Re: Cassini: where are colors and detail?

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From: Martin Brown (|||*newspam*|||*_at_nezumi.demon.co.uk*)
Date: 07/12/04

Date: Mon, 12 Jul 2004 09:23:27 +0100

In message <40F1B695.3040102@qwest.net>, "Roger N. Clark (change username to rnclark)" <username@qwest.net> writes
>Chris L Peterson wrote:

>> I haven't seen a color
>> detector suitable for the latter. Even the 300D, which is the best I've
>> evaluated, produces numerous identical RGB values for different wavelengths
>> between 450nm and 520nm.
>
>With the filter response curves I have I do not see how this is
>possible. While one filter response may be dropping as you change
>wavelength toward the red (e.g. blue filter), another will be increasing
>and both red and green increasing at a different rate. Thus
>R, G, and/or B values continue to change as wavelength is scanned.

There are definitely ambiguities in the accurate rendition of green monochromatic light with classic Bayer filter arrays. That is one of the reasons why Sony added the "Emerald" lighter green filter to enhance precision in the green response. They claim it is an improvement...

Algorithms in consumer cameras for interpreting Bayer sensors also go crazy when illuminated with pure monochromatic light and can give images with false colours that depend on both the intensity and wavelength of the light in complex non−linear ways.

Almost all consumer cameras have their response compromised in the purple to ensure that flesh tones are subjectively pleasing in the market they are sold (the same also being true of colour films). I find this defect much more of a problem when photographing certain purple flowers.
>
>
>> Again, I'm not saying you can't use a color detector for scientific
>> applications.
>
>Chris, this is from one of your previous posts:
>> They let other wavelengths through that contaminate the data, there are
>> ixel−to−pixel non−uniformities that are difficult to quantify, and the Bayer

>> pattern results in a loss of resolution and a decoupling of the spatial and
>> color information. In short, they are not very useful for any real science.
>
>You have constantly waffled back and forth. I entered this
>thread trying to clear up some confusion about why cassini
>didn't use bayer filters. I responded:
>
>"The main reason not to fly a RGB digital camera sensor
>is that it would be too limiting to have only 3 colors. ..."
>
>You responded:
>"I said the reason was that color sensors don't provide good data..."
>
>I responded:
>"Color RGBG sensors do provide good data, are linear and are great
>scientifically as far as they go."

They are good for high resolution colour snapshots, but I would hate to have to do spectrometry using a Bayer filtered CCD as the sensor.

>
>Let me summarize the way I see the use of Bayer and similar sensors.
>I do this as a current planetary scientist on multiple
>planetary missions, and I am currently a co−investigator on
>6 proposed missions, including mars landers (MSL), asteroid
>and moon missions. I have also served/serve
>on multiple NASA committees that define future science.
>
>1) RGB Bayer cameras are now space qualified and a reputable
> manufacturer is delivering cameras (e.g. Malin Space Systems).
>
>2) The future of imaging from spacecraft is changing. The cameras
> have less role in spectroscopy.

And that is the clincher. There are times when a single shot colour image is more useful than three or more individually filtered images taken at different times of a rapidly changing target.

>So, Chris, despite you saying bayer sensors are no good for spectral
>data and science, the scientific field is and will continue to move
>forward and use them, and I'm sure with great results.

I am inclined to agree with him. A monochrome sensor is much easier to calibrate. Spectral data from a Bayer sensor will necessarily be flawed.

Regards,

−−
Martin Brown