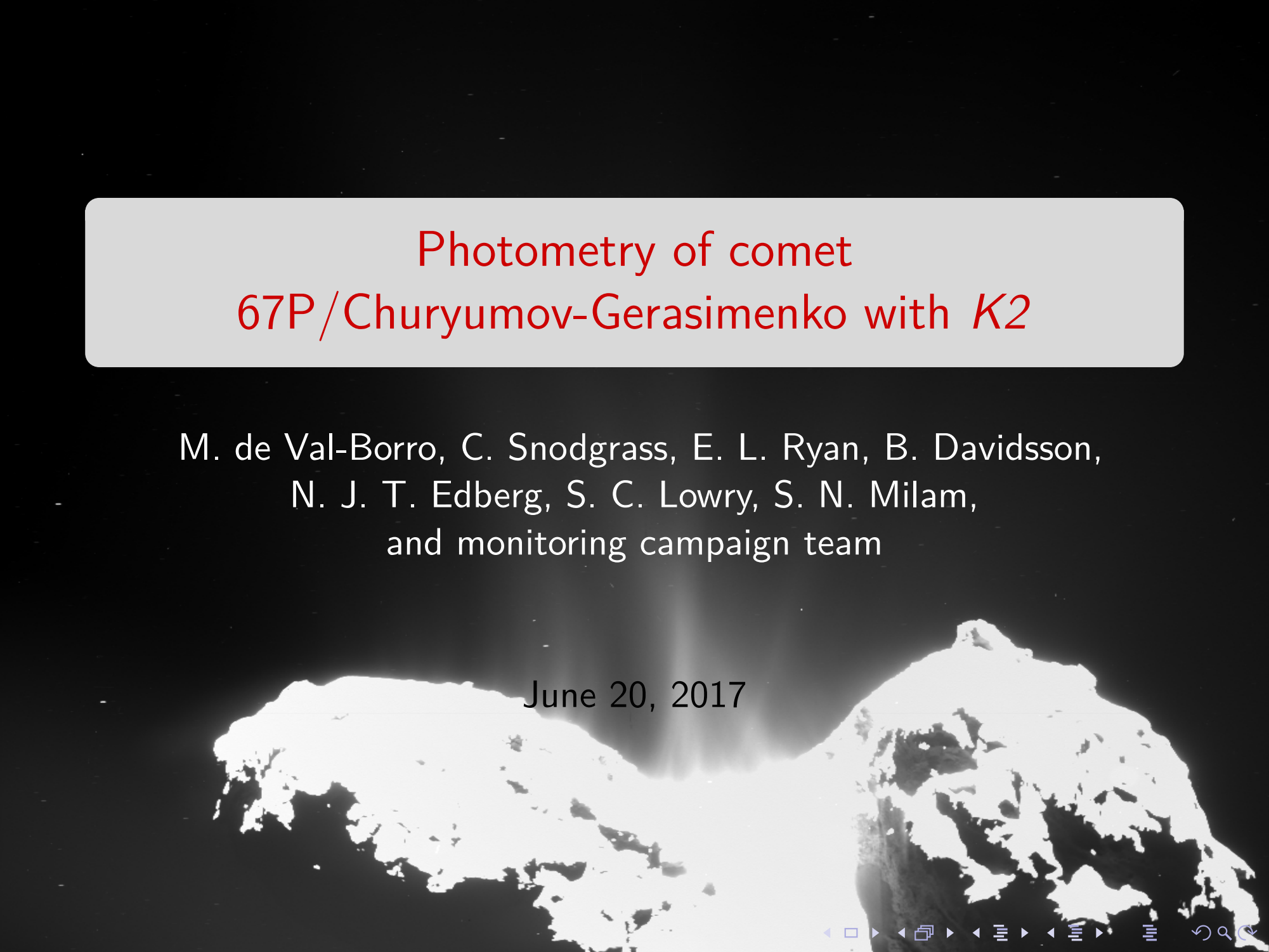
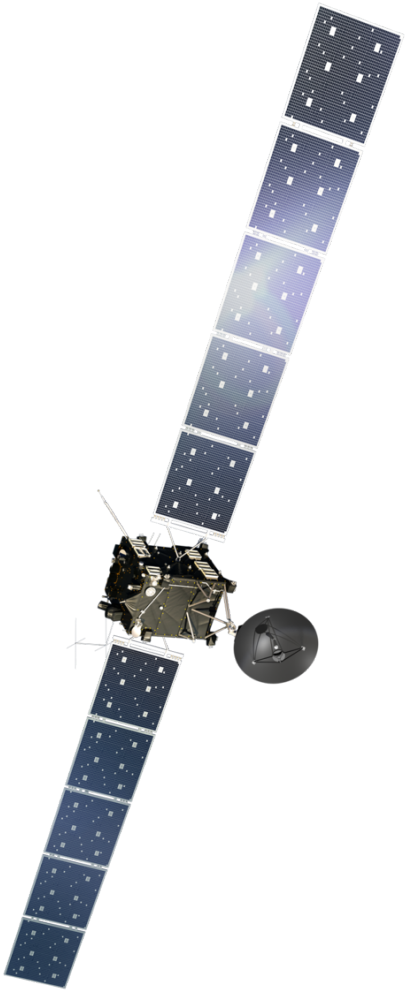


