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Title:	“Applying Physics to Solve National Security Challenges – A Creighton Grad’s Retrospective from Los Alamos”
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“Applying Physics to Solve National Security Challenges – A Creighton Grad’s Retrospective from Los Alamos”

Morris (Morrie) B. Pongratz,
Creighton Arts & Sciences, ‘64

Quo Vadis?
The four pillars

- Family
- God
- Community
- Vocation

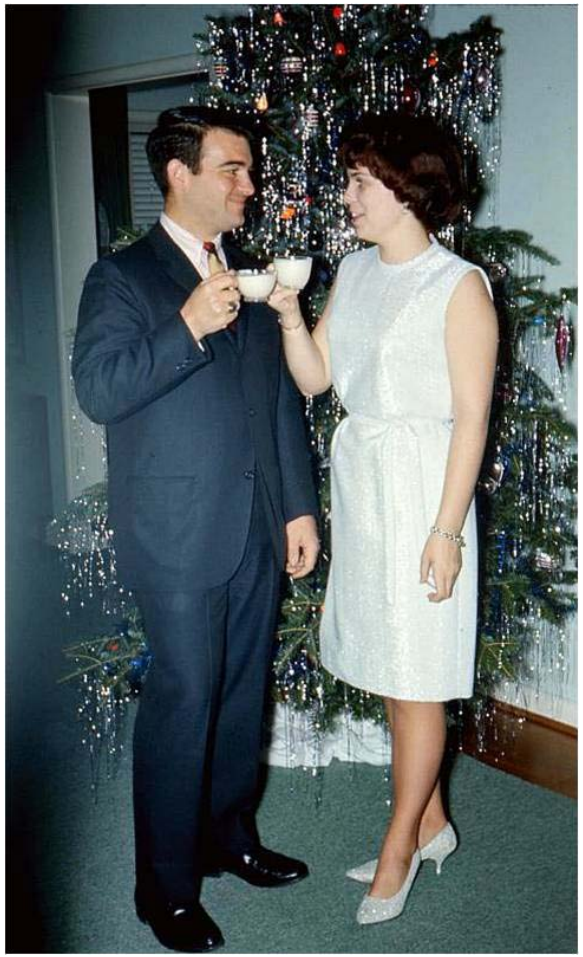
Family

It takes a village to … put up the hay..

- Born & raised near O'Neill, NE
  - Born the day the Battan Death March started
  - Remember Mom saying, "We dropped the bomb on Japan and our boys are coming home."
- K-8 in a one-room grade school
- HS at St. Mary's Academy in O'Neill
  - Football state champs in 1958!
- It did take everyone to "put up the hay". This early life experience was a crucial element of my "ethos".

Family

- Married Cheryl on April 8, 1967
- Karin born in 1969
  - Creighton Grad (1991)
  - Attorney in Phoenix
- Amy born in 1972 – died of CHD in 1973
- Dan in 1974
  - Creighton grad (1996)
  - Attorney in Omaha working for Warren Buffet company
- Grandson Kevin born in 1999 – hockey goalie



Education
Creighton University

- Creighton University – graduated Magna Cum Laude in May, 1964 with triple major – math, physics & philosophy with a minor in theology.
- Member of Creighton's GE College Bowl team in fall of 1963
  - Answered the first pop up question with "adhesion".
  - We lost
- Decided to go to grad school to study plasma physics to create a Controlled Thermonuclear Reactor (CTR) to ensure clean energy forever. Sigh…

