

## Cassini closes in on the centuries-old mystery of Saturn's moon Iapetus

Extensive analyses and modeling of Cassini imaging and heat-mapping data have confirmed and extended previous ideas that migrating ice, triggered by infalling reddish dust that darkens and warms the surface, may explain the mysterious two-toned "yin-yang" appearance of Saturn's moon Iapetus. The results, published online Dec. 10 in a pair of papers in the journal *Science*, provide what may be the most plausible explanation to date for the moon's bizarre appearance, which has puzzled astronomers for more than 300 years.

Shortly after he discovered Iapetus in 1671, the French-Italian astronomer Giovanni Domenico Cassini noticed that the surface is much darker on its leading side, the side that faces forward in its orbit around Saturn, than on the opposite trailing hemisphere.

One of the papers, led by Tilmann Denk of the Freie Universität in Berlin describes findings made by Cassini's Imaging Science Subsystem (ISS) cameras during the spacecraft's close flyby of Iapetus on Sept. 10, 2007, and on previous encounters. "ISS images show that both the bright and dark materials on Iapetus' leading side are redder than similar material on the trailing side," said Denk, suggesting that the leading side is colored (and slightly darkened) by reddish dust that Iapetus has swept up in its orbit around Saturn. This observation provides new confirmation of an old idea, that Iapetus' leading side has been darkened somewhat by infalling dark dust from an external source, perhaps from one or more of Saturn's outer moons. However, the ISS images show that this infalling dust cannot be the sole cause of the extreme global brightness dichotomy. Close-up ISS images provide a clue, showing evidence for thermal segregation, in which water ice has migrated locally from sunward-facing and therefore warmer areas, to nearby poleward-facing and therefore colder areas, darkening and warming the former and brightening and cooling the latter.

The other paper, by John Spencer of SwRI's office in Boulder, Colo., and Denk, adds runaway global migration of water ice into the picture to explain the global appearance of Iapetus. Their model synthesizes ISS results with thermal observations from

## TECHNICS

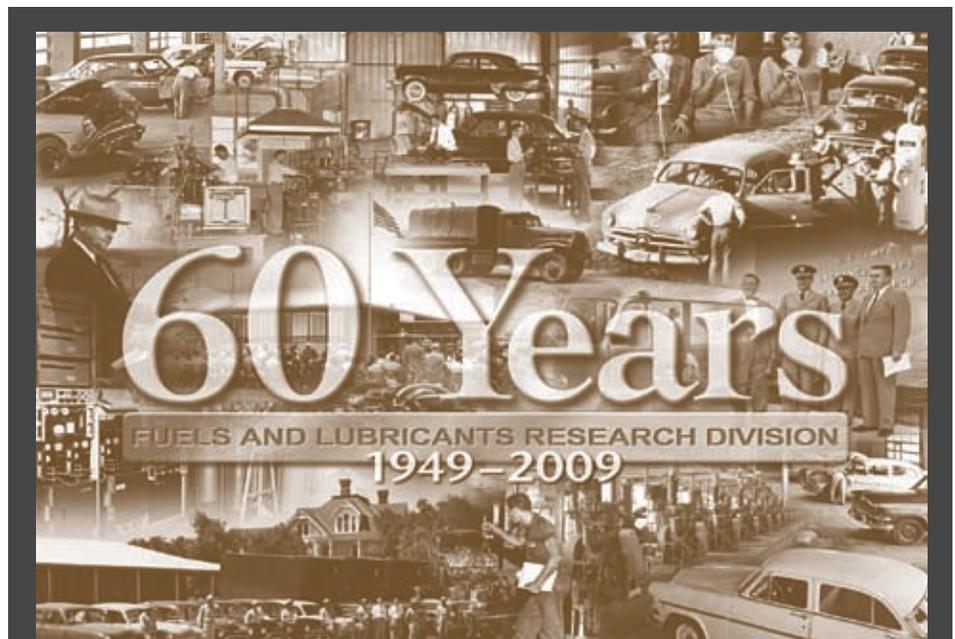
Brief notes about the world of science and technology at Southwest Research Institute

Cassini's Composite Infrared Spectrometer (CIRS) and computer models. CIRS observations in 2005 and 2007 found that the dark regions reach temperatures high enough (129 degrees Kelvin or -227 degrees F) to evaporate many meters of ice over billions of years. Spencer and Denk propose that the infalling dust darkens the leading side of Iapetus, which therefore absorbs more sunlight and heats up enough to trigger evaporation of the ice near the equator. The evaporating ice re-condenses on the colder and brighter poles and on the trailing hemisphere. The loss of ice leaves dark material behind, causing further darkening, warming, and ice evaporation on the leading side and near the equator. Simultaneously,

the trailing side and poles continue to brighten and cool due to ice condensation, until Iapetus ends up with extreme contrasts in surface brightness in the pattern seen today. The relatively small size of Iapetus, which is just 1,500 kilometers (900 miles) across, and its correspondingly low gravity, allow the ice to move easily from one hemisphere to another. "Iapetus is the victim of a runaway feedback loop, operating on a global scale," said Spencer.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. JPL manages the mission for the Science Mission Directorate at NASA Headquarters in Washington. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging team is based at the Space Science Institute, Boulder, Colo. The Composite Infrared Spectrometer team is based at NASA's Goddard Space Flight Center, Greenbelt, Md., where the instrument was built, with significant hardware contributions from England and France.

