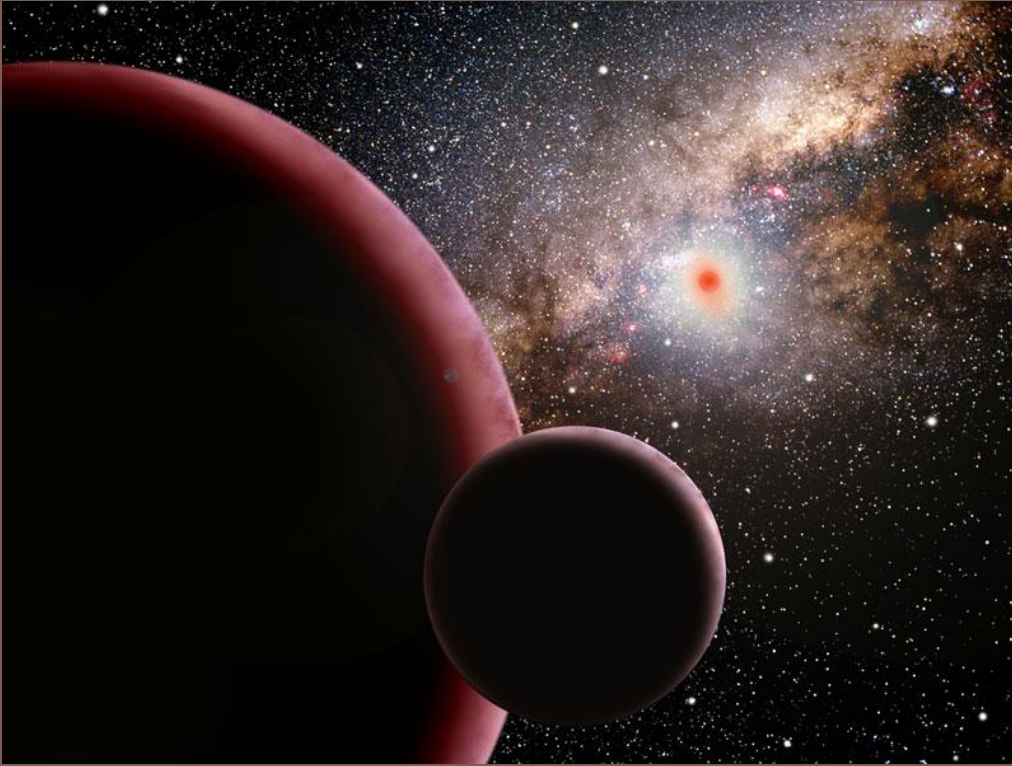




Crosstalk of KMTNet 18k Mosaic CCDs and Plan for KMTNet Science Run

김승리

한국천문연구원 광학천문본부 변광천체그룹

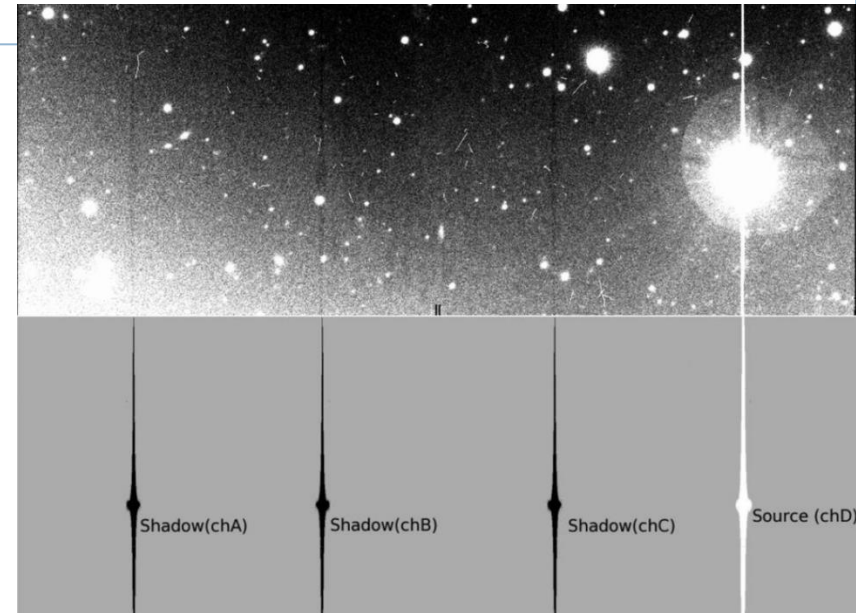
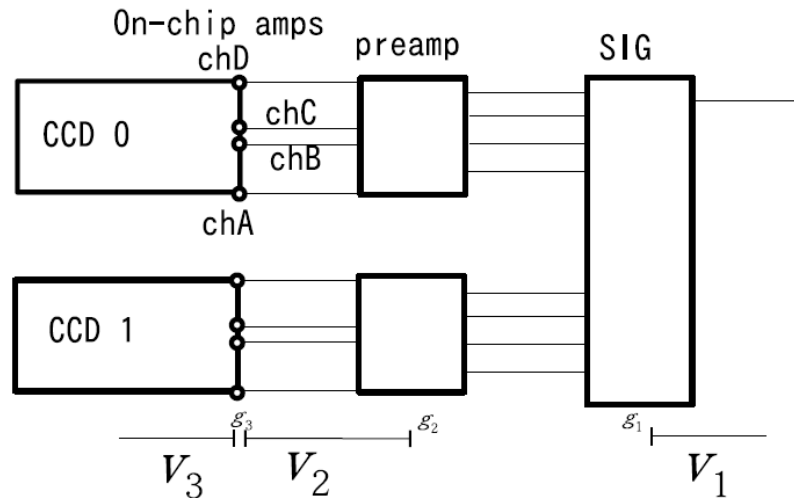
Crosstalk

❖ Wikipedia

- In electronics, crosstalk (XT) is any phenomenon by which a signal transmitted on one circuit or channel of a transmission system creates an undesired effect in another circuit or channel.

