FPACK and DES

Avoiding Noise in Compressed Data

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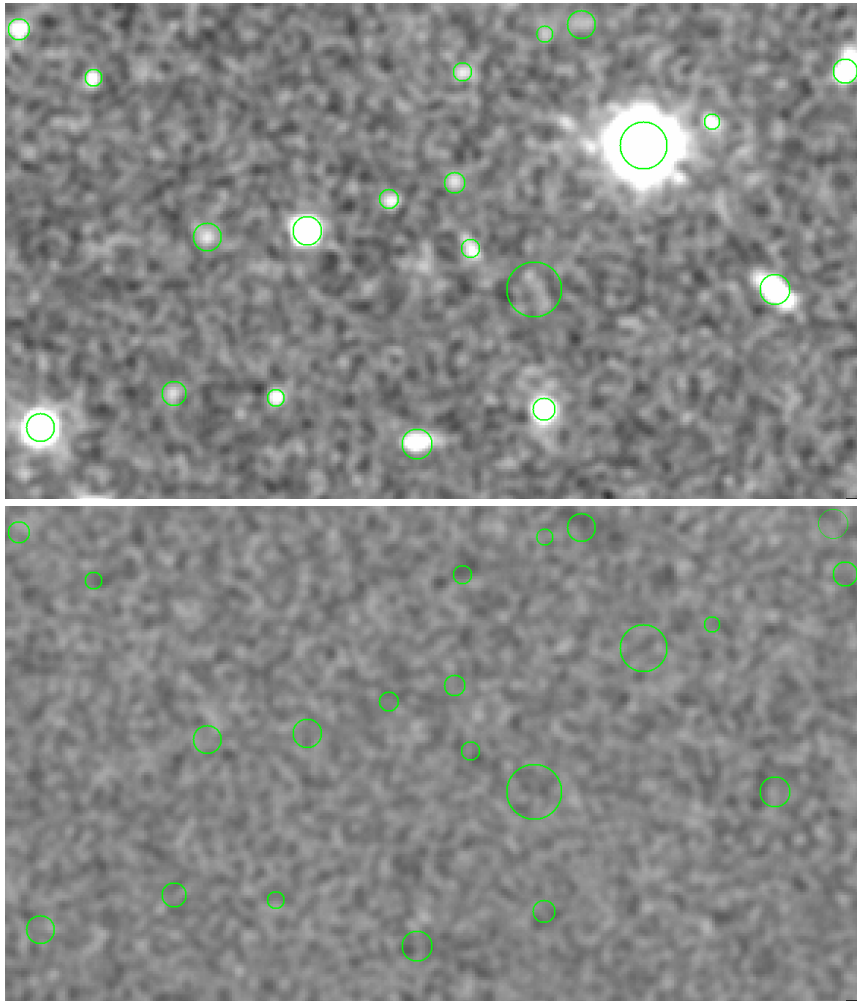
How Does FPACK Work?

- Converts floats to integers
- Integer spacing = RMS / q
- We select q (default: 4)
- Larger q: less noise added, less compression
- Integers are (Rice) compressed losslessly
- http://arxiv.org/pdf/1112.2671.pdf

