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Welcome to this update from VEXAG on topics dealing with Venus research and exploration. Your contributions, comments and suggestions welcome.

Sanjay Limaye, VEXAG Chair

The Beginning...



Mariner 2 was launched towards Venus on 27 August 1962. Its successful observations of the planet during its close approach to Venus on 14 December 1962 at a distance of about 35,000 km began the space era of planetary exploration. In the last half century planetary exploration has seen tremendous strides and is now an international endeavor. The technological achievements are awesome – beginning with bouncing off radar signals from a Venus and beyond to successfully lowering Curiosity Rover on the surface of Mars using the sky crane are a testament to creativity, technological prowess and public support. Planetary exploration is now receiving

support from new entrants – India which plans to launch a Mars Orbiter in 2013, Japan (Akatsuki is cruising towards a second encounter with Venus in 2015), and even China is rumored to be planning missions to Venus. It is becoming clear that Venus exploration will benefit from both collaboration and coordination among the space faring agencies. At COSPAR 2012 in Mysore, India, collaboration was highlighted during the Agency Forum by all attending space agency representatives. An International Venus Exploration Working Group is also being formed under the COSPAR umbrella that will further the dialog on future Venus exploration efforts. A

workshop on Venus was also conducted at the Indian Institute of Space Science and Technology following COSPAR, attended by thirty participants from different ISRO centers.

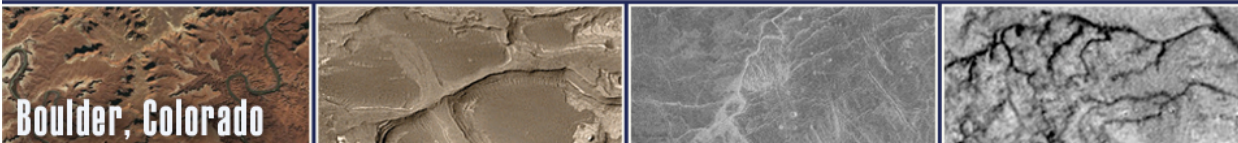
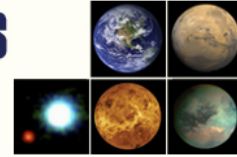


Mariner 2 float in the Rose Parade, Pasadena, CA, January 1963

News from the Comparative Climatology of Terrestrial Planets held in Boulder, Colorado

Comparative Climatology of Terrestrial Planets

June 25–28, 2012



The conference on Comparative Climatology of Terrestrial Planets was held June 25 – 28, in Boulder, CO. This conference brought together international specialists from a broad range of disciplines that presented the latest ideas on the comparative aspects of climates on Earth, Venus, Mars, Titan and extra-solar planets. This meeting was the first to be supported by all four divisions of NASA's Science Mission Directorate (SMD), and the international attendance exceeded 125 scientists from the Earth Sciences, Planetary Science, Astrophysics, and Heliophysics communities. Chief Scientist Dr. Waleed Abdalati addressed the attendees on Wednesday, June 27, and held a question and answer period where the audience was actively engaged. NASA/SMD opening and closing summary presentation was given by Adriana Ocampo from the Planetary Science Division. Richard Eckman from SMD's Earth Science Division participated in the panel and closing comments.



Dr. David Crisp from the Jet Propulsion Laboratory fields a question on the impact of atmospheric CO₂ changes in the Earth's atmosphere from Professor Raymond Pierre-Humbert of the University of Chicago.

The science program presented a balanced representation of science topics that spanned all four NASA science divisions. Many excellent presentations were made covering climate processes in Earth's atmosphere; terrestrial planet climate models; interactions between planetary interiors, surfaces and atmospheres; solar-atmosphere interactions; and exo-planet atmospheres. Most importantly, the conference achieved its primary goal of providing a unique opportunity for scientists to advance understanding in climate research by stimulating cross-discipline collaboration.

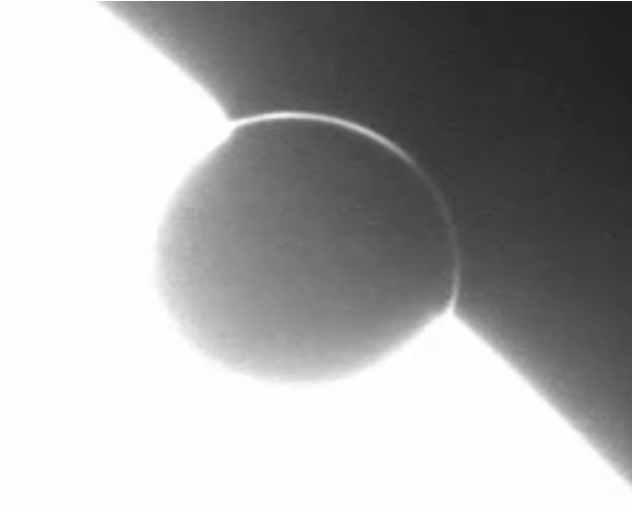
In addition to the formal science program, the public event sponsored by the Planetary Society featuring Bill Nye the Science Guy was also a huge success. Over 575 people from the Boulder area attended this event. Audience members listened attentively to presentations from Bill Nye (The Planetary Society), Brian Toon (University of Colorado), Jim

