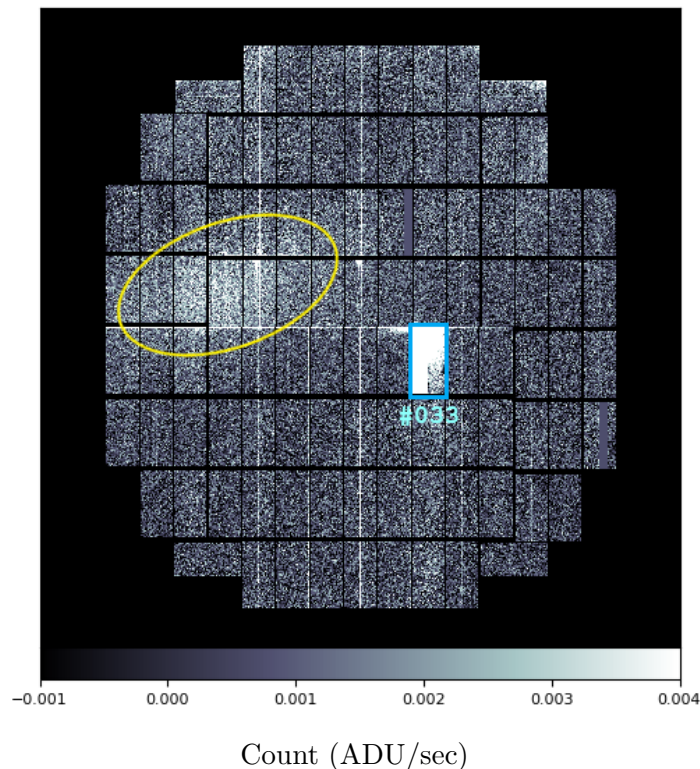


# Stray light on HSC dark frames

Apr 06, 2020 T. Teraï

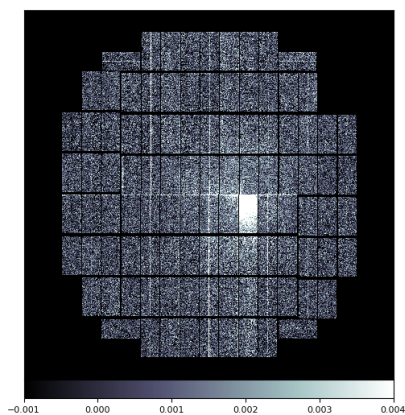
( revised on Nov 23, 2020 )

- A diffuse stray light was found on a portion of 300-sec dark images taken as science calibration data under a fixed condition where the dome and mirror cover were closed.
- The stray light spreads over multiple CCDs centered on the CCD #081 (1.28) with an intensity of  $\sim 0.003$  ADU/sec.
- As a result of our inspection, it turned out that only dark frames with **the  $r$  band (i.e., HSC-r and HSC-r2)** have this stray light.
- The source and optical path of the stray light are still under investigation.

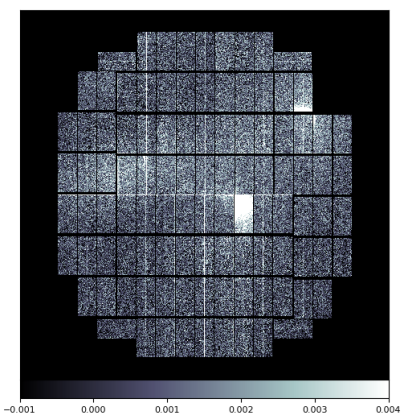


A dark frame with the HSC-r2 filter. The yellow line shows the area of the stray light. Note that the light emitted from the CCD #033 (0\_20) is a known issue since 2016.