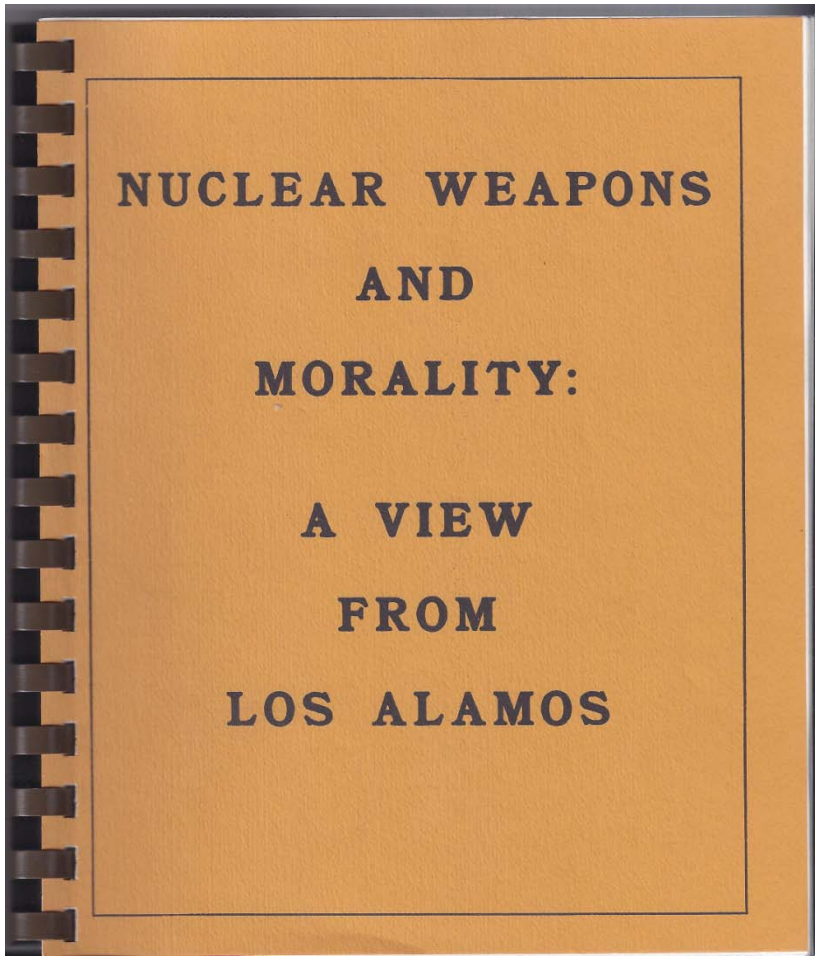
Education

University of Maryland

- Chose Maryland because of Hans Griem – plasma physics expert.
- NASA (Goddard Space Flight Center) entered my life
  - Switched to space physics (“rocket scientist”?)
  - PhD Thesis involved sounding rocket measurements of auroral electrons
- One-year Post-Doc at Maryland

God

- Example of parents, grandparents
- Jesuits – all that philosophy and theology…
- "Get involved"
  - "Nuclear Weapons and Morality"
  - Teacher – adolescents and adult seminar
  - Lector
  - Eucharistic minister
- Stay informed – "America" magazine subscription



Community

- Football coach, baseball and softball umpire, referee
  - Talented young folks disappeared to drugs and alcohol at adolescence.
- Ran for office – six terms on the Los Alamos County Council, one term on school board – total of 18 years in office
  - Focused of drug-free alternatives for youth
- NGO – non-governmental organizations
  - Kiwanis
  - Kiwanis Advisor to High School Key Club
  - PA announcer for Los Alamos – “Voice of the Toppers”
  - United Way Youth Team
- Named “Living Treasure” in Los Alamos
- Get Involved!

Vocation

"Rocket Scientist"

- Classified, Applied Physics – not going to build a list of publications
- First job - EG&G, Los Alamos
  - "E" for Harold Edgerton – greatest Nebraskan physicist???
  - Nuclear explosion Diagnostics
- Hired at University of California's Los Alamos Scientific Laboratory (LASL) in February, 1975.
- Retired from LANL in June, 2005 ("Scientific" became "National").
- Employed now at LANL as a Research Associate

Los Alamos National Laboratory
Mission

Supporting Nuclear Deterrence

Supercomputers simulate nuclear weapons performance—scientists then experiment to refine and verify data—to assure effectiveness of our deterrent without nuclear testing.

Reducing Global Threats

From epidemics to terrorist attacks, cyber security sabotage to energy security, LANL has unique capabilities that focus on identifying, anticipating, and responding to emerging threats.

Fostering Energy Security

Protecting our energy infrastructure while developing clean, sustainable energy sources are key areas of research and technology to ensure a secure future.

“What did you do at the office?”