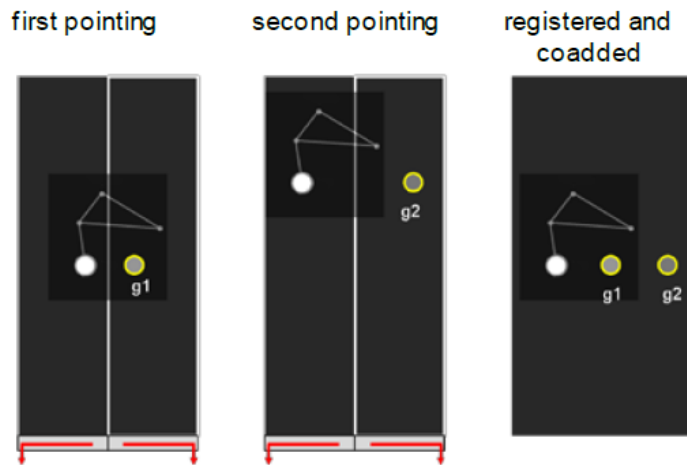
❖ Crosstalk analysis of Suprime-Cam CCDs

- Suprime-Cam (Subaru Prime Focus Camera) with ten 2k by 4k CCDs
- Four readout ports (A,B,C,D) for each CCD
- Yagi, M. 2012, PASP, 124, 1347

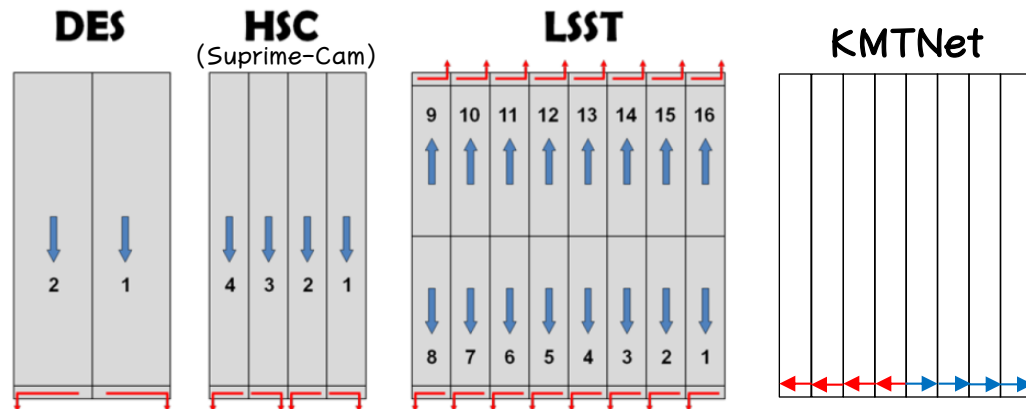
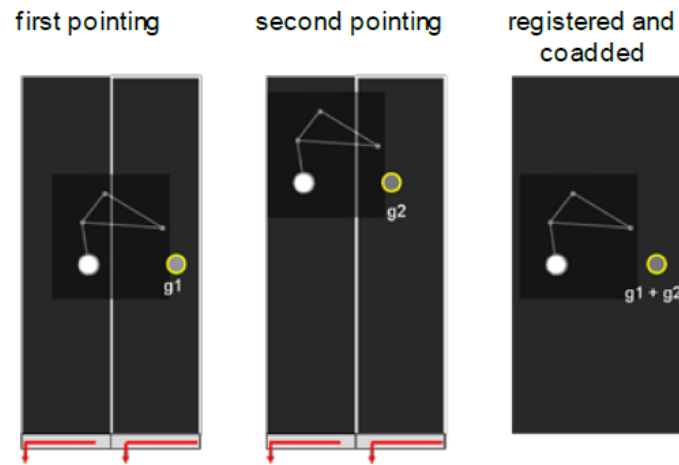


- ❖ Crosstalk in multi-output CCDs for LSST
 - O'Connor, P. 2015, *Tour. of Instrumentation*, 10, C05010 (arXiv:1501.04137)