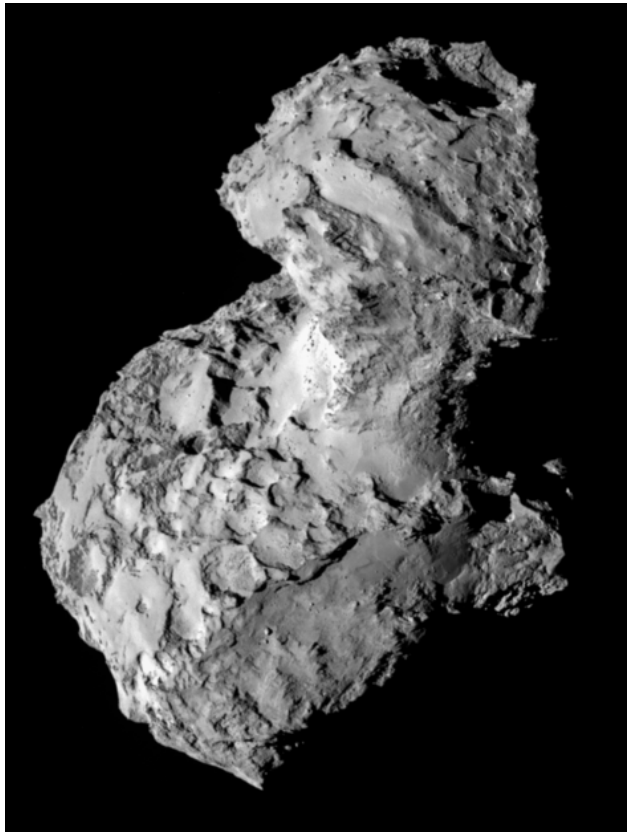
ESA's Rosetta mission



- Comets are the best-preserved material from the beginning of our planetary system
- ESA's Rosetta was the first mission to orbit and land on a comet to monitor its evolution
- 10 instruments on board to study structure and composition
- Launched in 2004, rendez-vous with 67P on 6 Aug 2014
- Descent of the Philae lander occurred on 12 Nov 2014
- Controlled impact in Sep 2016 allowed further data acquisition at very close distances

67P/Churyumov-Gerasimenko

- JFC discovered in 1969
- 4×4.5 km with two-lobe shape resulting from a low-velocity collision
- varied geological features (pits, cliffs, layers, boulders. . .)
- density $470\,\mathrm{kg\,m^{-3}}$
- porosity 70%
- surface temperature 200 K
- rotation period 12.4 hours
- average albedo 0.06
- D/H ratio 5.3×10^{-4}