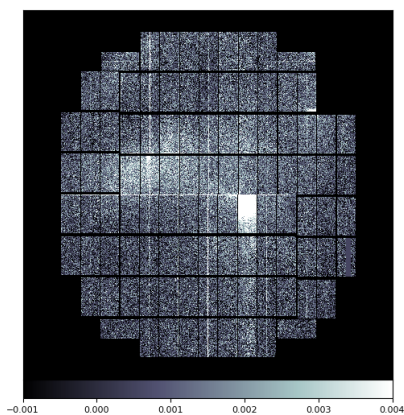
- Dark frames created from  $5 \times 300$  sec exposures (2014 Mar – 2016 Jan)



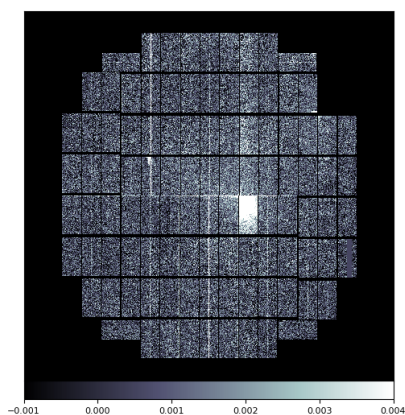
2014-03-29 UT, HSC-g



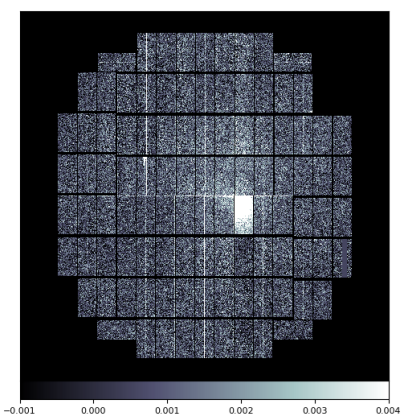
2014-07-05 UT, HSC-r



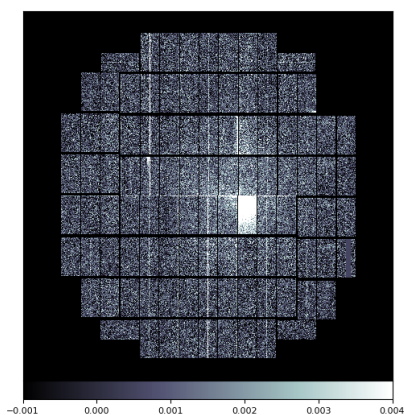
2014-09-20 UT, HSC-r



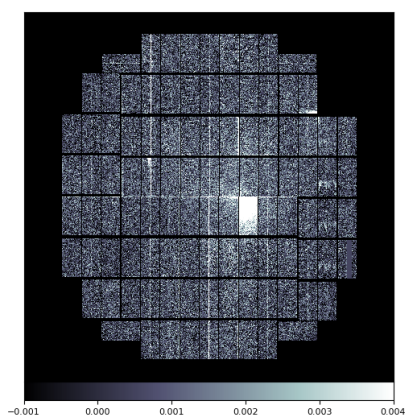
2014-11-14 UT, HSC-i



