

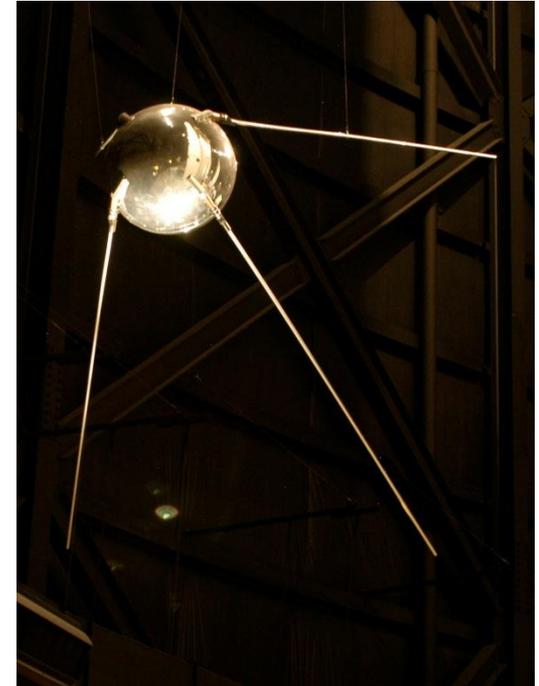
Origins of Space Science at Rice

Dick Wolf

(Thanks to Melissa Kean, Alex Dessler, Bob Haymes, Tom Killian, Umbelina Cantu, Valerie Call, David Alexander, Giovanni Fossati, Guy Hilburn, Edison Liang, Asher Pembroke, Frank Toffoletto, Pat Reiff, and Tom Hill)

The 1960s: A Unique Time for Science

- Physics had prestige among politicians because of the development of the nuclear weapons.
- In the 1950's and 1960's, the Soviet Union was widely regarded as an existential threat to the United States
 - The Soviet economy, though much smaller than the U.S., was growing at a higher percentage rate.
- Sputnik, launched October 4, 1957 was taken as evidence that the Soviets were passing the U.S. in science and technology.
- Science education suddenly became a top national priority.
 - There was massive popular support for this in the U.S., mainly because people were scared.
- Physics and engineering were the most prestigious undergraduate majors.
- Government support for science was rapidly increasing.
 - It was the time of “While you're up, get me a grant.”
- Jobs for scientists were plentiful.



Sputnik

Timeline

- 10/4/57 Sputnik launch
- 2/1/58 Explorer 1 launched
- 10/1/58 NASA established
- 1/31/61 First U.S. chimp in space
- 4/12/61 1st human in space
- 5/5/61 1st American in space
- 5/25/61 Kennedy stated goal of going to Moon before end of decade (State of Union)
- 9/19/61 Houston selected as site for Manned Spacecraft Center (MSC)
- 2/20/62 1st American orbited Earth
- 4/62 Construction of MSC started
- 9/12/62 Kennedy speech at Rice
- 9/63 MSC officially opened
- 7/16/69 1st manned lunar landing



- Note the pace with which things happened in the early 1960s.
- Contrast to today...

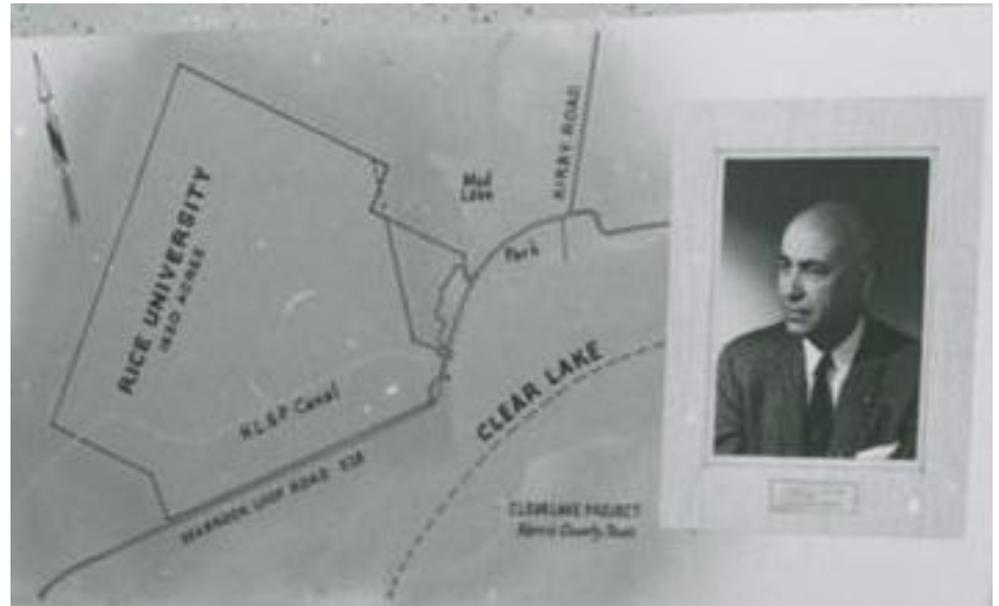
Rice Role in Siting of Manned Spacecraft Center