Hansen (NASA GSFC), Karen Rice (USGS), and David Grinspoon (Denver Museum of Nature and Science). Following the presentations, audience members supplied the panelists with questions for over an hour. Visit:

<http://www.youtube.com/watch?v=CVcoEP8z2Q0> and <http://www.lpi.usra.edu/meetings/climatology2012/>

Transit of Venus – 5/6 June 2012 – Thomas Widemann

The Venus aureole was observed successfully from coronagraphs deployed at many sites around the world and also from Solar Dynamics Observatory. These observations are useful in learning about the atmospheric thermal structure of Venus. The event was carried live on NASA TV and on the web through NASA Edge and was viewed from around the world.



Left: Venus aureole observed by SDO. Right: Pedro Machado and colleague did not actually observe the transit from the back of the elephant, but did capture the aureole at the site of the Udaipur Solar Observatory in India.

During Venus transits in front of the Sun, close to the ingress and egress phases, the fraction of the Venus disk projected outside the solar photosphere appears outlined by a thin arc of light, that we called the "aureole". The rays that pass closer to the planet center are more deviated by refraction than those that pass further out. For the 2012 opportunity we prepared a set of portable coronagraphs to obtain multi-wavelength, space- and time-resolved photometry of the aureole, in collaboration with other space and ground-based campaigns. This is a historical premiere. The coronagraphs were distributed in the visibility area around the Pacific, over eight sites where local logistic and observational support was available. Several sites obtained useful data at frame rates of several images/sec. First analysis of the campaign presenting first results obtained at 450, 535, 607 and 760 nm (FWHM 10 nm) will be shown at various fall meetings (EPSC - Madrid, Spain; AAS/DPS in Reno, NV; and AGU fall meeting). A comparison with data collected at the 2004 transit shows long term variations in the aspects, duration and latitudinal extension of the aureole, in particular a marked asymmetry between morning and evening Venus terminator. These can be linked to variations in the vertical distribution of the upper atmosphere absorbers (aerosols and cloud-top level). A general feature in all recent transits (XIXth - XXIst Century) is the presence of a brightness peak at high latitude, which was reported in 1769, 1874, 1882 and imaged several minutes before and after first and last contact, respectively. The historical record of the aureole contains hints of varying features and a constant polar-spot presence, which can now be interpreted in the light of the measurements obtained in 2004 and 2012.

Venus Workshop at the Indian Institute of Space Science and Technology



A workshop on Venus science objectives for future missions was held at the Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram, India on 23-24 July 2012. The idea for the workshop matured during several discussions with Indian

Space Research Organization over the last year with the purpose to provide a detailed introduction to Venus science and exploration priorities. More than thirty scientists, engineers from several centers of Indian Space Research Organizers as well as some faculty and students of IIST attended the workshop. Presenters were A. Vandaele and R. Drummond (BIRA), A. Fedorova, N. Evdokimova, A. Rodin (IKI), S. Smrekar (JPL via web), P. Ford (MIT via web), T. Misra (SAC/ISRO) and S. Limaye (U. Wisconsin).

The workshop also featured a detailed presentation on RISAT, a Synthetic Aperture Radar launched by ISRO in April 2012 and currently returning high resolution images of Earth's surface. The feedback from the participant confirms that the workshop was quite successful in meeting its goals.



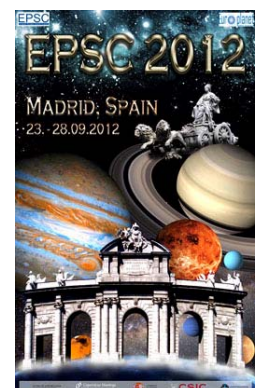
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Future Venus Meetings of Interest

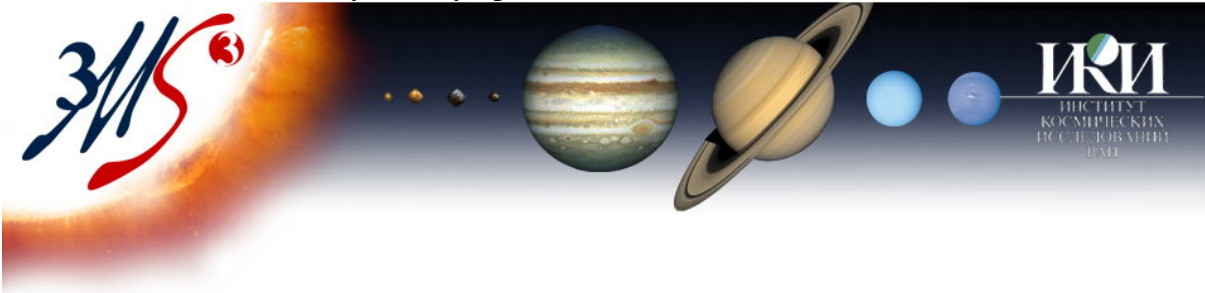


European Planetary Science Congress 2012, IFEMA-Feria de Madrid, 23 – 28 September 2012, Madrid, Spain

Several papers on Venus will be presented at this congress in Future Missions and Terrestrial Planets sessions.