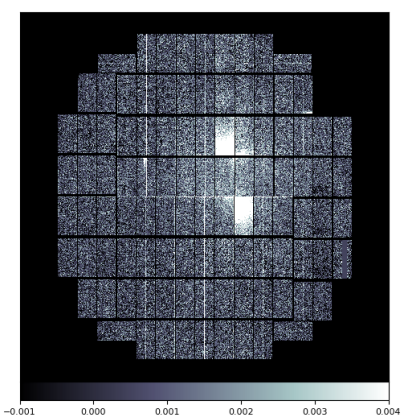
2015-03-31 UT, HSC-i



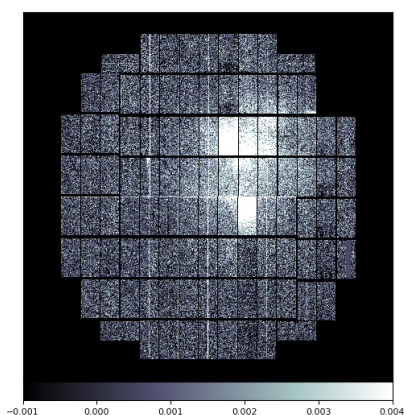
2015-05-14 UT, HSC-g



2015-07-10 UT, HSC-i



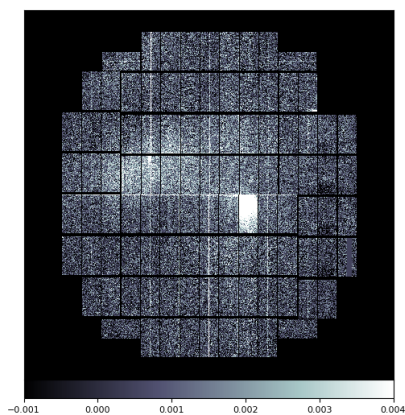
2015-11-09 UT, HSC-i



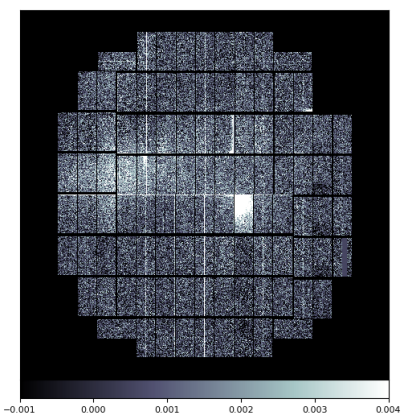
2016-01-14 UT, HSC-g



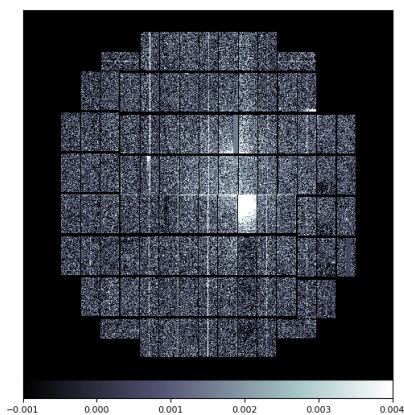
- Dark frames created from  $5 \times 300$  sec exposures (2016 Feb – 2016 Dec)