- Once NASA announced that a new Center would be built to serve as headquarters for the manned space program, several cities, including Houston, developed proposals.
- Key people involved in Houston proposal:
 - Morgan Davis, Chairman, Humble Oil and Refining Co.
 - Congressman Albert Thomas (Houston, Rice alum)
 - George Brown (chairman of Rice Board of Trustees)
 - Brown & Root got contract for architectural design of MSC
 - Kenneth Pitzer (Rice president)
 - Carey Croneis (Rice Chancellor)
- Advantages of Houston site:
 - Access to Ellington AFB
 - Room for a big NASA center
 - Climate that allows year-round training
 - Proximity to large city and to Rice and U of H
 - Congressman Thomas headed the House subcommittee in charge of NASA appropriations, and Vice President Lyndon Johnson, a Texan, headed the National Space Council
- Humble Oil gave Rice 1000 acres of undeveloped land from Humble's holdings near Clear Lake, with the understanding that it would be made available to the government
 - NASA later purchased another 600 acres from Rice, for \$1.4 million.

(Source: J. A. Cannon, *Houston History*, 6(1), 2008)

MSC Area: Then and Now

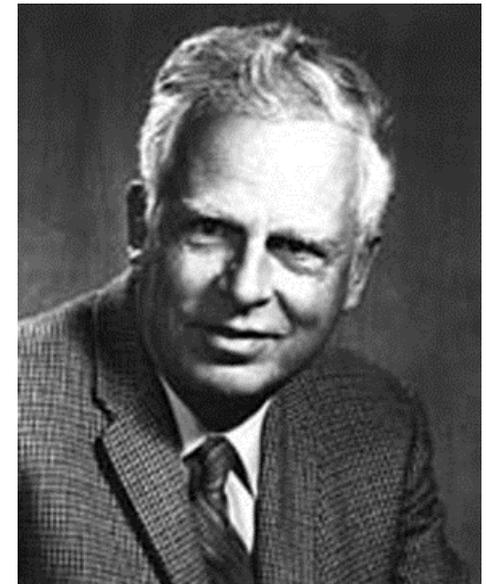
(Courtesy Pat Reiff)



(Google Maps)

Rice Role

- It was understood from the beginning that Rice would have a significant collaborative role with the MSC.
 - One factor was Rice’s strong program in materials science.
- There was considerable communication between NASA and Rice, for example:
 - Robert Gilruth (who would head MSC) and two other high NASA officials attended a Rice football game 9/22/61 and later attended a party at the home of Frantz Brotzen, who was then Dean of Engineering; attended by city officials as well as Rice and U of H administrators and faculty.
- Homer Newell, who was head of NASA’s Office of Space Science, envisaged the relationship of MSC and Rice to be similar to that between Robert Jastrow’s Institute for Space Studies and universities in the New York area.
 - Training and research
- In a speech before the Houston Chamber of Commerce 12/7/61, 3 mo. after selection of Houston as site for MSC, President Pitzer indicated the University’s “...willingness to expand its activities to meet space age needs...”.