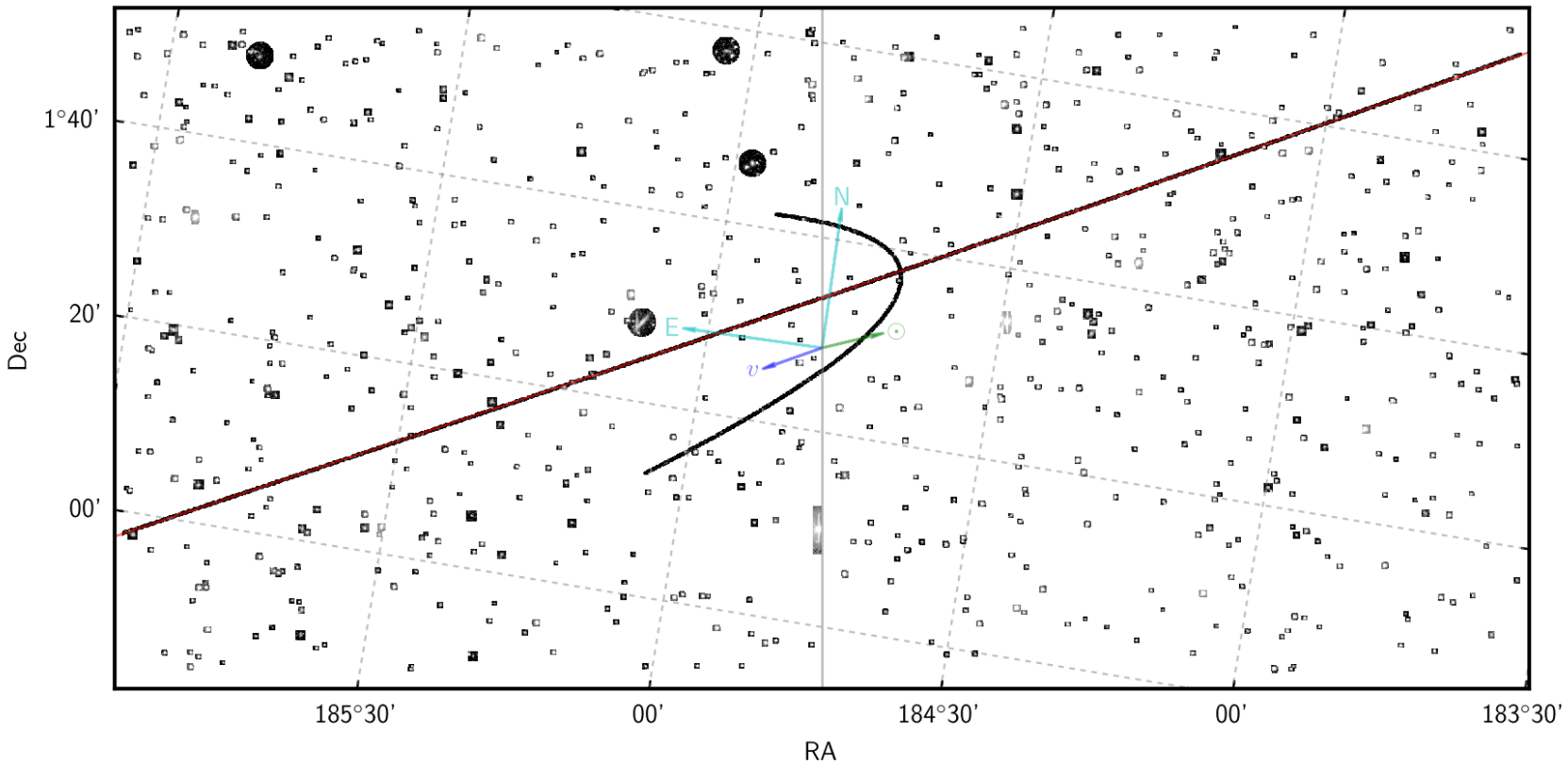
67P remote observing campaign (Snodgrass et al 2017)

- Similar to other campaigns that were carried out for comets that were targets of spacecraft flybys (81P and 103P)
- 67P orbit was characterised with high precision by ground-based observations before the arrival of the spacecraft in 2009
- Monitor coma activity in larger scales beyond Rosetta's orbit
- Remote observations of 67P allow for a comparison with the interpretation used for other comets not visited by a spacecraft
- Carry out observations wich are not available with Rosetta instruments