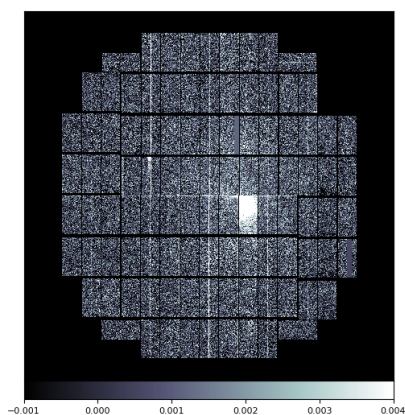
2016-02-04 UT, HSC-r



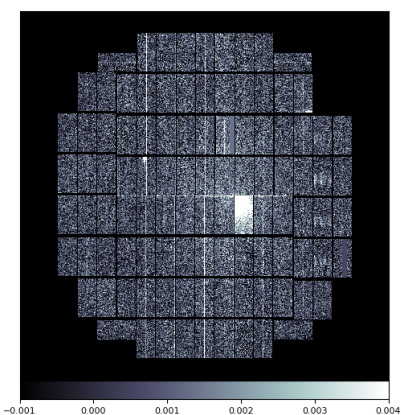
016-03-17 UT, HSC-r



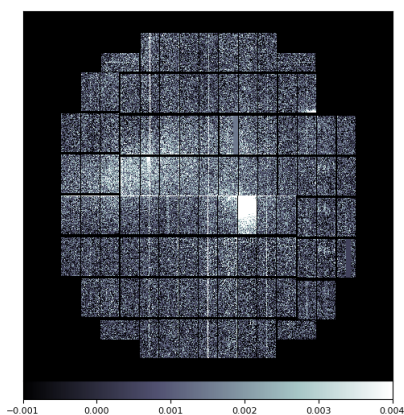
2016-04-13 UT, HSC-g



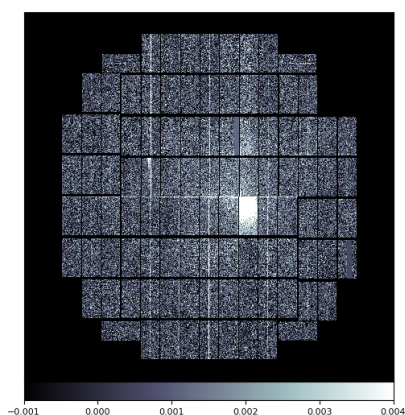
2016-06-06 UT, HSC-g



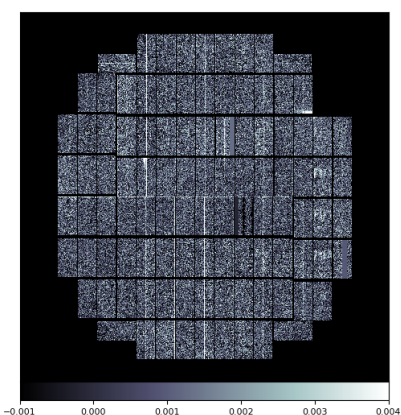
2016-07-30 UT, HSC-g



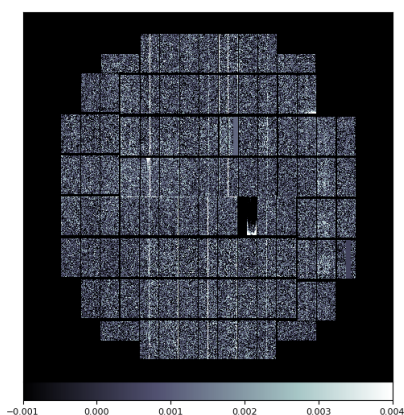
2016-08-25 UT, HSC-r2



2016-09-28 UT, NB0387



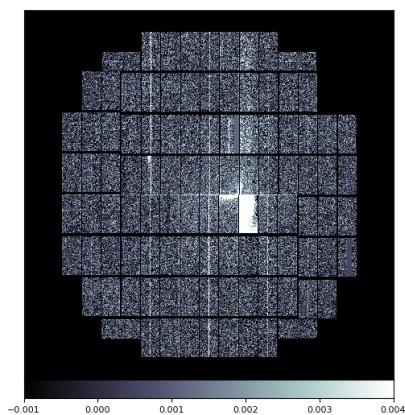
2016-12-01 UT, HSC-i2



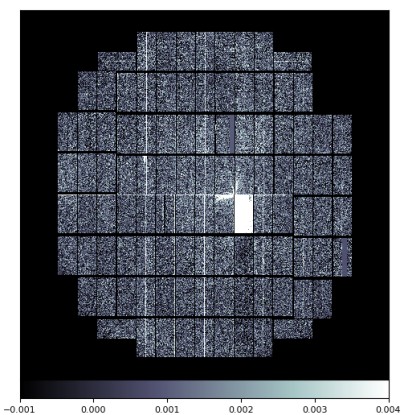
2016-12-31 UT, HSC-r2



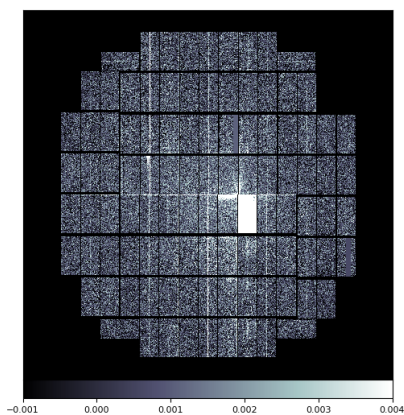
- Dark frames created from  $5 \times 300$  sec exposures (2017 Jan – 2017 Dec)



