DENVER MUSEUM OF NATURE AND SCIENCE
VENUS WINDS PROJECT
MINUTES OF MEETING

Date/Time/Location: 17 January 2016 6:00 PM Exploration Studio 102

ATTENDING

Art	Ashley	**BG**	Christian	**Connor**	Cristy	Dave
Drew	Dylan	Elizabeth	**Emilie**	John	Kevin	**Mark**
Marta	Michael D.	**Michael L.**	**Yvonne**			

Guests: None

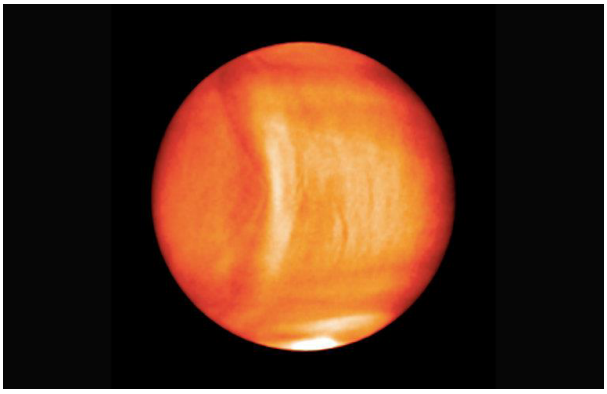
The meeting opened at 6:00 PM in Studio 102. Those **attending** are listed above.

NEW BUSINESS

Project Goals for 2017 – Mark

Mark showed plots of Venus cloud-level East-West winds as a function of latitude for 11 nights, produced by his collaborators. These were generated by using an automated algorithm with some velocities calculated by hand. The correspondence was poor enough that wind velocities derived by hand are likely to be more reliable. These data, however, hint at a 7-10 day periodicity to Venus' cloud-level East-West winds. That is, about every 7-10 days the winds seem to slow down by about 25%.

Then we discussed the stunning new Akatsuki 10 μm image that maps Venus' cloud top temperatures. A 10,000-km long, north-south, bow-like feature dominates the image, with more subtle bow-like waves on either side of the main feature. The bright feature is about 15°C warmer than the surrounding cloud tops, and the smaller dark band, just to the left of it, is about 10°C cooler than the surrounding cloud tops (see attached PowerPoint file). The amazing thing about this feature is that it is fixed relative to the surface, and maintains its position while sitting in the prevailing 100 m/s cloud-top winds. Akatsuki has observed this bow-like temperature anomaly to come and go, depending upon the local Venus time of day.



The bow-like feature, at the cloud tops, forms just downwind of the highest point of the equatorial highlands called *Aphrodite Terra*. It is most likely a giant mountain wave on the lee side of Aphrodite. This is known generically as a *gravity wave*. Prevailing east-west winds flow up and over the mountains of *Aphrodite*, launching waves that oscillate due to the competing forces of buoyancy and gravity. These waves apparently propagate all the way to the top of Venus' troposphere, which is where the cloud tops are. Just like mountain waves seen in the lee of the Rocky Mountains, they appear when there is a strong surface wind impinging on the windward side of the mountains at the right angle. When conditions for these surface winds are not favorable, the bow-like wave disappears.

These new observations provide us with a real opportunity to obtain a much deeper understanding of Venus' winds. Since the large gravity wave seen at Venus' cloud tops must propagate all the way up from the surface, the middle cloud-level winds that we measure in our images must sometimes pass through this standing wave. Therefore, our goal for 2017 is to measure the east-west winds on as many contiguous nights as possible, in order observe any regular slow down of these winds as they pass through this stationary wave. Since there are about 45 individual observing nights, we will calculate the east-west winds from only the 2-4 best images from the beginning and end of each night.

Adobe Photoshop Licenses. Steve Lee, curator of Space Sciences, has arranged for us to purchase up to 10 individual licenses for Adobe Photoshop. Mark took down the names and computer platforms of the seven folks who need this software, and sent them to Steve. This will allow us to unify our processing procedures for just one software tool. Thank you, Steve!

Automated Image Registration. Marta experimented with automated image registration software on her Dec 18 images. She gave them to Ka Chun Yu, curator of Space Sciences and our new museum liaison, who has some software that he built to co-register other kinds of images. Marta showed us the results – they were impressive. The Dec 18 images were automatically co-registered to within about 20 pixels. Although these are not quite good enough for our needs, there are apparently many adjustments that can be made to this algorithm, so there is some promise for it to be able to automate the most tedious tasks of our project. Marta reported that it only took Ka Chun about 15 minutes to register the images. Thanks, Ka Chun! He is planning on visiting us at our next meeting on Jan 31.

Assignment for Next Meeting. The assignment for Jan 31 is to identify the best 2 images near the beginning of 10 or 20 observing nights, and the best 2 images from the end of each of those nights. Bring copies of these images with you to our next meeting on Jan 31, 2017. It might also be worthwhile to look for anomalous north-south features in our images. There were hints of something like that in Marta's Dec 18 images, so maybe 'ghosts' of the cloud top gravity wave actually exist in some of our images.

Submitted by Arthur C. Tarr, Venus Winds Project Coordinator