FPACK on Images

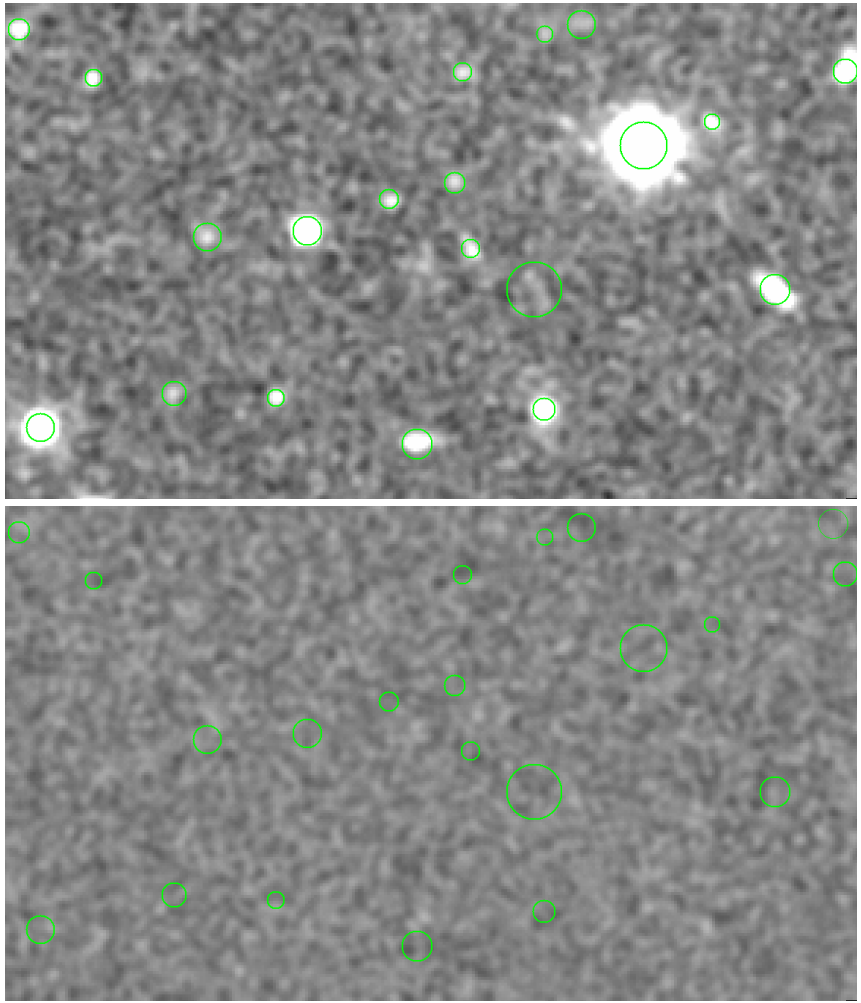
- FPACK adds noise: $(12q^2)^{-1/2}$ RMS_{image}
- For q = 4, this is 7.2%
- We calculate 8.3%
- 0.3% when added in quadrature



Original image (top). Original-FPACKed (bottom)

FPACK on Images

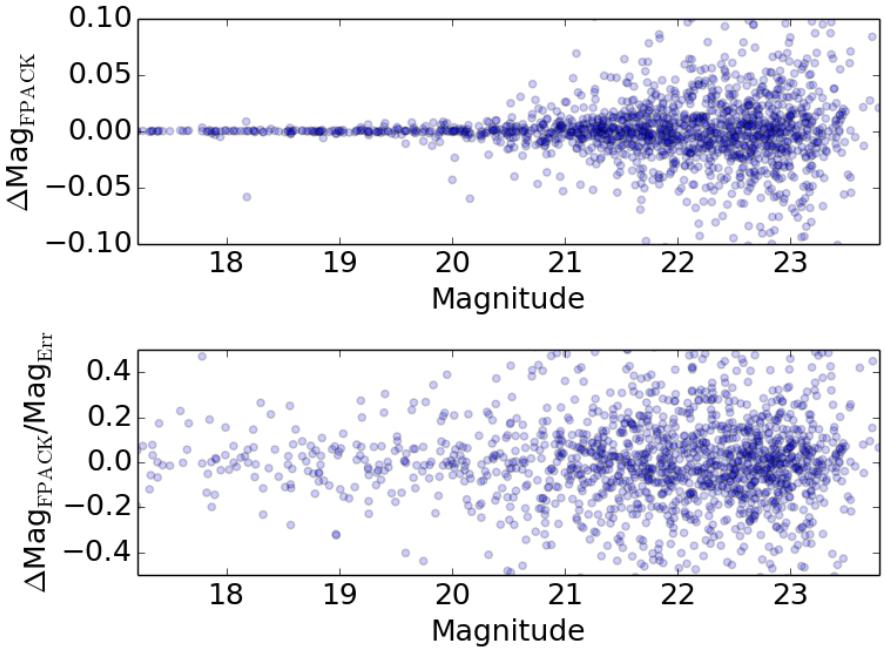
- Is there signal poking through?
- The eye is bad at this task
- What about SExtractor?