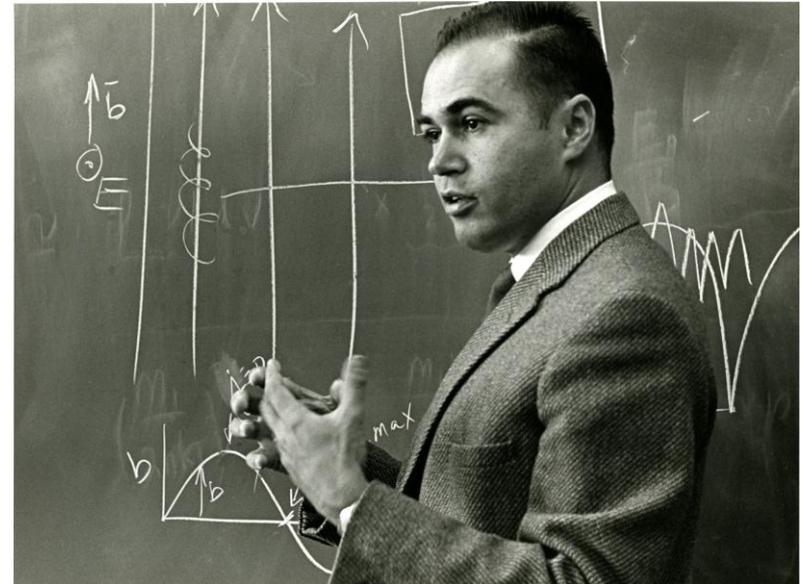


Kenneth Pitzer

(Source: J. A. Cannon, *Houston History*, 6(1), 2008)

Beginning of Space Science at Rice

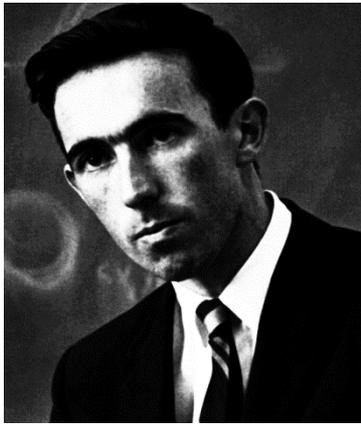
- During 1962, President Pitzer worked to set up space science courses at Rice.
 - He originally envisaged space-related courses within the Physics Department, but that department wasn't interested. Neither was Geology.
 - Pitzer decided to start a Department of Space Science.
 - As head of the new department, which would be the first department in the nation dedicated to graduate education in space science, Pitzer appointed Alex Dessler (B. S., Caltech; Ph.D. Duke).
 - According to Dessler, Pitzer made these decisions without consulting the faculty.
 - There were no divisional deans in 1962.
- About Alex Dessler:
 - After receiving his Ph. D. in low-temperature physics, Dessler went to work for Lockheed, which was advertising positions in space research.
 - 15 months before Sputnik.
 - Dessler says he found working with rockets appealing.
 - As a high school kid he had enjoyed blowing things up.
 - Within a few years, he became a leader in space physics.



Dessler's Philosophy

- Dessler's own specialty was the solar-system plasmas (now called "space plasma physics" or "heliophysics").
 - He saw space plasma physics as part of astrophysics.
 - The space near Earth is a laboratory for study of large-scale plasmas, which occupy most of the universe.
 - He also saw upper atmospheric chemistry as part of the same overall enterprise.
- His vision of the Space Science Department had three major research areas: astrophysics, space plasmas, and atoms-and-atmospheres.
- These were all physics-based areas of space science (no space medicine)
- He wanted a mix of theorists and experimentalists in each area.
- The education of graduate students was to be the main goal of the Department.
 - All research projects were to involve graduate students.
 - Every graduate student was to be broadly trained in physics and in all three areas of space science, and to be expert in one.
 - The goal of graduate education was primarily to teach the student how to do research, realizing that the student would probably change fields of research after graduation.
- Once Dessler got to Rice, he went energetically about recruiting faculty.

Faculty Appointed 1963-64



Brian O'Brien

Ph.D. Iowa (Van Allen)

- Many rocket flights through aurora
- Ill-fated Owl twin satellites



Bob Haymes

Ph.D. NYU

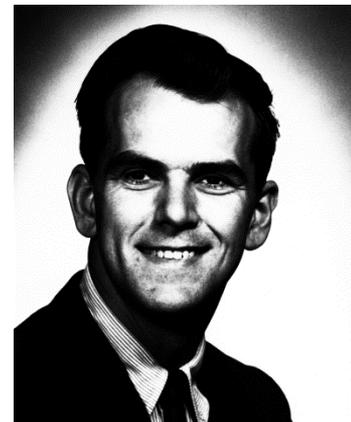
- Pioneering balloon observations of high-energy X-rays and γ -rays
- Trained several leaders in that field.



Don Clayton

Ph.D. Caltech (Fowler lab)

- Expert in theory of nucleosynthesis
- Wrote leading text on stellar structure
- Became leader in meteoritics



Curt Michel

Ph.D. Caltech (Fowler lab)

- Scientist astronaut
- Wide-ranging theoretical interests
- Became a leading expert on theory of pulsars
- Wrote influential book on pulsar magnetospheres

Bill Gordon (1918-2010)

- As a professor at Cornell he designed and supervised construction of Arecibo Observatory, world's largest radio observatory.
 - Used for both astrophysical and ionospheric research
- Father of the incoherent backscatter radar, now a widely used technique for measuring ionospheric properties.
- Served as Dean of Engineering and Natural Science, Vice President and Provost, Acting President, Member of Board of Trustees
- Maintained an active research program in ionospheric physics while he served in these administrative posts
 - Directed a series of Space Science graduate students, some of whom became very influential.