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The Fuels and Lubricants Research Division at Southwest Research Institute celebrated the 60<sup>th</sup> anniversary of automotive research, development and evaluation at the Institute during October. The first engine laboratory at SwRI was constructed in early 1949 after Norman Penfold joined the Institute staff and began establishing a fuels and lubricants laboratory to serve the petroleum and automotive industries. Many of the original clients remain clients of the division today.

## UTSA, SwRI join national research roundtables

The University of Texas at San Antonio (UTSA) and Southwest Research Institute (SwRI) have joined the Government-University-Industry Research Roundtable (GUIRR), the nation's advisers in science, engineering and medicine.

GUIRR provides a platform for leaders in science and technology from academia, government and business to discuss and take action on national and international scientific matters. This includes such topics as university-industry partnerships, scientific training in academia, the relationship between academia, government and business, and the effects of globalization on U.S. research. Through roundtable meetings and working groups, GUIRR's university and industry partners provide guidance and suggest possible solutions to streamline policies and procedures unique to the government-university-industry interface. This counsel, often documented in advisory reports, is distributed to key national leaders, including the President's staff.

"UTSA aspires to become a top research university, and our membership in GUIRR demonstrates this commitment," said Robert Gracy, vice president for research at UTSA. "UTSA's partnership with Southwest Research Institute to join GUIRR will not only strengthen the relationship between our respective institutions, it will allow our institutions to contribute to the development of national policies that will facilitate science and technology research collaborations in the future."

"As a contract research and development organization serving multiple industries and government clients, SwRI strives to apply scientific discoveries and new technologies in innovative ways," said Walter Downing, SwRI executive vice president. "Teaming with UTSA as GUIRR university-industry partners gives us a unique opportunity to participate in, learn from and contribute to the leading research collaborations in the nation."

For more about GUIRR, see <http://www.nationalacademies.org/guirr/>. Contact Maria Martinez at (210) 522-3305 or [maria.martinez@swri.org](mailto:maria.martinez@swri.org).

## SwRI® Fire Technology Department celebrates 60th anniversary

When a fire is out of control, the results can be devastating. In 2007, the U.S. Fire Administration recorded more than 3,000 deaths, more than 17,000 injuries and about \$733 million in property damage due to fires. Just 60 years ago, some 10,000 deaths, and \$700 million in property damages were reported in the United States annually from fires.

The first report of fire research and testing at Southwest Research Institute dates back to 1949. Sixty years later, SwRI's Fire Technology Department continues to be one of the world's largest organizations dedicated to fire research and testing.

SwRI offers multidisciplinary fire and explosion research and engineering services, including fire resistance and material flammability testing, as well as listing and labeling and follow-up inspection services. The Institute has more than 50,000 square feet of space dedicated to fire research and testing, including a new facility for sprinkler testing and related research with a ceiling capacity of up to 60 feet. The Institute serves government and commercial clients in the construction, transportation, chemical and petrochemical, nuclear, and telecommunications industries.

"What sets us apart is the breadth of our services and the way we work with our clients," said Dr. Marc Janssens, director of the SwRI Fire Technology Department. "Our clients communicate directly with the engineer or scientist who will manage the project, unlike other labs that have sales departments where the client does not communicate with the technical people until much later. We receive outstanding feedback on client quality surveys. Along with our focus on client satisfaction, our department continues to be very active in domestic and international codes and standards development."

SwRI's Fire Technology Department is ISO 9001:2008 registered by NSF International Strategic Registration Ltd., and the testing laboratory and inspection agency operations are ISO/IEC 17025 and 17020 accredited by the International Accreditation Service Inc.



Also, SwRI is a Nationally Recognized Testing Laboratory (NRTL) by the Occupational Safety and Health Administration (OSHA). Government agencies such as the U.S. Coast Guard, the California State Fire Marshall's Office, the Florida Building Commission, the City of Los Angeles Department of Building and Safety, and New York City's Office of Technical Certification and Research (OTCR) have recognized SwRI's Fire Technology Department.

Internationally, the Institute is recognized by Lloyd's Register of Shipping (London), Det Norske Veritas, the American Bureau of Shipping, and the Explosives and Dangerous Goods Division of the Occupational Safety and Health of New Zealand.

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