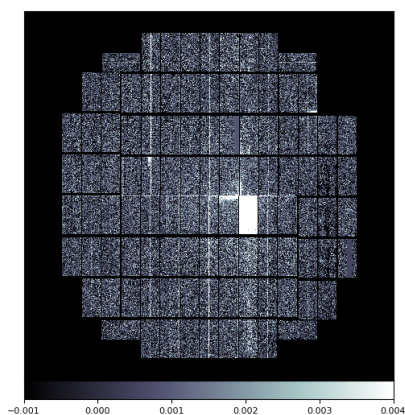
2017-01-24 UT, HSC-g



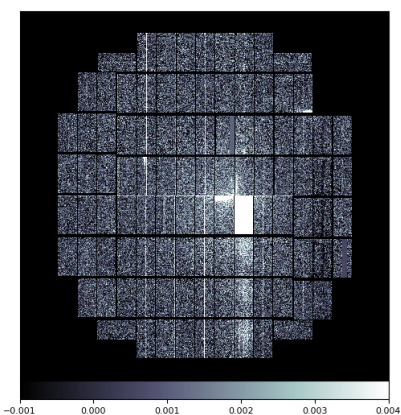
2017-02-25 UT, HSC-i2



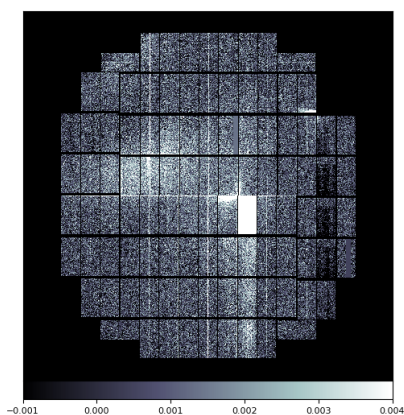
2017-03-24 UT, NB0718



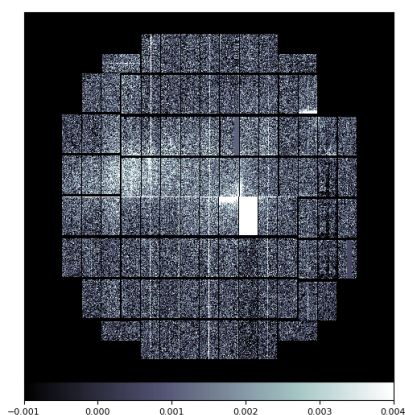
2017-04-23 UT, HSC-g



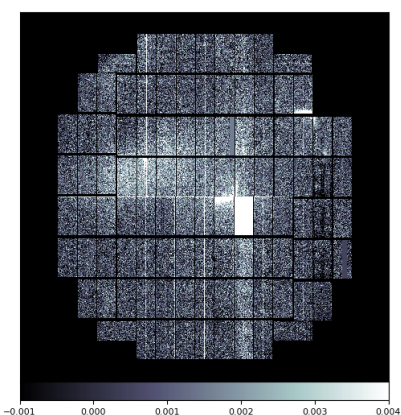
2017-06-26 UT, HSC-g



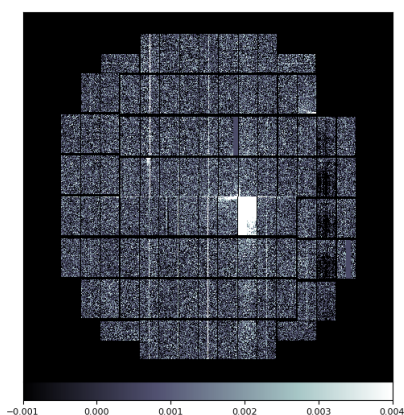
2017-07-22 UT, HSC-r2



2017-08-22 UT, HSC-r2



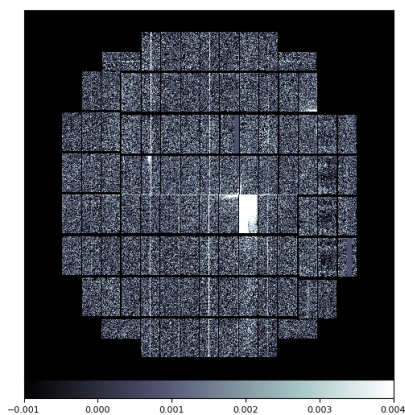
2017-09-19 UT, HSC-r2



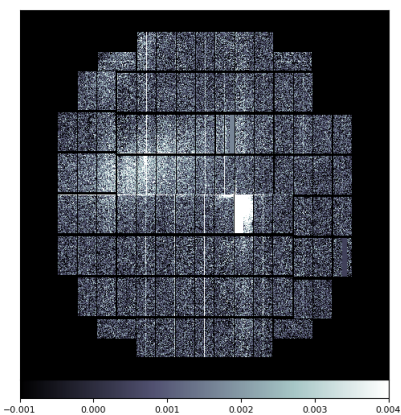
2017-12-16 UT, HSC-g



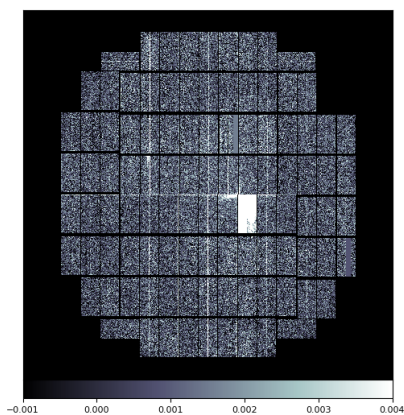
- Dark frames created from  $5 \times 300$  sec exposures (2018 Jan – 2019 Mar)