Space Science Building



3/9/65



7/1/65



1/6/66



1/20/66



3/24/66



9/9/66

- Financed by a grant from NASA (via Congressman Thomas)

(Photos: Alex Dessler)

Faculty Listed in 1967-68 General Announcements

Astrophysics Space Plasmas Atoms&

Atmospheres

Lunar Geology

Frank Low

Brian O'Brien

King Walters*

N. Soga

Bob Haymes

Hugh Anderson

Robert Kovar

John Freeman

Paul Cloutier

Bill Gordon*

Don Clayton

Alex Dessler

Bob Brown

Dieter Heymann*

Wallace Tucker

Curt Michel

Neal Lane*

Dick Wolf

Observations
Experiments

Theory

* Joint appointments, budgeted elsewhere

- The Space Science Department had 13 regular faculty in 1967-68 and remained with about that strength until 2000, when it merged with Physics.
- 0-13 in about four years!

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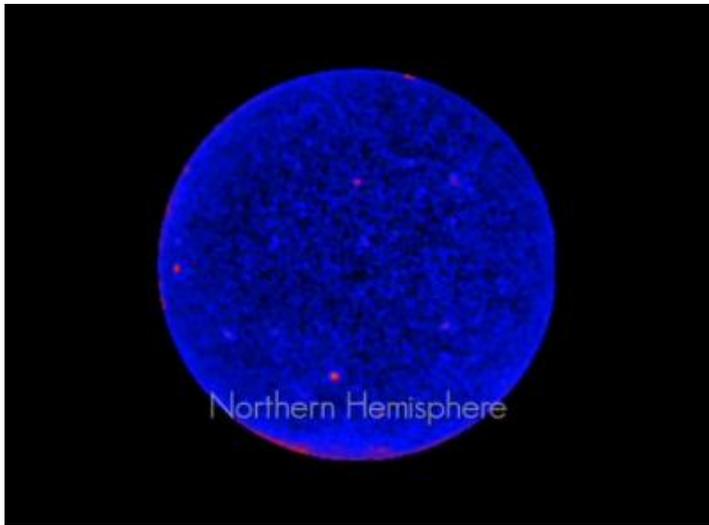
- It was quickly decided to drop the lunar geology effort to concentrate on subjects more closely related to physics.
- The Atoms & Atmospheres group was a little slower getting started than the first two, but it strengthened a lot in the few years after 1968.
- That three-group structure, with both theory and experiment/observation in each, was part of Alex Dessler's vision for the Space Science Department.

Concluding Comments on the 1960s

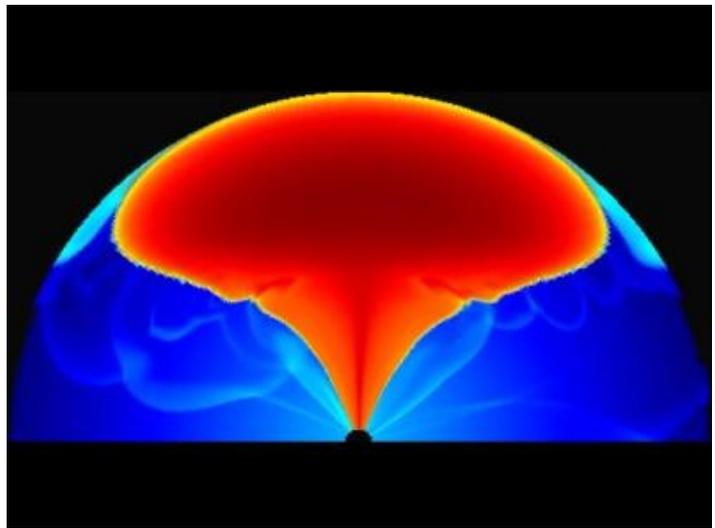
- I've tried to briefly tell the story of how space science got started at Rice and how it grew to a substantial department in just a few years.
 - It happened due to extraordinary efforts by Albert Thomas, Kenneth Pitzer, and most of all Alex Dessler.
 - As founding chair, Dessler had a clear vision for the Space Science Department, and he executed it with remarkable effectiveness.
 - The speed with which things got started seems totally remarkable compared to today.

