Pitfalls in Making Pretty Pictures

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High-quality images for public outreach pushed by

- STScI/STECF, Hubble Heritage Project
- Jean-Charles Cuillandre, CFHT
- Adam Block, NOAO
- ...

Large investment of time, long learning curve

If you find your own images here: I’m sorry!
1 Overview
   - Things that usually go wrong
   - Essentials for a good picture

2 Guidelines for pretty pics
   - Observations
   - Data reduction
   - Photoshop science
1. Overview

It looks all so simple...
Things that usually go wrong

In the order encountered by beginners:

- **Dynamic range compression:**
  - Saturation
  - Background clipping

- Distortion correction

- Colour calibration

- Over-processing and under-exploitation

(C) ESO, M83, SOFI

Use ESO FitsLiberator

(Lars Lindberg Christensen)
Things that usually go wrong

In the order encountered by beginners:

- Dynamic range compression:
  - Saturation
  - Background clipping
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- Colour calibration
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(C) ESO, Part of LMC, WFI
Things that encountered go wrong

In the order encountered by beginners:

- Dynamic range compression:
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(C) ESO, RCW108, WFI
Things that usually go wrong

In the order encountered by beginners:

- **Dynamic range compression:**
  - Saturation
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- **Distortion correction**
- **Colour calibration**
- **Over-processing and under-exploitation**

(C) Jim Misti, M63
Things that usually go wrong

In the order encountered by beginners:

- Dynamic range compression:
  - Saturation
  - Background clipping

- Distortion correction

- Colour calibration

- Over-processing and under-exploitation

Do it right from the beginning, and your PR officer will love you
Essentials for a good pretty picture

Observing

- A good observing strategy

Data reduction

- Get the relative astrometry right
- Careful sky background modelling for extended targets and multi-chip cameras
- **Absolute colour calibration**
  (5% of all astronomers are colour blind)

Photoshop science

- Dynamic range compression
- Avoid over-processing
2. Guidelines – Observations

No good observing strategy:
   No good science
   No nice pics

Please do:

   - Extensive (excessive) dithering:
     Defects, defringing, inter-chip gaps, astrometry, photometry
   - Blank fields for extended targets, not only in the near-IR:
     Defringing, sky modelling

This holds in particular for multi-chip cameras.
2.1 Guidelines – Astrometry

(C) ESO, Capodimonte Deep Field, WFI
2.2 Guidelines – Sky subtraction

Colour pictures are excellent indicators of data reduction quality

M 83, near-IR
2.2 Guidelines – Sky subtraction

Colour pictures are excellent indicators of data reduction quality

M 83 (showing sub-percent residuals in sky background)

THELI sky background configuration
2.3 Guidelines – Colour calibration

(C) M 31, Jim Misti
2.3 Guidelines – Colour calibration

(C) Melotte 15, Jim Misti
2.3 Guidelines – Colour calibration

(C) M 101, Jim Misti
2.3 Guidelines – Colour calibration

(C) M 63, Jim Misti
2.3 Guidelines – Colour calibration

M 63 with SDSS calibration
2.3 Colour calibration – G2V stars

Requirement: an absolute white point

Observations of a G2V solar-type standard star.

But:

- G2 stars are rare
- If in field of view, then most likely saturated
- Nightly observations required to match atmosphere
- OPC/TAC and you won’t like that waste of time
- Simply not available for archival data
2.3 Colour calibration – SDSS ugr calibration

**Solution:** Select G2V stars photometrically

<table>
<thead>
<tr>
<th>SDSS</th>
<th>NOMAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.38 &lt; u - g &lt; 1.48$</td>
<td>$0.62 &lt; B - V &lt; 0.68$</td>
</tr>
<tr>
<td>$0.34 &lt; g - r &lt; 0.54$</td>
<td>$0.30 &lt; V - R &lt; 0.70$</td>
</tr>
</tbody>
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**Advantages:**
- Internal calibration
- Almost always in the field of view
- Comes for free, no extra time
2.3 Colour calibration – SDSS ugr calibration

The corresponding dialogue in THELI

Fall-back solution: all stars white on average

This works nicely in the near-IR :-)
Overview
Guidelines for pretty pics

Observations
Data reduction
Photoshop science

(C) ESO, M83 spiral arm, VLT/FORS2
M83 spiral arm, VLT/HAWK-I (JHKs, 0.4′′ seeing)

(C) Yuri Beletsky, Mischa Schirmer, Mark Gieles
M83 core, HAWK-I

(C) Yuri Beletsky, Mischa Schirmer, Mark Gieles
2.4 Guidelines – Photoshop science

Typical post-processing tasks
- Dynamic range compression (e.g. through FitsLiberator)
- False-colour composition (e.g. more than 3 filters)
- Noise filtering
- Sharpening (wavelet, deconvolution)
- Background flattening

Last, but not least
- Less is more, don’t overdo it
- Give your eyes a rest
Thank you