Abstract:
Even before the official dawn of the Space Age – that is, the launch of the Sputnik and Explorer spacecraft in 1957-1958 – the University of Colorado’s Laboratory for Atmospheric and Space Physics was engaged in forefront space research. Using rockets to get to the fringes of outer space, LASP researchers made pioneering observations of the Sun and Earth’s upper atmosphere. This talk will recount some of the earlier history of LASP’s contributions to Sun-Earth (and planetary) studies. A principal focus of the talk will be the modern studies of energetic particles and electromagnetic fields in Earth’s cosmic neighborhood. LASP has been playing an increasingly prominent role in forefront studies of Earth’s environment and LASP researchers are using this core terrestrial knowledge to advance planetary and astrophysical understanding as well. Moreover, study and understanding of the space environment of Earth is absolutely essential for our knowledge of “space weather” which represents a major threat to our modern technological society. The presentation will address all these aspects and will conclude with a look forward to future LASP programs and opportunities.

Biography
Dr. Daniel Baker is Director of the Laboratory for Atmospheric and Space Physics at the University of Colorado-Boulder and is Distinguished Professor of Planetary and Space Physics there. He holds the Moog-Broad Reach Chair of Space Sciences at CU. Dr. Baker obtained his Ph.D. degree with James A. Van Allen and has published over 800 papers in the refereed literature and edited eight books on topics in space physics. Dr. Baker was selected as an Associate of the U.S. National Academies (2004). Awards include University of Colorado’s Robert L. Stearns Award for outstanding research, service, and teaching (2007); University of Colorado’s Boulder Faculty Assembly Distinguished Research Lecturer Award (2010); American Institute of Aeronautics and Astronautics James A. Van Allen Space Environments Medal (2010); American Astronomical Society Kavli Prize Lectureship (2015); and Vikram A. Sarabhai Professorship of the Indian Physical Research Laboratory (2015). Dr. Baker is a Fellow of the American Geophysical Union, the International Academy of Astronautics, the American
Institute of Aeronautics and Astronautics (AIAA), and the American Association for the Advancement of Science (AAAS). He is a member of the U.S. National Academy of Engineering. He has served as chair of the National Research Council Committee on Solar and Space Physics, member of the National Research Council’s 2003 Decadal Survey Panel for solar and space physics, and member of the 2006 Decadal Review of the U.S. National Space Weather Program. He served as chair of the National Academies 2013-2022 Decadal Survey in Solar and Space Physics.

Location:
The meeting will be at the IHOP Restaurant, 2040 Ken Pratt Boulevard, Longmont. Please join us for coffee, dinner, or just dessert around 6 pm; the general meeting and presentation will begin at 7 pm.

Upcoming Events

May 5<sup>th</sup> 9 pm Prairie Ridge Elementary, 6632 St. Vrain Ranch Boulevard, Firestone, CO

May 13<sup>th</sup> 9 pm Imagine Charter School 6<sup>th</sup> Grade Star Party, 1573 Twilight Ave, Firestone, CO.

May 14<sup>th</sup> 9:00 pm Majestic View Nature Center 7030 Garrison St, Arvada, CO

May 19<sup>th</sup> 2016 7 pm LAS Meeting “The Laboratory for Atmospheric and Space Physics (LASP): Understanding Particles and Fields throughout the Solar System” presentation by Dr. Dan Baker, Director LASP at IHop Restaurant, 2040 Ken Pratt Boulevard, Longmont.

May Celestial Highlights

Moon

New moon: May 6<sup>th</sup> 1:31 pm
First quarter: May 13<sup>th</sup> 11:03 am
Full moon: May 21<sup>st</sup> 3:16 pm
Third quarter: May 29<sup>th</sup> 6:13 am

Mercury

Mercury transits across the Sun’s disk on Monday morning May 9<sup>th</sup> from 5:12 am until 12:42 pm. Mid-transit is at 8:58 am. Mercury transits the Sun an average of about 13 times per hundred years. The next one is November 11, 2019.

Venus

Venus is not visible this month.

Mars

Mars begins the month with an apparent brightness of -1.5 and is 16 arc sec across. At the end of the month it will be magnitude -2 and will be 19 arc sec across. Mars opposition will be on May 22<sup>nd</sup>. It moves from constellation Scorpio to Libra on May 28<sup>th</sup>.
Jupiter begins the month at -2.3 magnitude and disk size of 41 arc seconds. By the end of the month it -2.1 magnitude and apparent disk size of 37 arc seconds. Shadows from Jupiter moons Io and Callisto are visible on the disk at the same time as Jupiter. These shadows can be seen starting May 6 from 10:40 pm to 11:59 pm.