(a) Serial readout oppositely directed

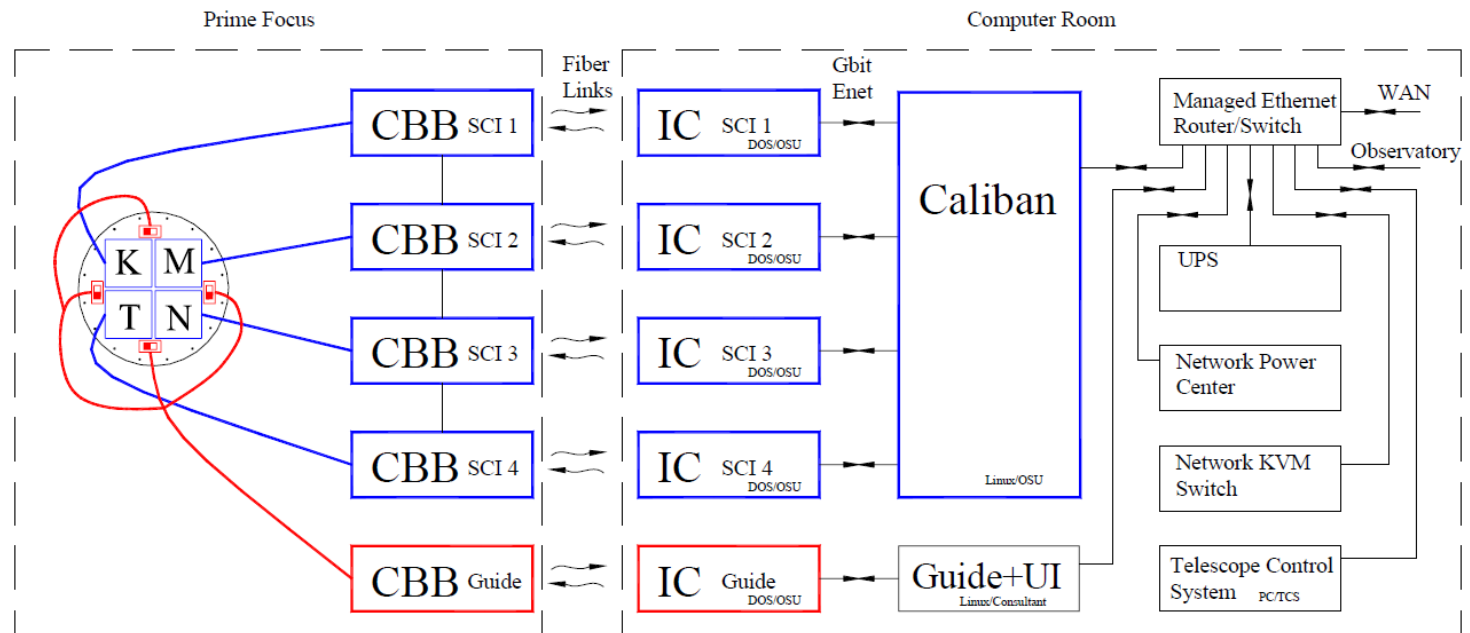


(b) Serial readout same direction



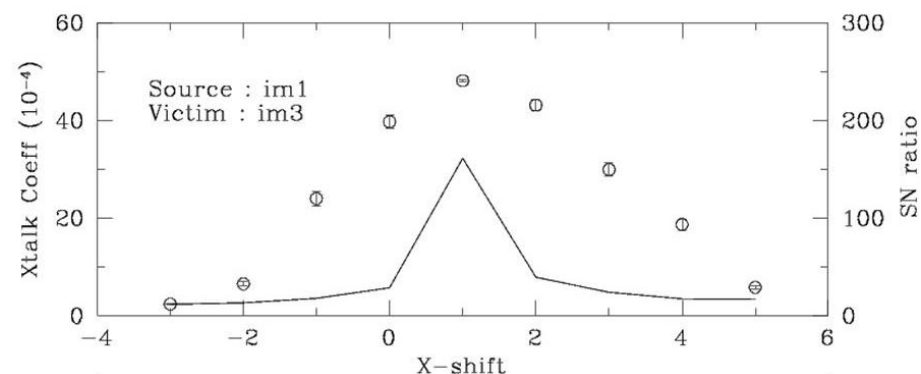
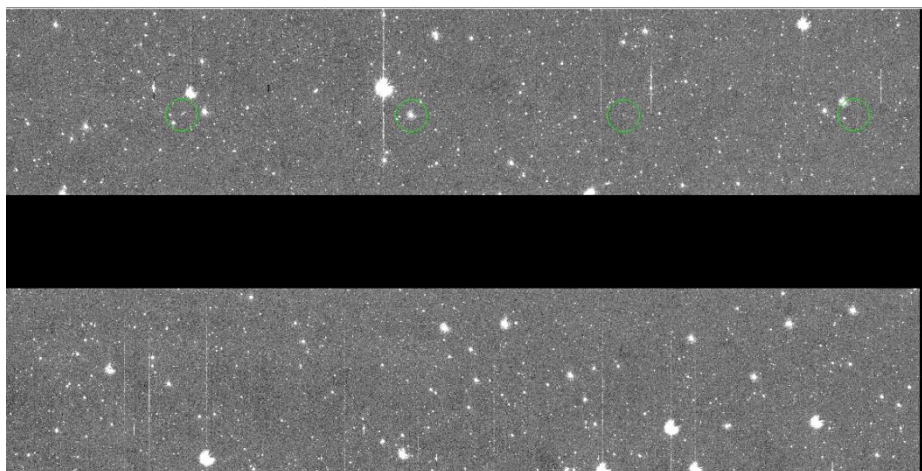
KMTNet Crosstalk

- ❖ KMTNet Mosaic CCDs
 - Eight readout ports for each CCD
 - Independent electronics and readout configuration for each CCD
- ❖ Crosstalk correction by using the IRAF tasks
 - `xtcoeff`, `xtalkcor` at `mscred` package
 - Coefficient = $(\text{Victim} - V_{BG}) / (\text{Source} - S_{BG})$, assuming the linearity

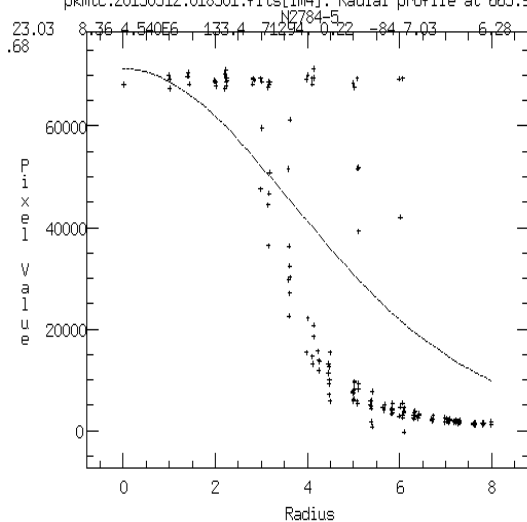


KMTNet Crosstalk

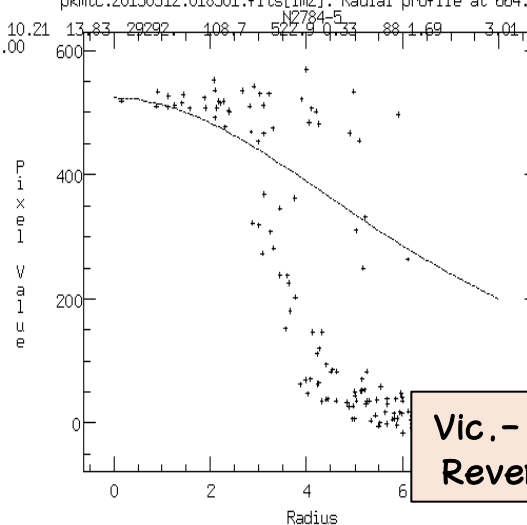
5



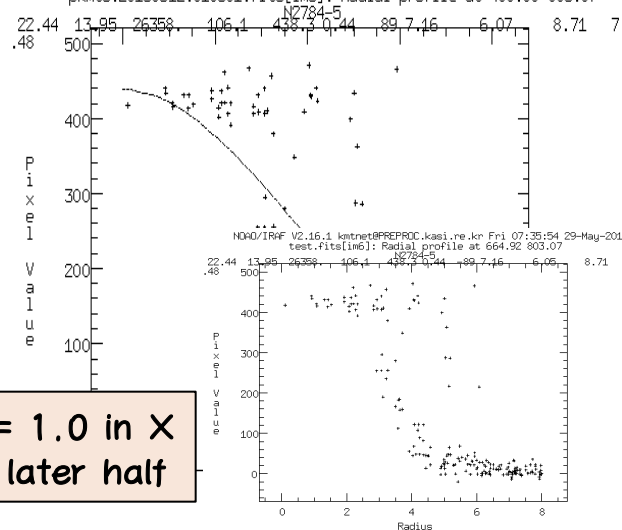
NOAO/IRAF V2.16.1 kmtnet@PREPROC.kasi.re.kr Fri 06:13:07 29-May-2015
pkmtc.20150512.018501.fits[im4]: Radial profile at 663.99 803.01