- Nuclear Explosion Diagnostics
- 1963 CTBT - “Readiness to Test” clause
- Strategic Defense Initiative (SDI)
- NASA
- Test Ban Treaty Verification
- Nuclear Forensics

High Altitude Nuclear Explosion Phenomenology

US & USSR conducted a number of high altitude tests

Teak (1958) [77km, 3.8MT]

Kingfish (1962)

Orange (1958) [43km, 3.8MT]

Starfish

H.A.N.E. Phenomenology Issues

- Prompt gamma ray damage to space assets
- Delayed damage to satellites from energetic betas and fission fragments
  - Collisionless coupling
  - Space-time volume?
- Radar Blackout – can't see through overdense H.A.N.E. plasmas
- RF propagation scintillations
  - Scintillations from underdense structured plasmas
  - Space-time volume
  - Power spectral density of structures

Simulating H.A.N.E.

Active Experiments in Space

- Nuclear Explosions – a “no, no”
- Barium Releases
- Ionospheric Depletions

STAR FISH: The debris fireball stretching along Earth's magnetic field with air-glow aurora as seen at 3 minutes from a KC-135 surveillance aircraft

Theory/Modeling

- HANE – modeling generation and evolution of High Altitude Nuclear Explosion produced plasmas
- Structure producing plasma instabilities
- RF Propagation
  - Sub-ionospheric – TRACKER code
  - Transionospheric – TIPC code
- Ionospheric depletion modeling

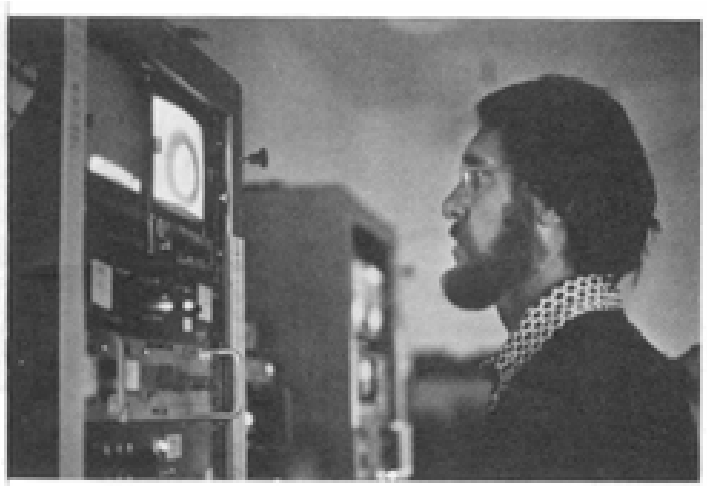
High Altitude Nuclear Explosion Phenomenology
Barium Releases

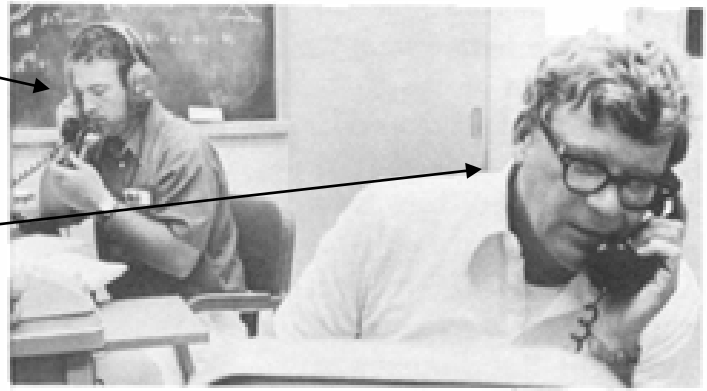
- LASL/LANL involvement began with the SECEDE II releases in late 60's and continued through the PLACES releases
- Used to simulate HANE physics or environments
- Generally in partnership with the Defense Nuclear Agency or NASA

Thermite release showing plasma structuring. Barium ions appear pink. Neutral barium atoms appear white.

Morrie Pongratz – the beginning

"Project Director" 2 months after joining LASL





Morrie

Bob Jeffries, J-10 DGL

have developed and refined suitable instrumentation to carry out their research mission since the first such rocket flight in March 1966.

With Waso out of the way, J-10's space physics team became more and more frustrated by unfavorable weather and rocket problems. Loxia, first scheduled for May 7 by Morris Pongratz, J-10 project director, was scrubbed for 6 successive evenings. On 2 occasions the weather was perfect for the launch and the countdown went all the way to zero, but when the firing signal was given the rocket motor failed to ignite. Checkout of the usually reliable and well-tested system uncovered an entire lot of defective initiators.