Observing sites

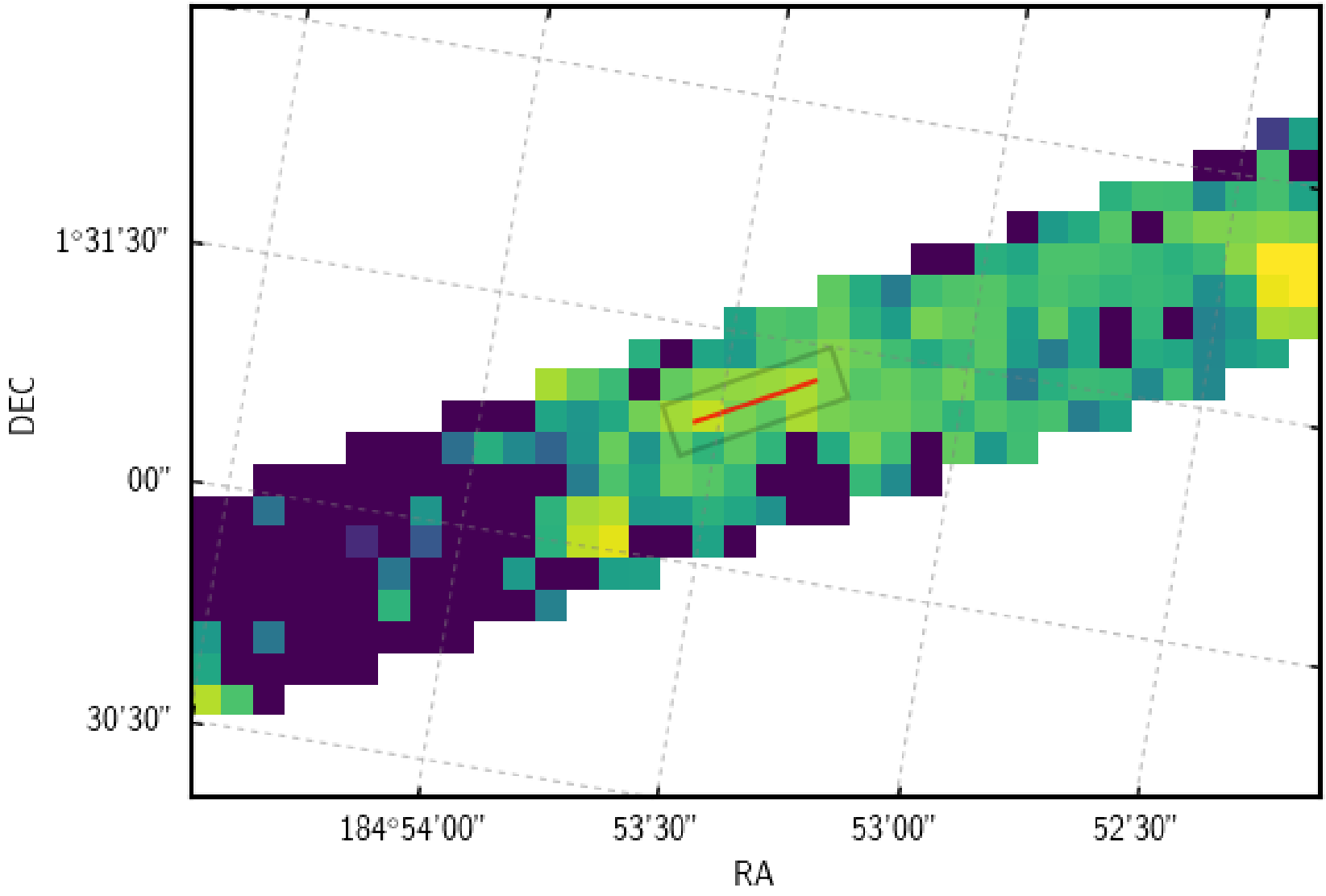
- Participating observatories in ground-based campaign (Snodgrass et al 2017, arXiv:1705.10539)
- `http://www.rosetta-campaign.net/observations` for a searchable log