NOAO/IRAF V2.16.1 kmtnet@PREPROC.kasi.re.kr Fri 06:24:04 29-May-2015
pkmtc.20150512.018501.fits[im2]: Radial profile at 664.88 803.10



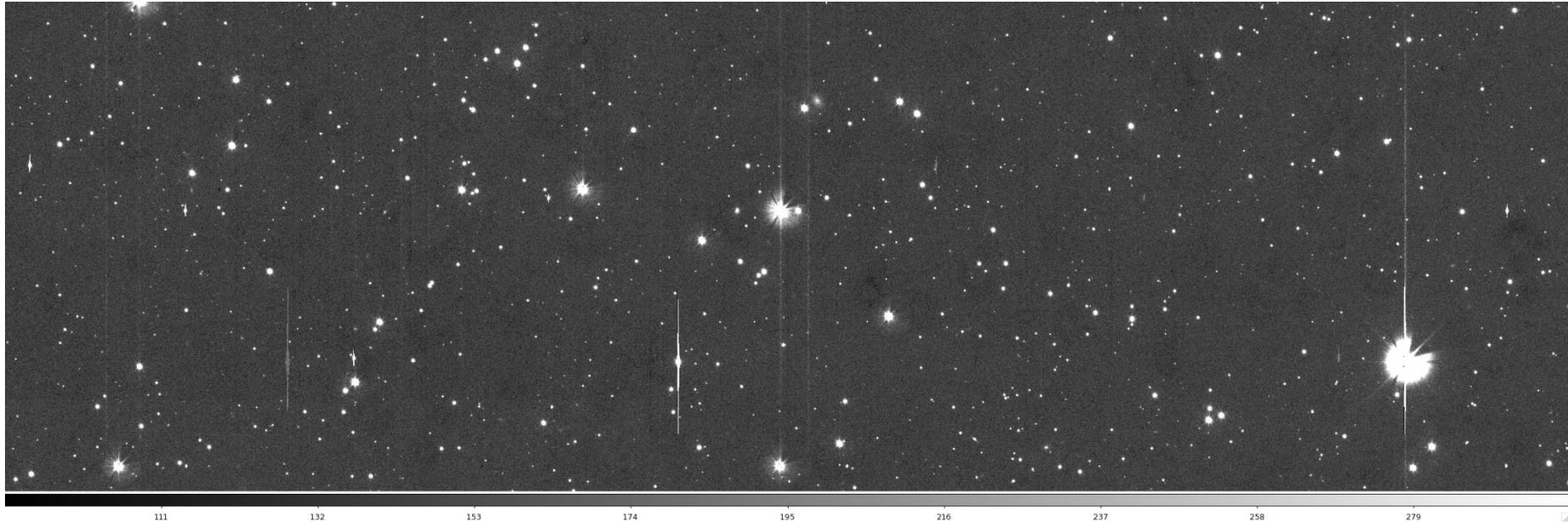
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pkmtc.20150512.018501.fits[im6]: Radial profile at 488.08 803.07



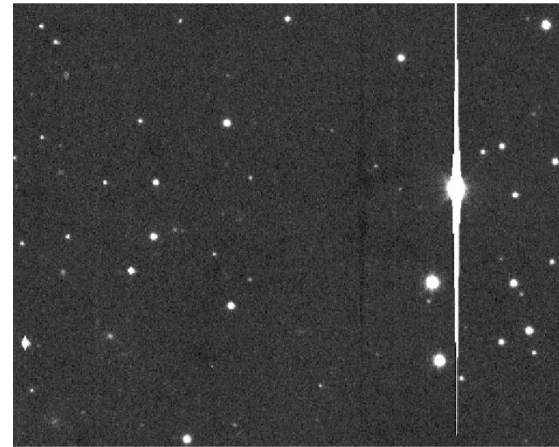
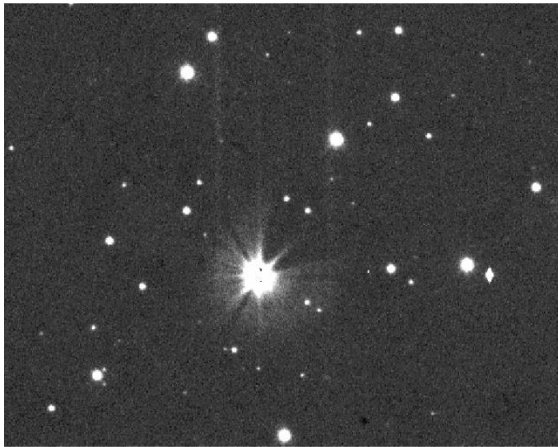
Vic. - Sou. = 1.0 in X
Reverse at later half