The Third Moscow Solar System Symposium, 3M-S³, Moscow, Russia, October 8-12, 2012



The third Moscow international Solar System Symposium (3M-S3) will take place from October 8 till 12, 2012. Subject matter of this symposium covers many problems of the Solar system science with a central topic “Moon and Mars exploration”. There will be Venus presentations related to the Venus International Reference Atmosphere update, Venus Express as well as future missions to Venus (<http://ms2012.cosmos.ru/>).

44th Annual Meeting of the Division for Planetary Sciences, Reno, Nevada. 15-19 October 2012

Several interesting papers on Venus (Length of Day, Venus Transit and Venus Express results) will be presented.

UAVs for Venus, NASA/GRC, 6 November 2012

A one day meeting will be held in Cleveland on November 6, 2012 to discuss Venus science that can be accomplished by UAVs above ~ 62 km altitude on Venus. Not easily explored by balloons, and generally inaccessible to entry probes, region near and above the cloud top of Venus harbors the unknown ultraviolet absorber whose identity remains unknown. UAV's appear a possible means of sampling this region to determine the properties of this absorber, among other potential science objectives. Interested persons should contact Tibor Kremic.

VEXAG Meeting, Washington, DC, 13-15 November 2012

The tenth VEXAG meeting will be held 13–15 November 2012. The 2.5 day meeting will be held at or near NASA Headquarters in downtown Washington, DC. It is anticipated that the meeting will be carried via WebEx. Please visit the VEXAG URL to indicate your interest in attending/participating in the meeting. A draft agenda is posted at the same URL.

The primary objective of this meeting is to review and update the [Goals and Objectives for Venus Exploration](#). The purpose of the Goals and Objectives Document is to lay out a practical roadmap for obtaining observations to answer the major questions about Venus by future missions, and is a critical document for potential proposers to mission AOs and hence your participation in ensuring its scope and priorities is important. Venus scientists are urged to examine the Goals and Objectives document (http://www.lpi.usra.edu/vexag/VenusExploreGoalsObjectives_03_12.pdf) and submit suggestions for any desired changes to the Goals and Objectives Focus Group by e-mail or via the Bulletin Board accessible from the VEXAG URL. Time will be made available for short science presentations as well as updates from the

community on issues relevant to Venus science and exploration. Please watch for additional information regarding advance registration and meeting details.

Fall Meeting of the American Geophysical Union, San Francisco, 3-8 December 2012

A meeting of the VEXAG Executive Committee will be held during the AGU meeting. A room has been requested for Wednesday, 11:30 – 13:30. There are two Venus sessions. Program will be available at the AGU URL in September.

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Venus in the News

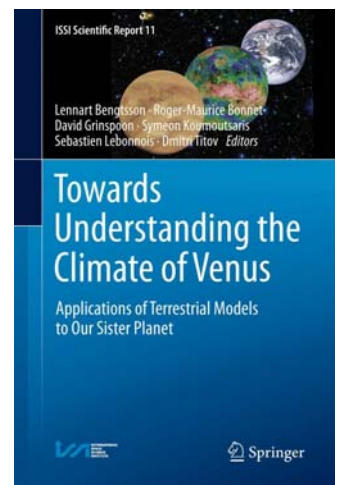
Congratulations to Janet Luhmann, recipient of the 2012 COSPAR Space Science Award in Mysore, in part due to contributions she has made to the study of the effects on Venus of its space environment.



Towards Understanding the Climate of Venus - Available November 2012

Applications of Terrestrial Models to Our Sister Planet, [ISSI Scientific Report Series](#), Vol. 11, Bengtsson, L.; Bonnet, R.-M.; Grinspoon, D.; Koumoutsaris, S.; Lebonnois, S.; Titov, D. (Eds.)

This is the output of the ISSI working Group on the Climate of Venus. Chapters include: History of Venus Observation.- The Surface and Atmosphere of Venus: Evolution and Present State.- Radiative Energy Balance in the Venus Atmosphere.- Atmospheric Circulation and Dynamics.- The Dynamics and Circulation of Venus Atmosphere.- Modeling Effects.- Models of Venus Atmosphere.- Comparing Earth and Venus.- Future Prospects.



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Venus Missions

Venus Express Mission

Operating normally. Longest radio occultation season this summer, VMC, VIRTIS, SPICAV/SOIR, ASPERA and MAG observations continuing. VIRTIS data for the full mission up to March 2012 have now been delivered and are available in the ESA Planetary Science Archive at www.rssd.esa.int/psa/.

Akatsuki Mission

Cruising in solar orbit towards a close approach in late 2015. Decision on how and when to insert in Venus orbit will be made in 2014. Some new results from Venus observations acquired after the first close approach and later have been obtained.