As the LASL scientists' frustration increased so did the interest of people all over the islands. Ha-

Active Experiments in Space:

Ionospheric Depletions

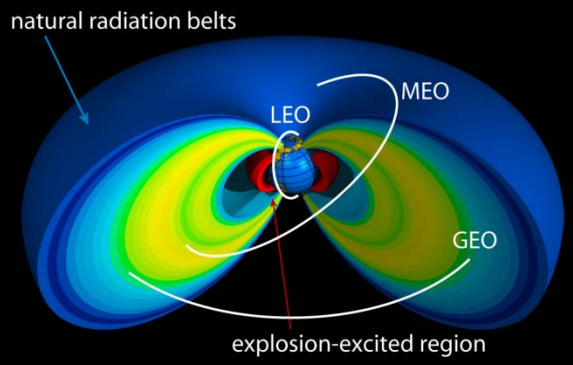
Project	Description	Rationale
Lagopedo	HE detonation in F-region above Hawaii (1977)	Verify charge-exchange/dissociative-recombination theory of Skylab plasma depletion
Waterhole I, II & III	HE detonations in topside auroral ionosphere above Churchill, Canada	Study role of thermal electrons in auroral acceleration processes

Helios Laser Simulations of HANE Physics

DREAM

The Dynamic Radiation Environment Assimilation Model

Natural Sources



Los Alamos
NATIONAL LABORATORY
EST. 1943

Nuclear Sources

B.E.A.R. Experiment
SDIO Project

- Beam Experiment Aboard a Rocket
- Demonstration of neutral particle beam, RFQ accelerator in space
  - 1 MeV hydrogen atoms
  - Most energetic accelerator ever flown in space
- Project Scientist in charge of beam diagnostics
  - “Current”
  - Range
  - Pointing
  - Divergence

Combined Release Radiation Effects Satellite (CRRES)