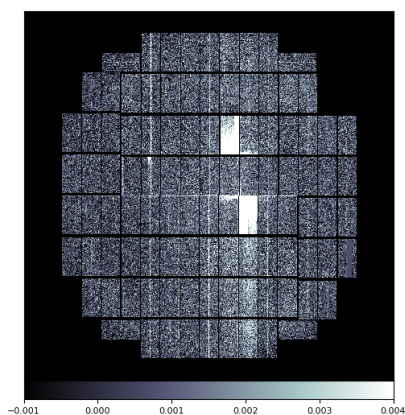
2018-01-22 UT, HSC-g



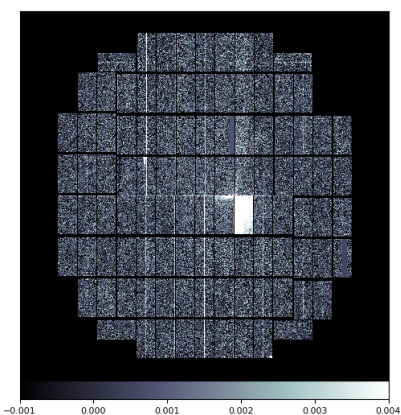
2018-02-14 UT, HSC-r2



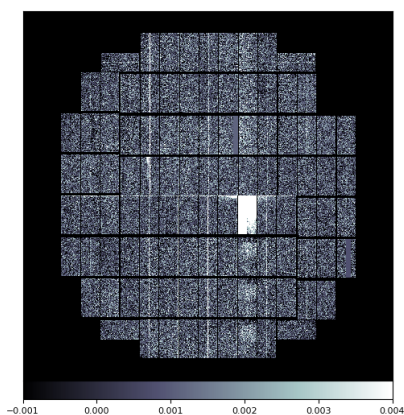
2018-03-09 UT, HSC-i2



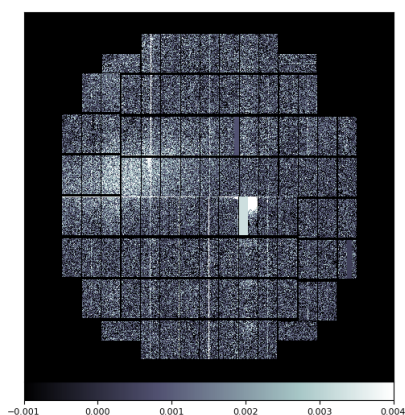
2018-04-11 UT, NB0816



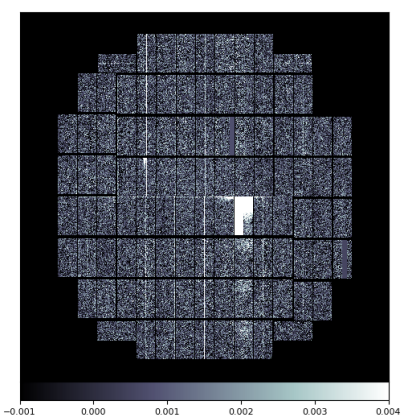
2018-11-04 UT, HSC-g



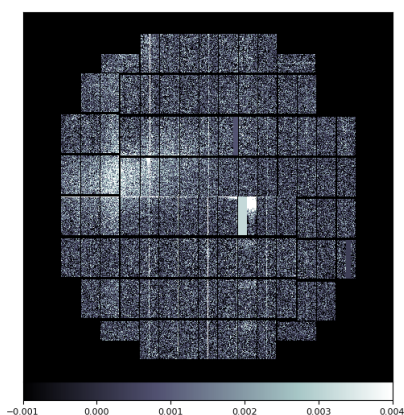
2018-12-12 UT, HSC-i2



2018-12-29 UT, HSC-r2



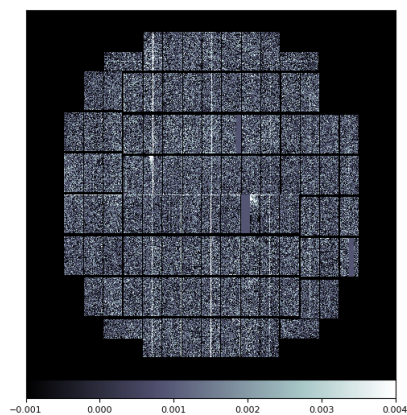
2019-01-31 UT, HSC-g



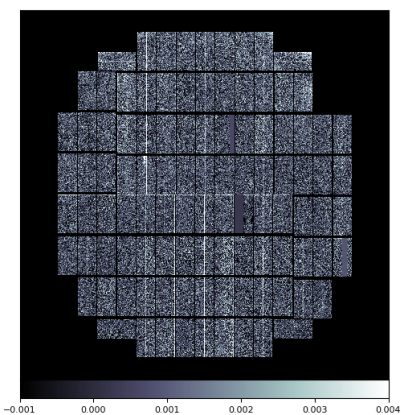
2019-03-06 UT, HSC-r2



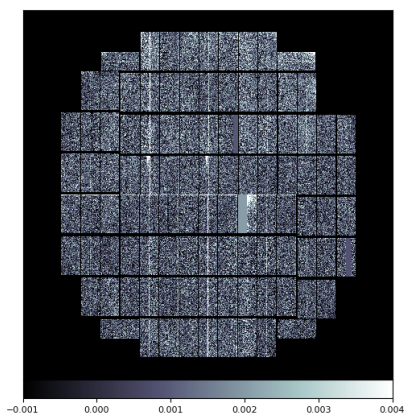
- Dark frames created from  $5 \times 300$  sec exposures (2019 Apr – 2020 Mar)