K2 observations in Sep 9-17 2016



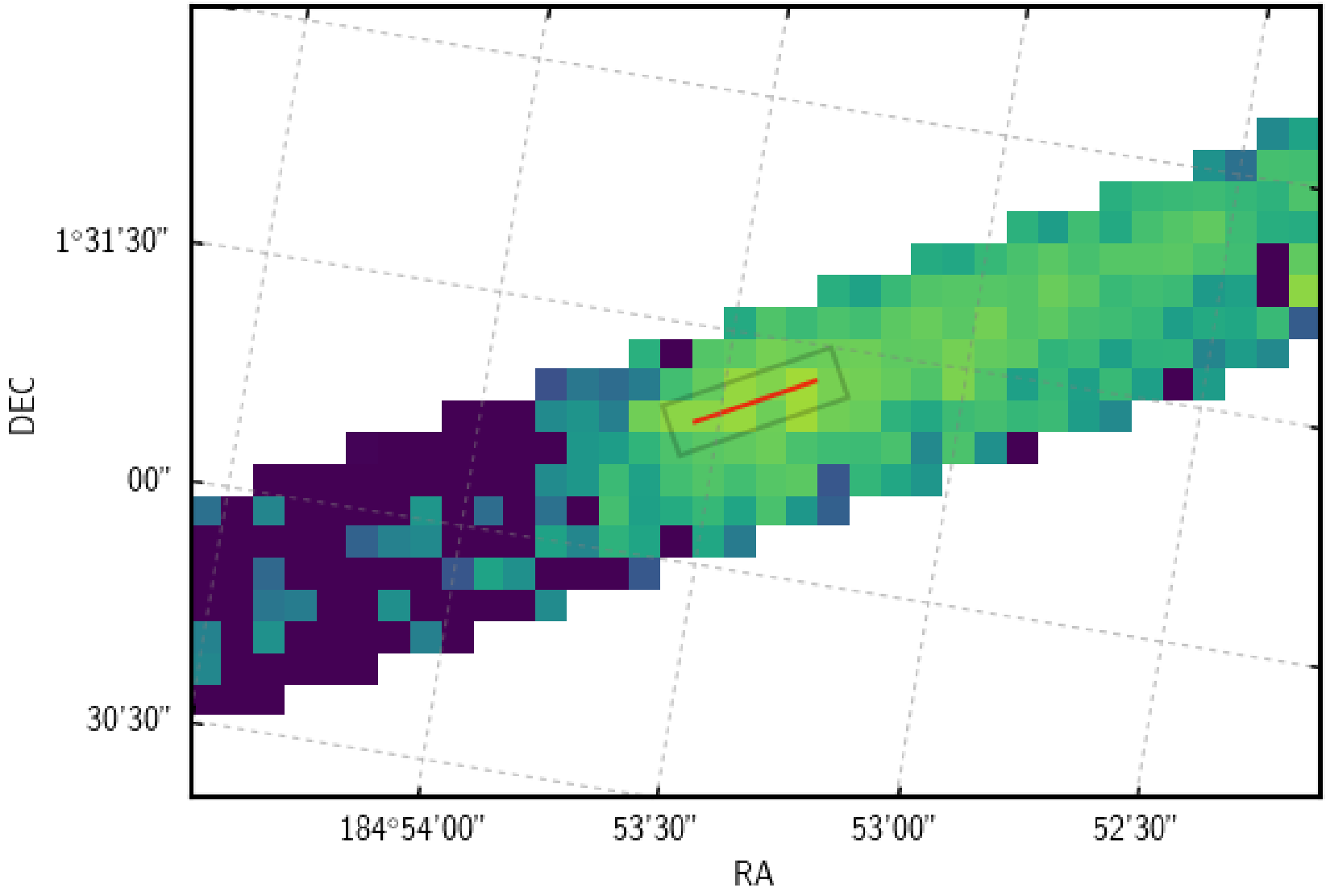
Mosaic of channel 69 and 70 in *Kepler*'s CCD module 21 consisting 3487 target pixel files.