Assuming the longitude of the Great Red Spot is 248° it may be seen at mid transit at the following times this month:

<table>
<thead>
<tr>
<th>May</th>
<th>Time</th>
<th>Alt.</th>
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<tbody>
<tr>
<td>1</td>
<td>10:54 pm</td>
<td>53°</td>
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<tr>
<td>4</td>
<td>12:33 am</td>
<td>36°</td>
</tr>
<tr>
<td>4</td>
<td>8:24 pm</td>
<td>58°</td>
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<td>6</td>
<td>10:03 pm</td>
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<tr>
<td>8</td>
<td>11:41 pm</td>
<td>42°</td>
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<td>11</td>
<td>1:20 am</td>
<td>22°</td>
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<tr>
<td>11</td>
<td>9:12 pm</td>
<td>59°</td>
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<tr>
<td>13</td>
<td>10:50 pm</td>
<td>47°</td>
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<tr>
<td>16</td>
<td>12:29 am</td>
<td>28°</td>
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<td>16</td>
<td>8:21 pm</td>
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<td>9:59 pm</td>
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<td>20</td>
<td>11:38 pm</td>
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<tr>
<td>23</td>
<td>9:08 pm</td>
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<tr>
<td>25</td>
<td>10:47 pm</td>
<td>40°</td>
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<tr>
<td>28</td>
<td>12:18 am</td>
<td>20°</td>
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<tr>
<td>30</td>
<td>9:56 pm</td>
<td>45°</td>
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</tbody>
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Saturn is in lower part of the constellation Ophiuchus. It is magnitude +0.2 in brightness as month begins and +0 on May 31st. Its disk size is 17 arc seconds this month.

Uranus

Uranus is poorly placed low in the morning sky this month. It is in the constellation Pisces; it is magnitude +5.9 in brightness and its disk is 3.3 arc sec across.

Neptune

Neptune is visible low in the morning sky in constellation Aquarius. It is magnitude 7.9 and 2.2 arc sec across.

Meteor Showers

The Eta Aquariids meteor shower peaks on May 5th and 6th. It is not a great meteor shower for us in the northern hemisphere as the radiant is very low in the east-southeast before dawn. They’ll be dramatic fast moving Earth grazers coming at you from the radiant which will be will be low in the south just before dawn. The Eta Aquariids are debris from
Comet Halley.

Comets

**Comet 252P (Linear)** is visible this month in constellation Ophiuchus. It is mag 8.4 in brightness and coma is 21 arc min across.

**Comet C/2013 X1 (PANSTARRS)** is visible this month in constellation Pisces at magnitude 7.5 and 9 arc min coma.

**Comet C/2014 S2 (PANSTARRS)** is visible in the constellation Ursa Major. It is magnitude 9.10 and coma is 2 arc min.
Overhead Sky at 9:30 pm May 15
April 21’ 2016 Meeting Minutes by Joe Hudson

Meeting began at 1900 hours local.

Vern Raben, president, opened the meeting and introduced club officers:

Gary Garzone vice president, Mike Fellows treasurer, Brian Kimball board member, Jim Elkins board member, Tally O’Donnel board member, and Joe Hudson secretary. Agenda for the evening was announced. Upcoming events on the calendar were announced:

- May 5 Prairie Ridge Elementary
- May 13 Imagine Charter School
- May 14 Majestic View Nature Ctr.
- May 19 LAS next meeting. Topic will be “The Laboratory for Atmospheric and Space Physics (LASP): Understanding Particles and Fields Throughout the Solar System” by Dr. Dan Baker. David Elmore and Tally on their trip to Atacama.

Presentation: “Time Domain Astronomy and the Las Cumbres Global Telescope” by Dr. Tim Brown (who has been a LAS member for 25 years) is the current Principal Scientist at LCOGT, and also Adjunct Professor associated with the Center for Astrophysics and Space Astronomy (CASA) at the University of Colorado, Boulder. Astronomer’s view of the universe is changing from seeing the sky as unchanging "wallpaper", to a dynamic picture in which everything changes, all the time. More, we are realizing that the ways in which things change often give us clues to the physics of astronomical objects that we could not obtain otherwise. The buzzword for this view is "time-domain astronomy", and its hardware manifestations range from the 8-meter Large Synoptic Survey Telescope (LSST), down through the Kepler Mission's 1-meter space telescope, to 30-cm backyard telescopes run by enthusiastic amateurs. In the middle of this range is Las Cumbres Observatory Global Telescope (LCOGT), so far the only observatory dedicated exclusively to the general field of time-domain astronomy, and equipped to observe many kinds of time-varying phenomena. LCOGT operates a worldwide network of telescopes with apertures from 40 cm to 2 meters, working on programs that include extrasolar planets, supernovae, near-Earth asteroids, and active galactic nuclei. I will briefly review the history of observational astronomy (and show that observing the time domain is getting back to old roots), and then describe LCOGT's origins and facilities, ending with some highlights of the science that LCOGT scientists are now doing.