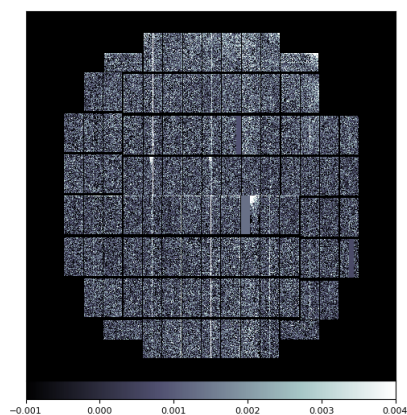
2019-04-01 UT, HSC-i2



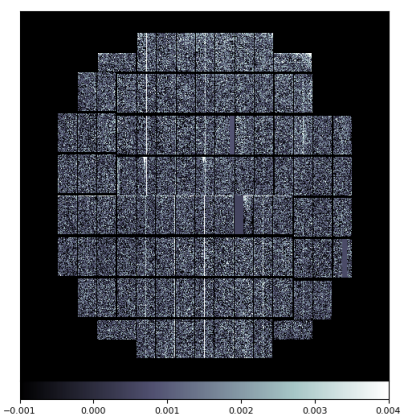
2019-05-04 UT, HSC-g



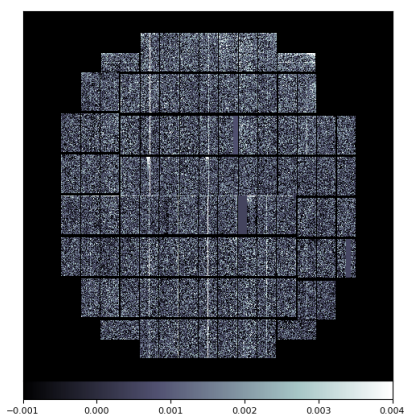
2019-05-30 UT, HSC-i2



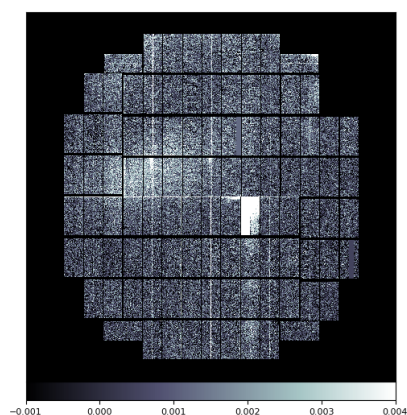
2019-10-01 UT, NB0515



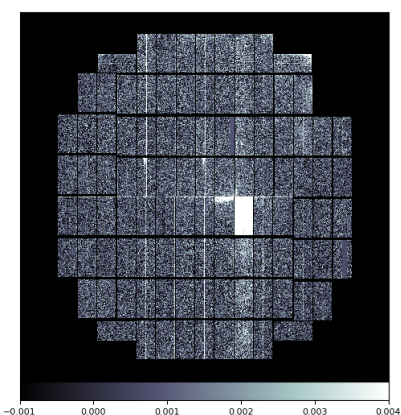
2019-10-30 UT, HSC-g



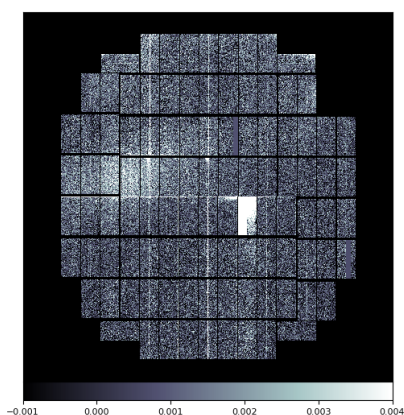
2019-11-26 UT, HSC-g



2019-12-21 UT, HSC-r2



2020-01-17 UT, HSC-g

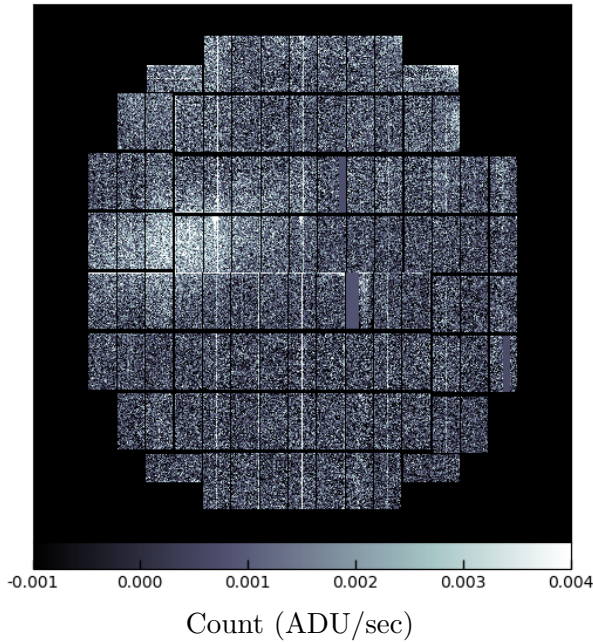


2020-03-02 UT, HSC-r2

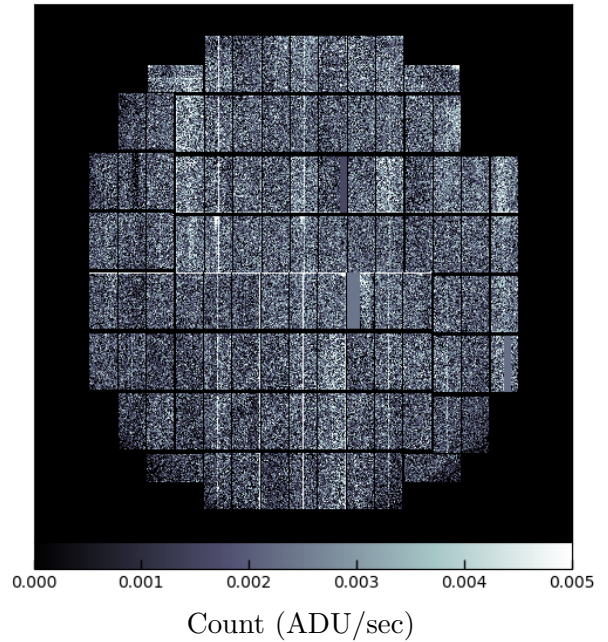


This page was appended on November 23, 2020.

- **Additional investigation in November 2020:** two sets of five 300-sec exposures were taken with the  $r2$  band under the shutter opened and closed, respectively, in a dark condition with the dome and mirror cover closed.
- The stray light does not appear on the images taken under the shutter opened.
- It is presumed that the stray light is caused by emitted light from the focal plane which is reflected on the shutter surface.
- Channel 4 of CCD#033 (saturated over the entire area) may be the light source.



Composite image of five 300-sec dark frames  
( with HSC's shutter closed )



Composite image of five 300-sec exposures  
( with HSC's shutter opened )