Differential imaging photometry



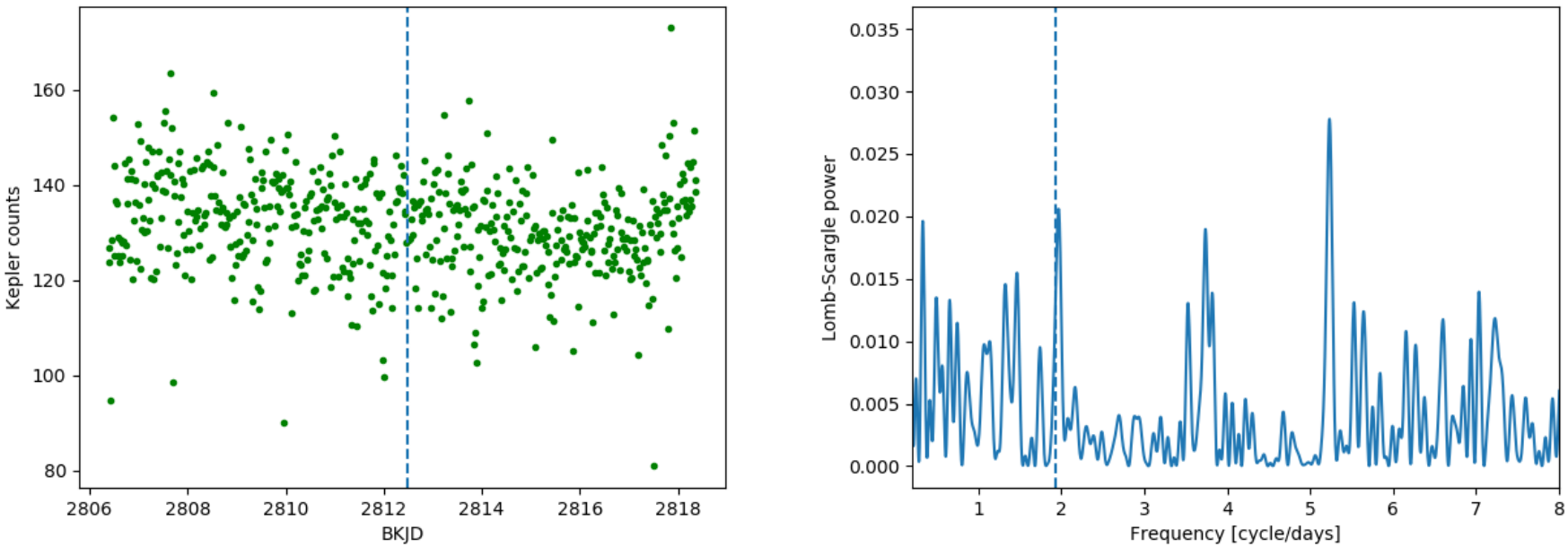
Pixel stamps around comet 67P/Churyumov-Gerasimenko in channel 69