Presentation: An invitation to the 2016 Rocky Mountain Star Stare (RMSS) hosted by the Colorado Springs Astronomical Society by CSAS president Scott Donnell.

The 30th annual Rocky Mountain Star Stare will be held this June 29 through July 3 on 35 acres of CSAS owned land.
near Gardner CO., located between Westcliffe and Walsenburg south west of Colorado Springs. The Rocky Mountain Star Stare offers both daytime and night time activities with a new 'Town Hall' for larger gatherings and vendor participation.

Speakers this year will be Dr Pamela Gay and Jim Bradburn Westcliffe, and the event also offers dark sky group and workshops, amateur scope building, with many children's activities and door prizes, a photo contest, and catered meals that are all 'home cooked' (pricing found at http://www.rmss.org/meals.htm ). Please be advised that the event offers 'dry camping' only, with no site electricity.

This year RMSS runs from June 29 – July 4 (Wed thru Sun) and is extended with the 4\textsuperscript{th} being a 'free day'.

Early registration is available up to May 15th with $45 for adults, 20 for persons 13 to 18, and under 12 free. After May 15\textsuperscript{th} adults are $65, $30 for persons 13 to 18, and under 12 again are free.

**Presentation: Observing in Australia by Mike Hotka** of the OzSky Star Safari, April 2-9 2016.

More information is available at http://www.ozsky.com

Mike presented highlights from an observing trip he took to Australia as offered by OzSky.com

Major trip highlights included:

- onsite scopes and most of the scope were 'light buckets' and (of course) under a very dark sky

Actual observing nights were April 2 through 9 with all night volunteers to help visitors.

- excellent catered meals (try the kangaroo)

If nothing else, the showpiece items in the Southern Sky alone made it the trip of a lifetime. The total trip duration ran 13 days, with travel by air from Denver to Sydney and train to Coonabararbran New South Wales, Australia. Overall the trip was a little north of $3000 US and Mike says it was worth every penny.

An excellent online presentation is available at mikehotka.com/ozsky2016

**Business Meeting**

Treasurer's report was presented by Mike Fellows.

Ongoing LAS project were discussed:

- Library Telescope Project - 23 people on wait list for scopes at Longmont Library (average wait time is 8 weeks). Delivered 2 scopes to the Louisville Library. Extension of the Library telescope project still under consideration.
- LAS Telescope construction: no update
- All Sky Camera Project: no update
• Radio Telescope project: no update
• Eclipse Planning: NW Nebraska Star Party – Vern to scout the area / possible rental land this Spring.
• Astro workshops at Hall Ranch after the public star party on June 25 and Sept 23

Meeting adjourned at 9 pm.

**Planetary Imaging Techniques:**

**Wavelet Magic by Vern Raben**

The Registax6 application available from [http://www.astronomie.be/registax/](http://www.astronomie.be/registax/) has been my tool of choice for quite a while now for stacking and sharpening planetary images. The Autostakkert application from [http://www.autostakkert.com/](http://www.autostakkert.com/) is now my personal favorite for aligning and stacking images as it is much easier to process multiple video files. However, I still use Registax6 wavelet sharpening to bring out details in planetary images. Over the years I came up with some wavelet settings that seemed to work fairly well. A few weeks ago I spent half a day to see if I could get better results. Below is my April 12th red channel image of Mars produced by AutoStakkert:

![Image of Mars produced by AutoStakkert](image1.jpg)

I started by setting the top two wavelet layer settings to 100% to see the effect of those layer settings:

![Wavelets Settings](image2.jpg)

As expected this exaggerated the noise quite a bit. (See following image).
To see the effect of filtering only, I set “sharpen” for layer 1 to zero. (Other layers were left at default settings).

This resulted in the following:

Detail looked fairly good but still lots of noise so I then increased the “Denoise” setting a click at a time. Somewhere between 0.3 and 0.35 the noise pretty much disappeared.

Moving on to wavelet layer 2 I increased the “sharpen” setting. Above 0.16 or 0.17 there didn’t seem to be any additional detail coming in and noise increased a fair amount.
Since there was noise apparent I increased the “Denoise” setting for wavelet layer 2. At around 0.3 the noise disappeared.

Making further adjustments to layers 3, 4, 5, or 6 resulted in degraded image. Also these settings work well for Jupiter and Saturn. Only adjustment sometimes needed is to back off the layer 2 setting from 100 to maybe 70 or 80.
Jupiter by Brian Kimball

Nightscape of Sprauge Lake
by Brian Raben