KMTNet Crosstalk

6

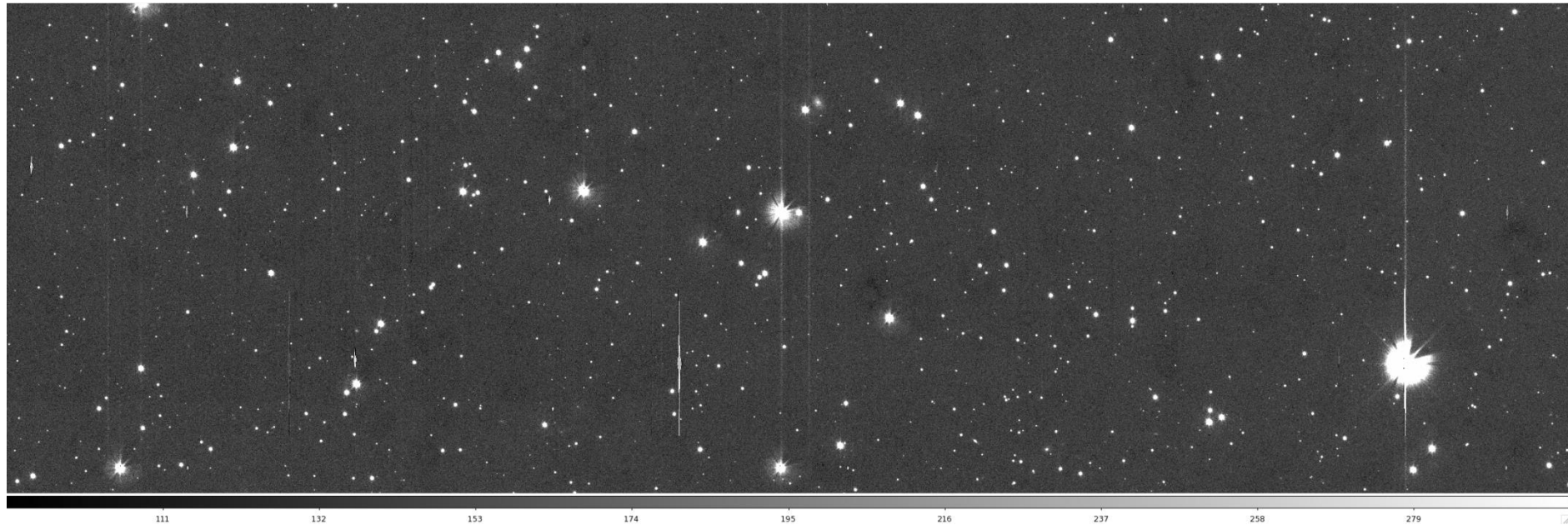


Before

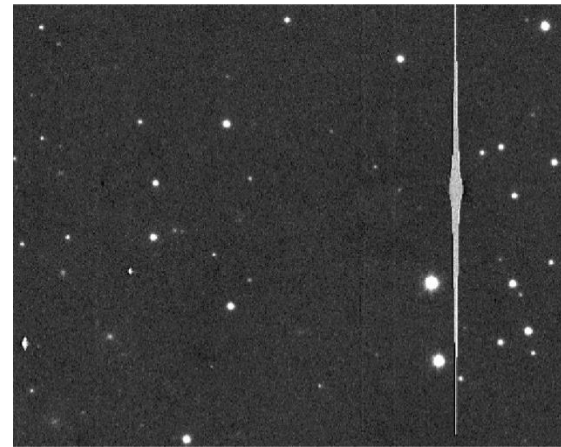
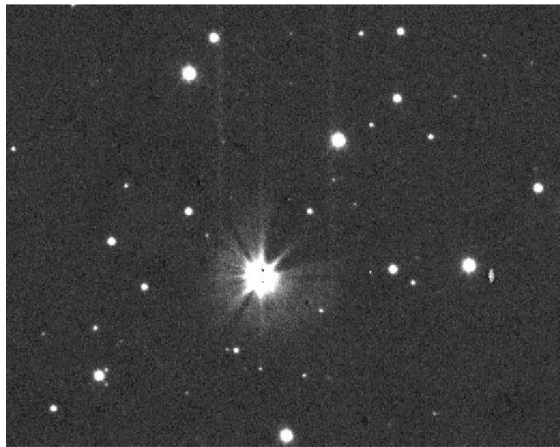