Differential imaging photometry



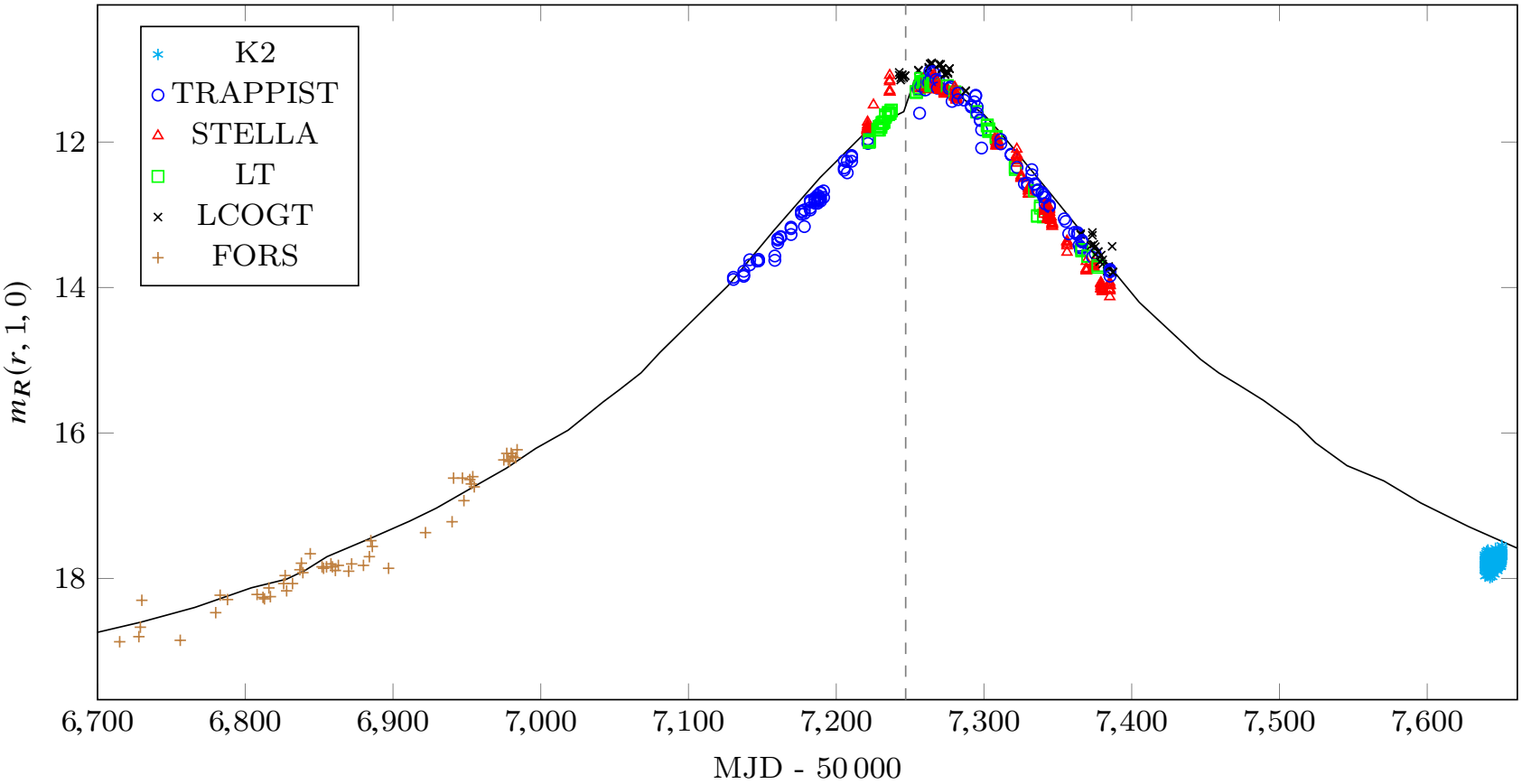
Pixel stamps around comet 67P/Churyumov-Gerasimenko in channel 69

67P/Churyumov-Gerasimenko K2 light curve



Light curve of 67P/Churyumov-Gerasimenko. The dashed vertical line indicates the cadence at which the comet passed from channel 70 to 69.

67P/Churyumov-Gerasimenko light curve



- Light curve measured by *K2*, VLT/FORS and ground-based robotic telescopes within $\rho = 10\,000$ km
- Measurements of total *R*-band magnitude corrected to unit geocentric distance and zero degrees phase angle against r_{h} (Snodgrass et al. 2016b,a).

Conclusions

- We have studied the short-term variability of comet 67P/Churyumov-Gerasimenko using *K2* in long-cadence mode during Sep 9-17 2016
- At this time Earth-based observations were no longer possible
- We confirm the empirical predictions for the activity of the comet at a heliocentric distance using a photometric aperture with a projected radius of $\rho = 10\,000\,\mathrm{km}$
- Brightness is well described by the post-perihelion prediction with a power-law relationship of the form $\propto r^{-5.6}$
- We plan to make the reduced data from the 67P campaign available to facilitate comparison with Rosetta results

References I

Snodgrass, C., Jehin, E., Manfroid, J., et al. 2016a, A&A, 588, A80

Snodgrass, C., Opitom, C., de Val-Borro, M., et al. 2016b, MNRAS, 462, S138