NASA Funded

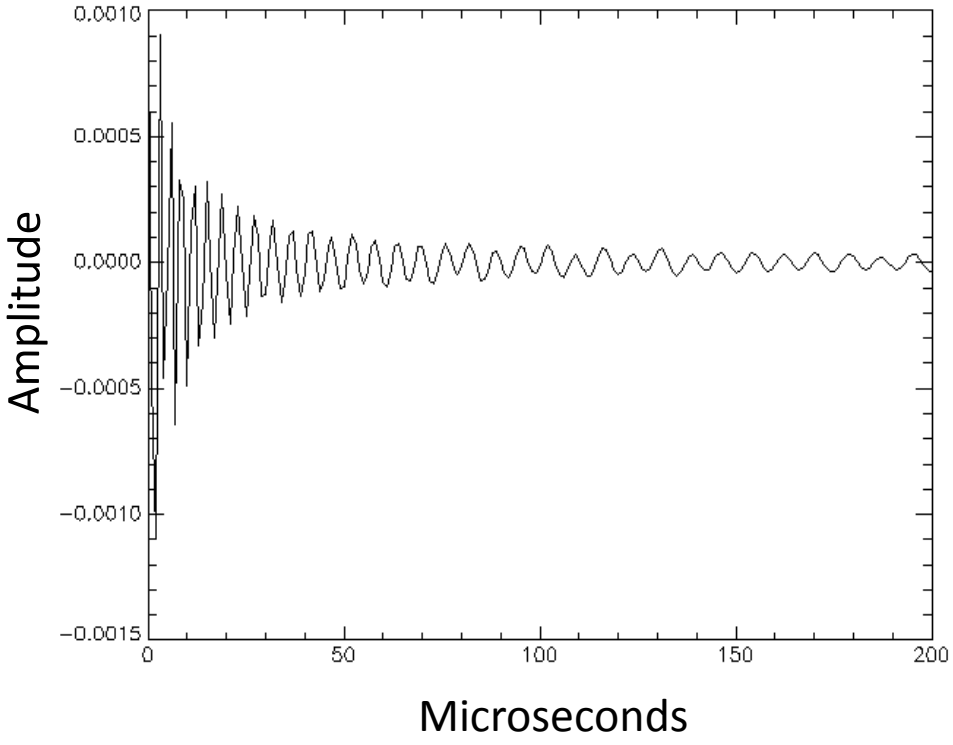
CRRES Principal Investigators

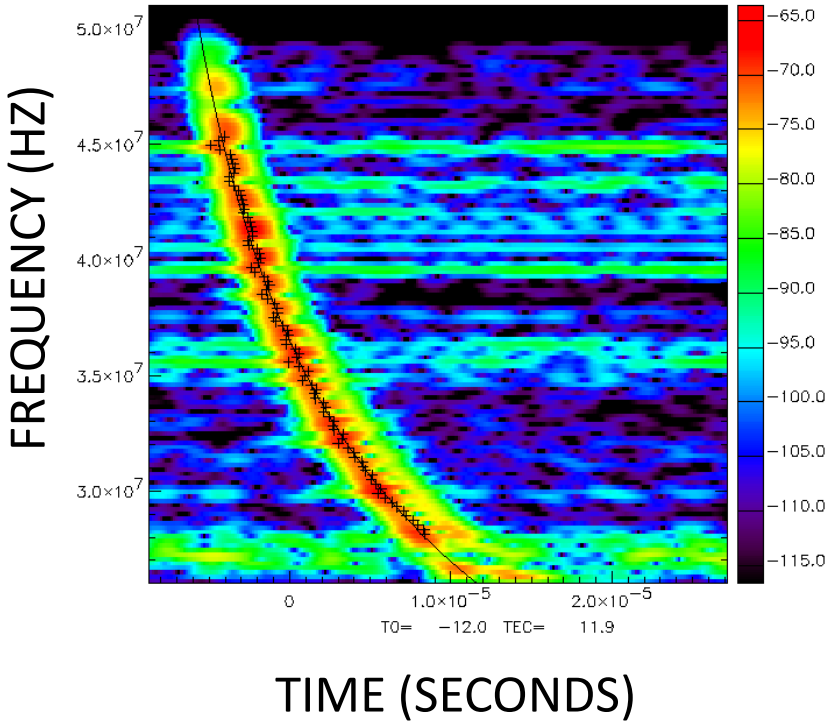
G-10 barium release above St. Croix from CRRES satellite. Barium ions appear blue. Neutral barium atoms appear green.

Test Ban Treaty Verification

- EMP Sensors flown on GPS
  - Multi-frequency time-of-arrival to remove ionospheric dispersion
  - Geolocation via TDOA
  - Need GPS quality clocks
- Background is lightning
  - Provides way to determine real time TEC globally
- Ground-based lightning sensors for ground truth - EDOTX