KMTNet Crosstalk

7



After



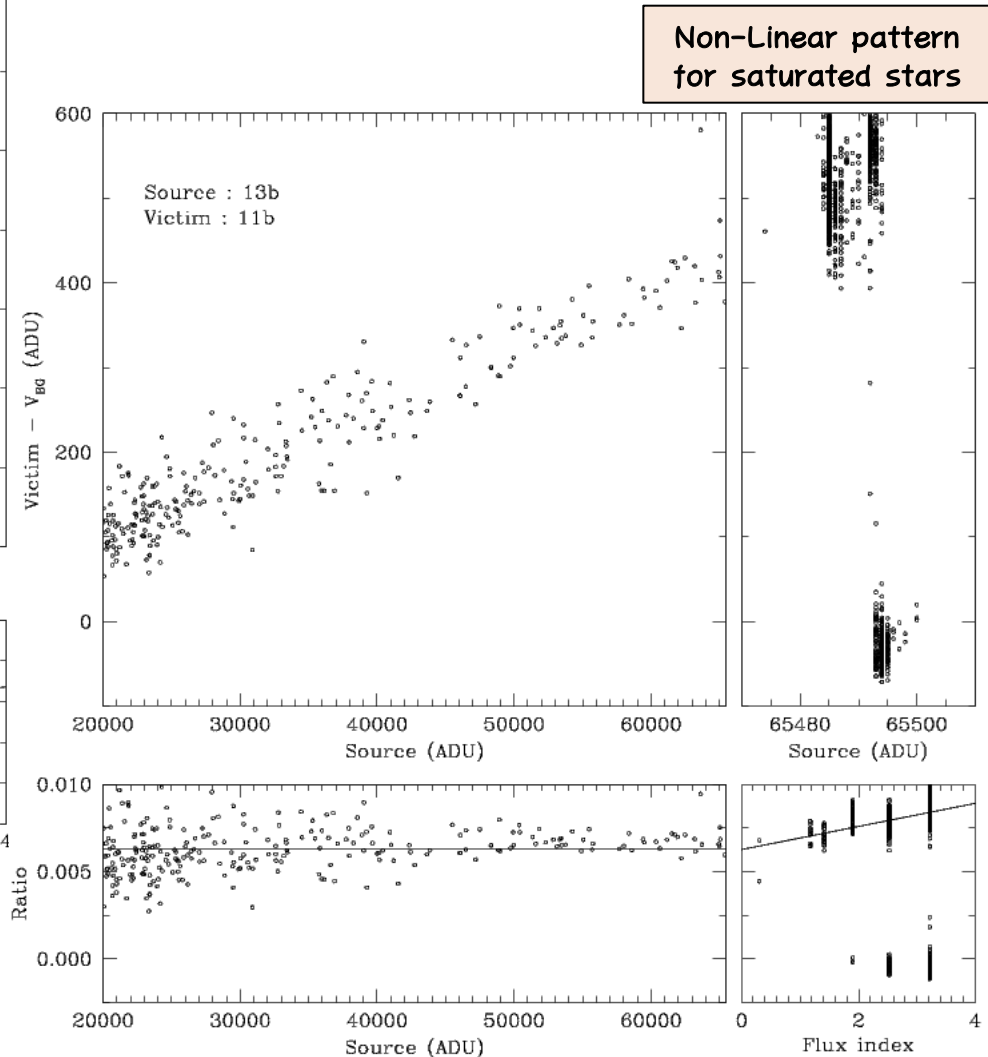
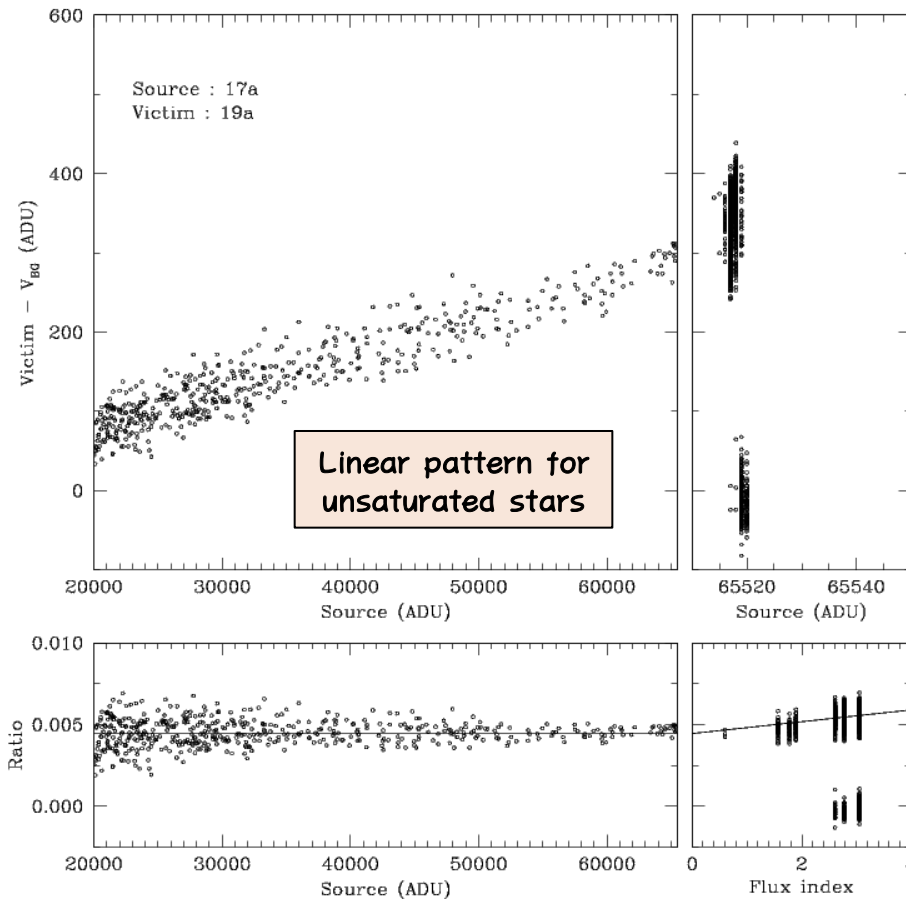
KMTNet Crosstalk

8

- ❖ Crosstalk of multi-readout CCDs
 - Typical crosstalk coefficients $\sim$ a few 10^{-4} (ideal; $\sim 10^{-5}$, i.e. < 1 ADU)
 - Crosstalk of KMTNet Mosaic CCDs
 - : 1 pixel difference in X-axis between source and victim
 - : Coefficients $\sim$ up to several 10^{-3} for the source of $< 60,000$ ADU
 - $\Rightarrow$ well corrected for crosstalk images by the unsaturated stars
 - : Have different coefficients near the saturation level ($> 65,000$ ADU)
 - $\Rightarrow$ the crosstalk residual of ~ 100 ADU by saturated stars
 - ❖ Correction by using the IRAF task
 - Required about 10 minutes each image
 - : Mainly due to taking into consideration of shifting 1 pixel in X-axis and of reversing the half images with opposite readout direction
 - : Unusable for the KMTNet pre-processing pipeline
 - Could not correct the nonlinear effect for saturated stars
- $\rightarrow$ Require a new S/W optimized to the KMTNet Mosaic CCD images**