Original image (top). Original-FPACKed (bottom)

FPACK on Catalogs

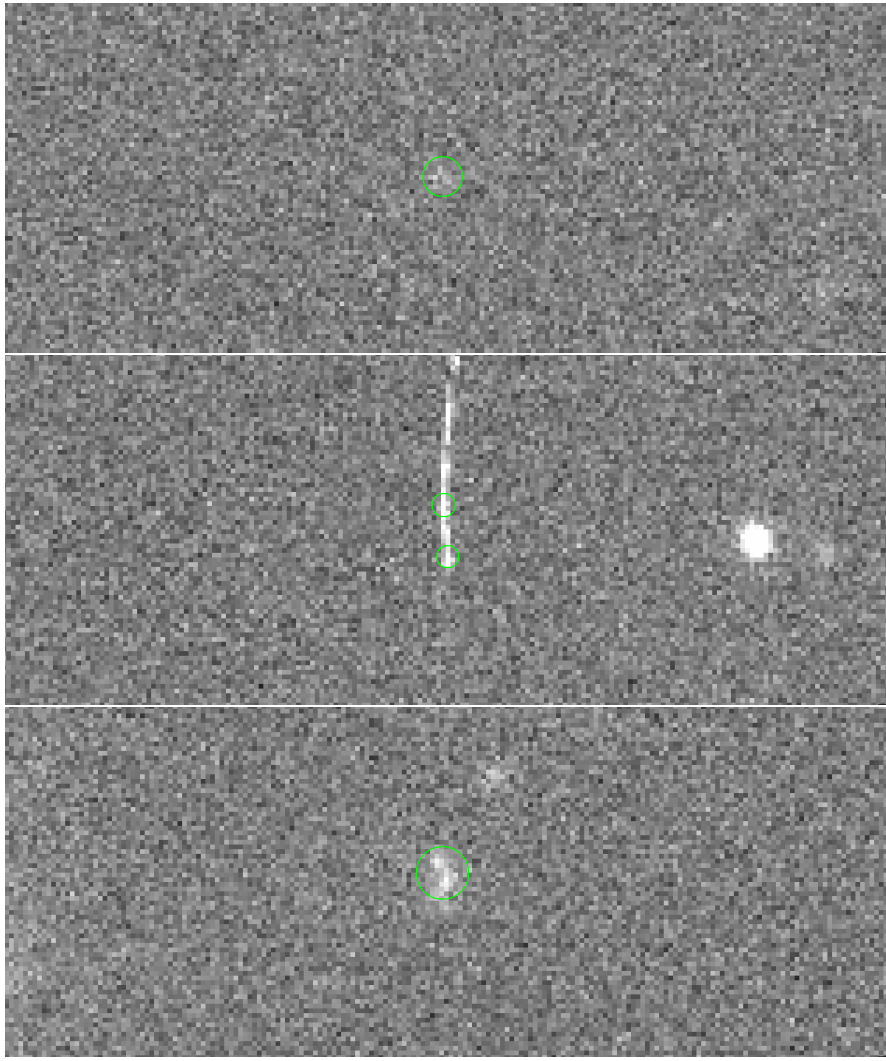
- Made a catalog
- FPACKed and unpacked image
- Made that catalog
- Difference RMS ~ 0.2*Mag_{Err} for q = 4



The ΔMag between (top) and Δ(Mag/Mag_{Err}) for a particular z badn Supernova image

Outliers

- $\Delta Mag > Mag_{Err}$, 0.05
- 0.8% satisfy for q = 4
- ~50% Faint
- ~40% Artifacts
- ~10% Close Pairs



Varying Q

q	RMS(ΔMag)	RMS(ΔMag/Mag_{Err})	RMS_{Diff}/RMS_{Image}	Outliers	Compression Ratio
4	0.021	0.20	0.083	11	7.7
8	0.012	0.12	0.041	4	6.5
16	0.0057	0.055	0.021	5	5.6
32	0.0031	0.027	0.010	0	4.9
64	0.0017	0.015	0.005	0	4.4

Summary/Recommendation

- We add 0.02 mag noise to 10σ sources
- Small effect if noise is uncorrelated
- Noise may be correlated with sources
- q to 16 makes problem less scary
- Preserves 5.6x compression