Achievements of Faculty and Alumni

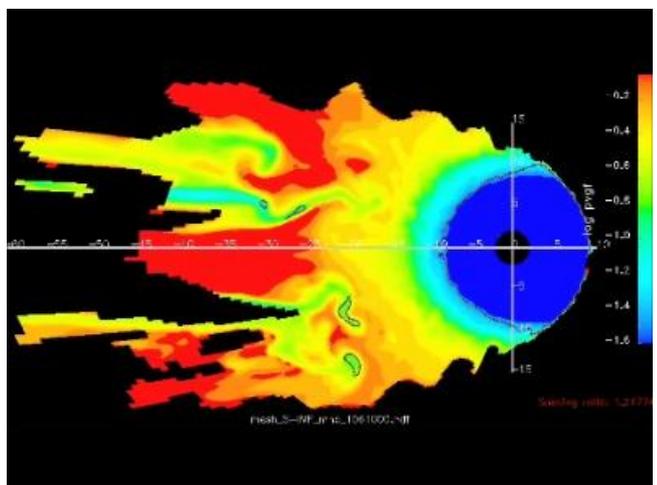
- One accomplishment of the space science effort at Rice was the production of thousands of technical papers—hard to summarize in a minute or two.
- One thing that stands out is that three former Rice faculty played leading roles in opening up major new fields of research
 - X- and γ -ray astronomy (Bob Haymes)
 - Infrared astronomy (Frank Low)
 - Incoherent-backscatter radars (Bill Gordon)
- Gordon and Chamberlain were elected to the National Academy of Science .
- Gordon was elected to the National Academy of Engineering.
- Four Rice instruments were placed on the lunar surface (Freeman and Reasoner).
- Our alumni have been our most important product.
 - Most of our ~235 Ph.D. alumni are in highly productive careers in science and technology, in universities and government and corporate labs.
 - Many have become leaders in their fields
 - The variety of their technical careers is fully consistent with Alex Dessler's original philosophy.
 - One alum is a college president and a bunch have become deans, dept. chairs.
 - One made the Forbes list of richest Americans and has engaged in major philanthropy.
 - Many, many have risen to the level where they have received major awards.



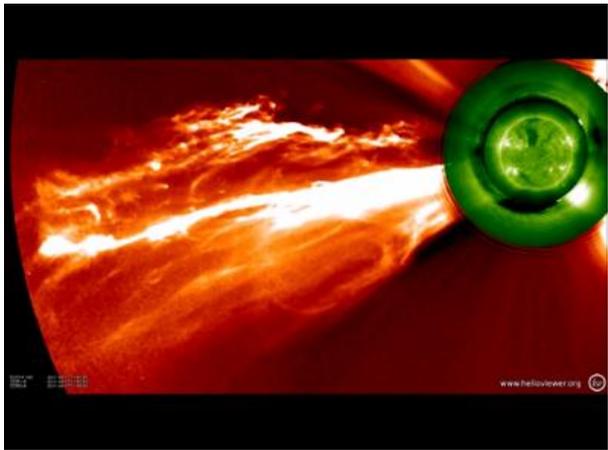
Blazars (blinking orange spots) observed in γ -rays by Fermi/LAT over a few months. Includes animations of pulsar, active galactic nucleus (from G.Fossati)



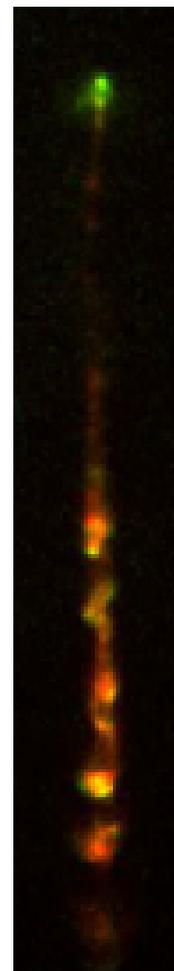
Density plot of mass accretion onto a black hole (bottom center). Initial configuration is a torus. Inflow is accompanied by outflows left & right.(MHD Simulation, G.Hilburn/E.Liang)



Transport by bubbles in Earth's plasma sheet for steady southward interplanetary B field (MHD Simulation, A.Pembroke/F.Toffoletto)



NASA STEREO observations of large solar flare and coronal mass ejection. Small circle upper right is the Sun (from D. Alexander)



HST images of jets from star formation in HH34 (P. Hartigan)

STILL