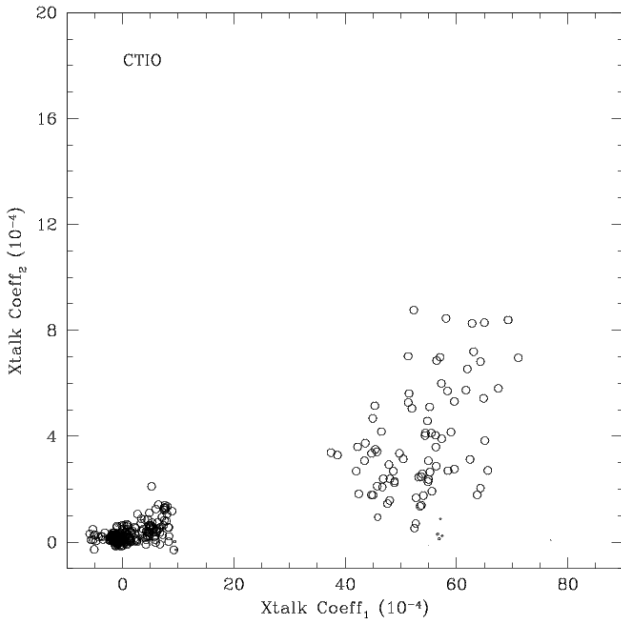
Results of new S/W

9

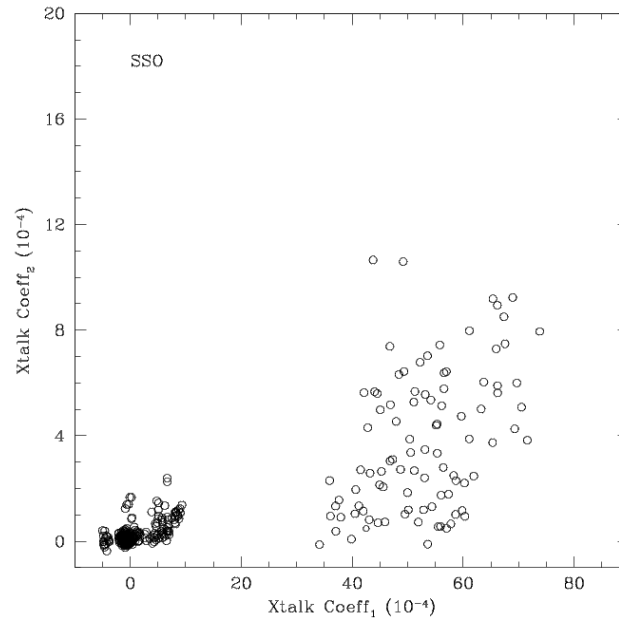


Results of new S/W

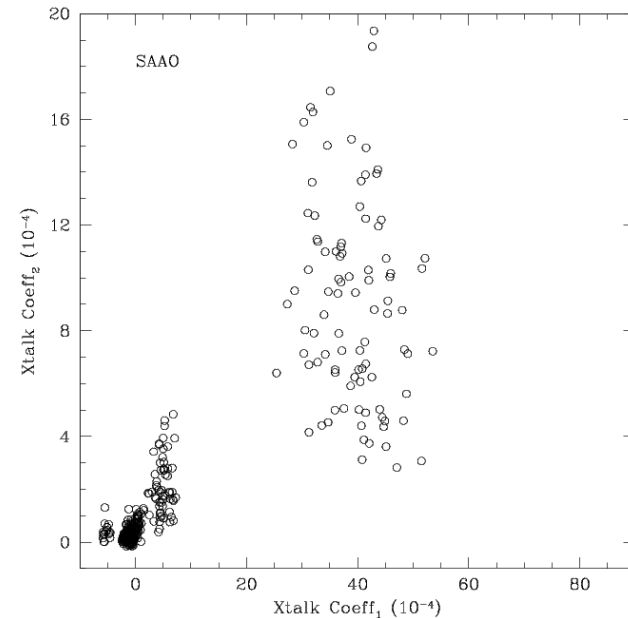
10



The Crosstalk effect is different from camera to camera, especially, the second camera installed at KMTNet-SAAO site.

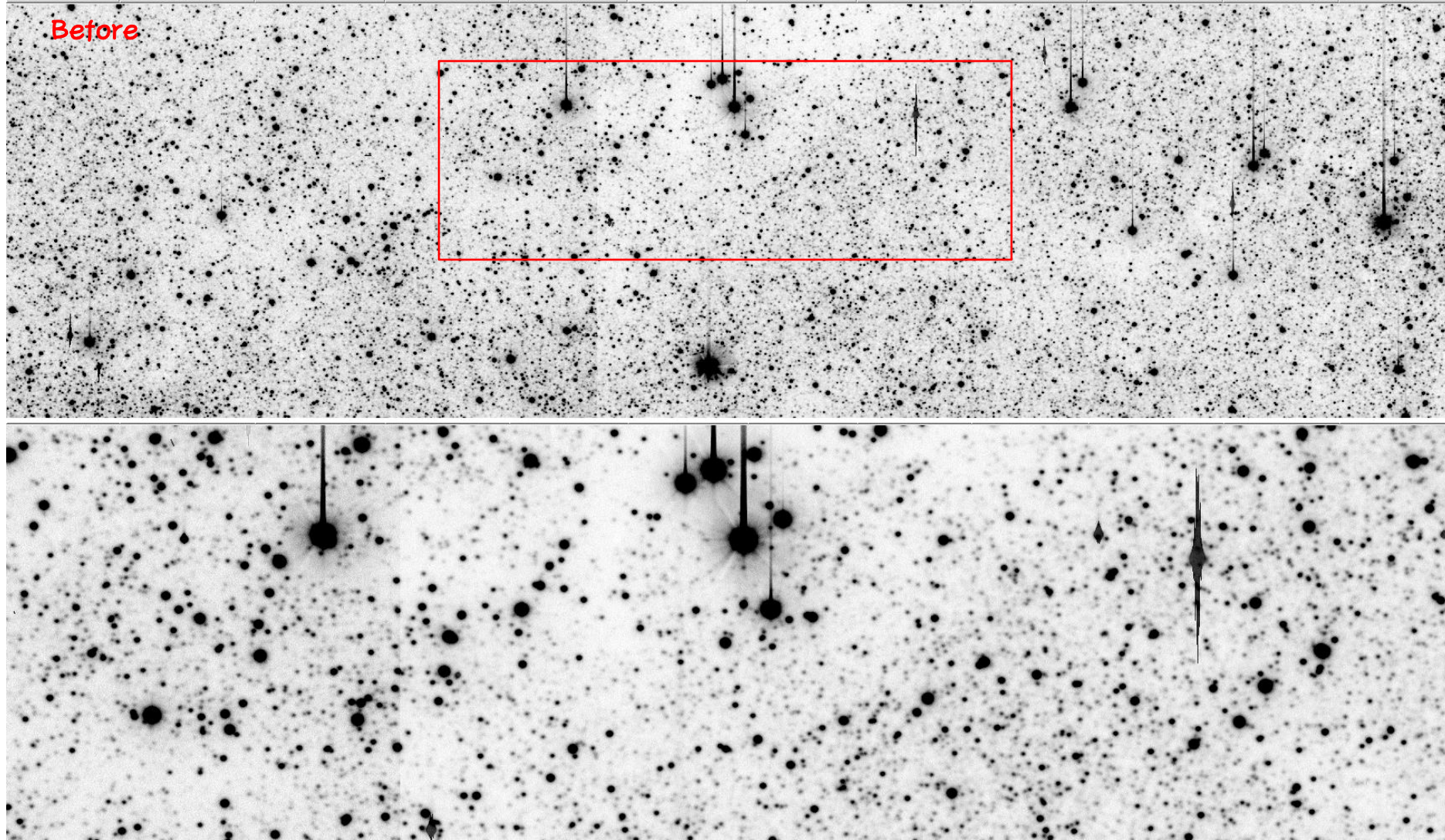


The Crosstalk coefficients are nearly the same within the errors, but may be a little changed on the timescale of a few months.



Results of new S/W

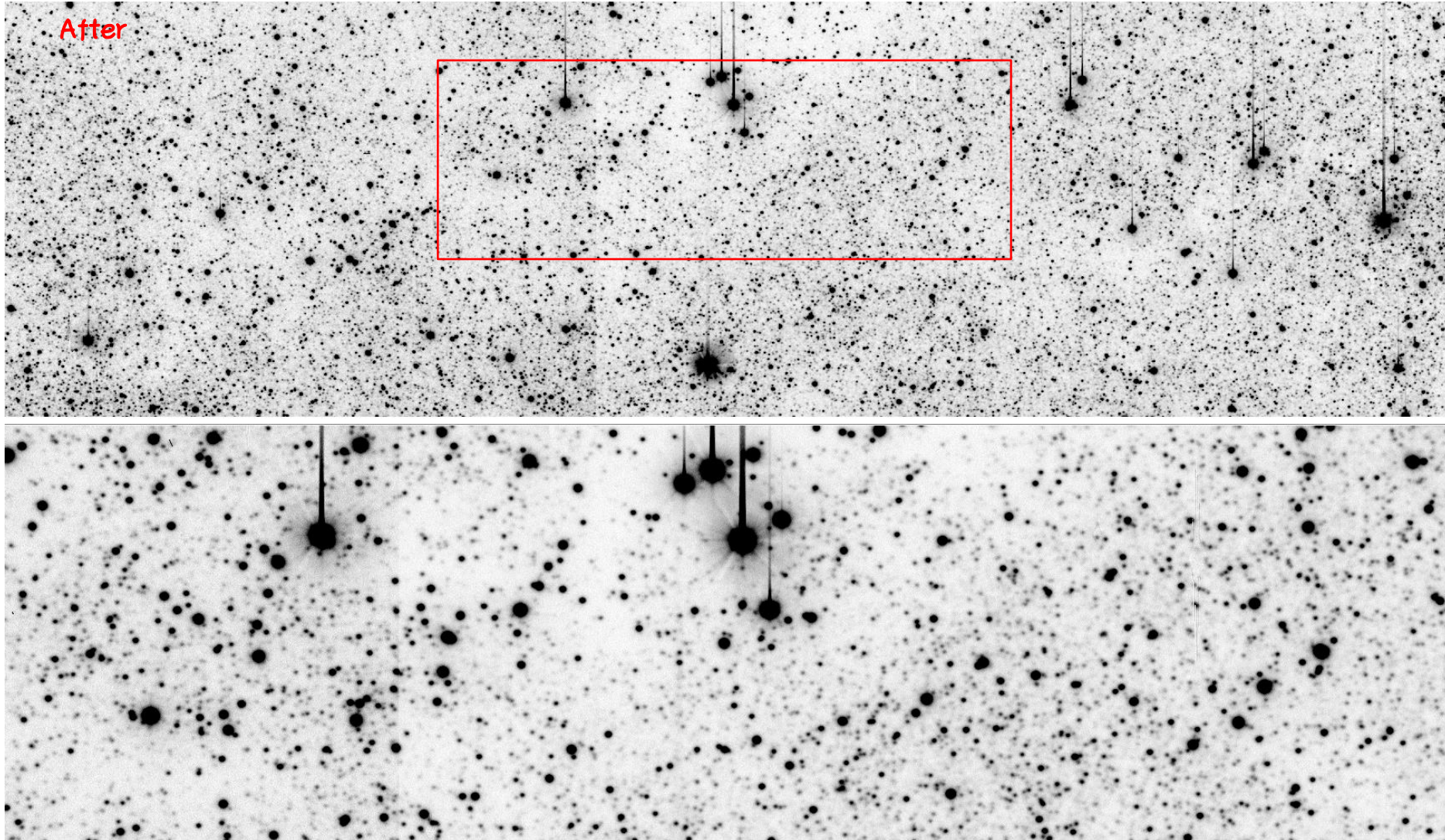
11



Results of new S/W

12

After



Summary

13

❖ New S/W to correct the crosstalk of KMTNet Mosaic CCD images

- kmtnet_xtcoef.c : determination of crosstalk coefficients

Vic	Sou	Coeff_1	Stddev_1	Num1	Satur	Coeff_2	Stddev_2	Num2
2a	1a	-0.000024	0.000025	33	65520	0.000024	0.000016	36
2b	1b	-0.000006	0.000027	37	65520	0.000028	0.000015	33
3a	1a	0.004677	0.000078	31	65520	0.000738	0.000042	33
3b	1b	0.004688	0.000074	29	65520	0.000518	0.000045	30
4a	1a	-0.000041	0.000029	38	65520	-0.000011	0.000023	35
4b	1b	-0.000057	0.000019	34	65520	0.000015	0.000023	25
5a	1a	0.000506	0.000025	32	65520	0.000119	0.000032	39
5b	1b	0.000489	0.000029	36	65520	0.000071	0.000019	36
6a	1a	-0.000068	0.000022	37	65520	0.000007	0.000022	36
6b	1b	-0.000073	0.000024	35	65520	0.000003	0.000017	44

- kmtnet_xtcorr.c : correct the crosstalk effects
- It takes about 1-2 minutes for kmtnet_xtcoef each image and about 1 minute for kmtnet_xtcorr, depending on how many saturation pixels are existed at the image.
- All of KMTNet CCD images are distributed to the researchers after correcting the crosstalk effects from 11th September, 2015.
- Most of the crosstalk may be disappeared, but a little can be remained, particularly originated from the saturated stars and near the edge. Then it will be good to run again the kmtnet_xtcoef & kmtnet_xtcorr.