The ionosphere stretches and chirps the original EMP signal

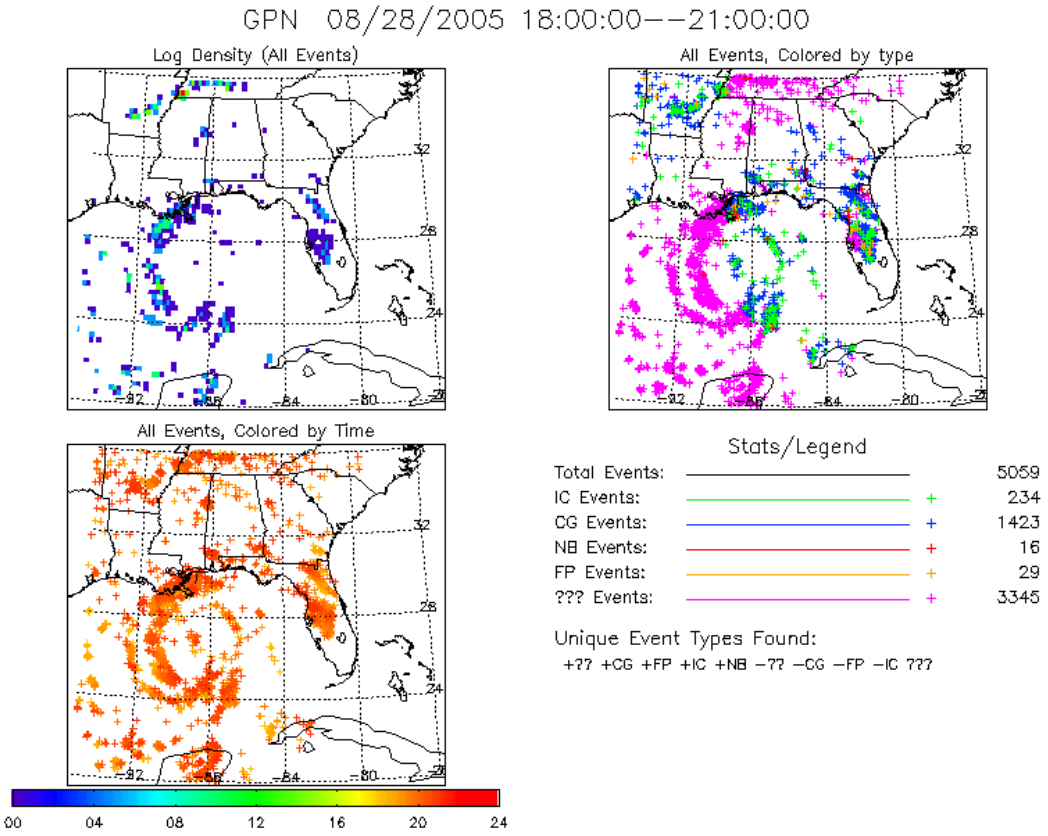




Need to understand VHF propagation effects to determine infinite frequency time-of-arrival (TOA) for geolocation purposes

Tracking Hurricane Katrina via Lightning

- Array of EDOTX sensors geolocate lightning via TDOA
- Able to track Katrina at night too far offshore for radar
- Lightning frequency correlates with storm intensification



Advice

- In 1960 you measured photons, particles and fields
- As computational power increases, scientists and engineers increasingly rely on simulations of complex models to test hypotheses and inform analyses.
  - MCNP - a general-purpose Monte Carlo N-Particle code
  - Plasma fluid codes
  - Particle-in-Cell (PIC) codes
- Communication skills – oral and written

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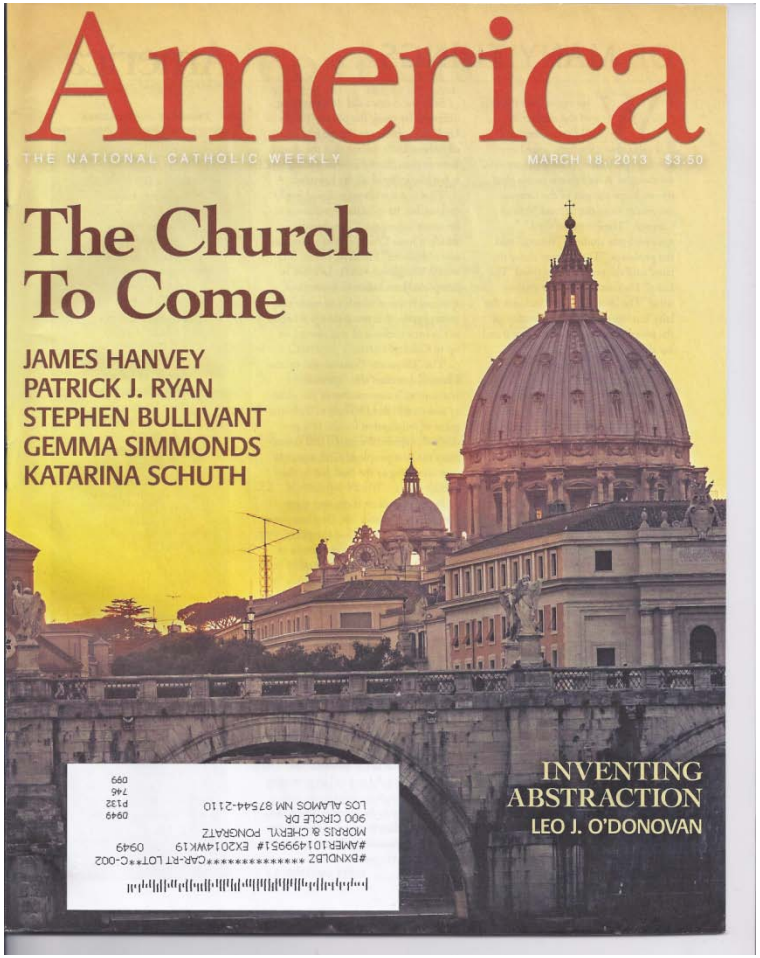

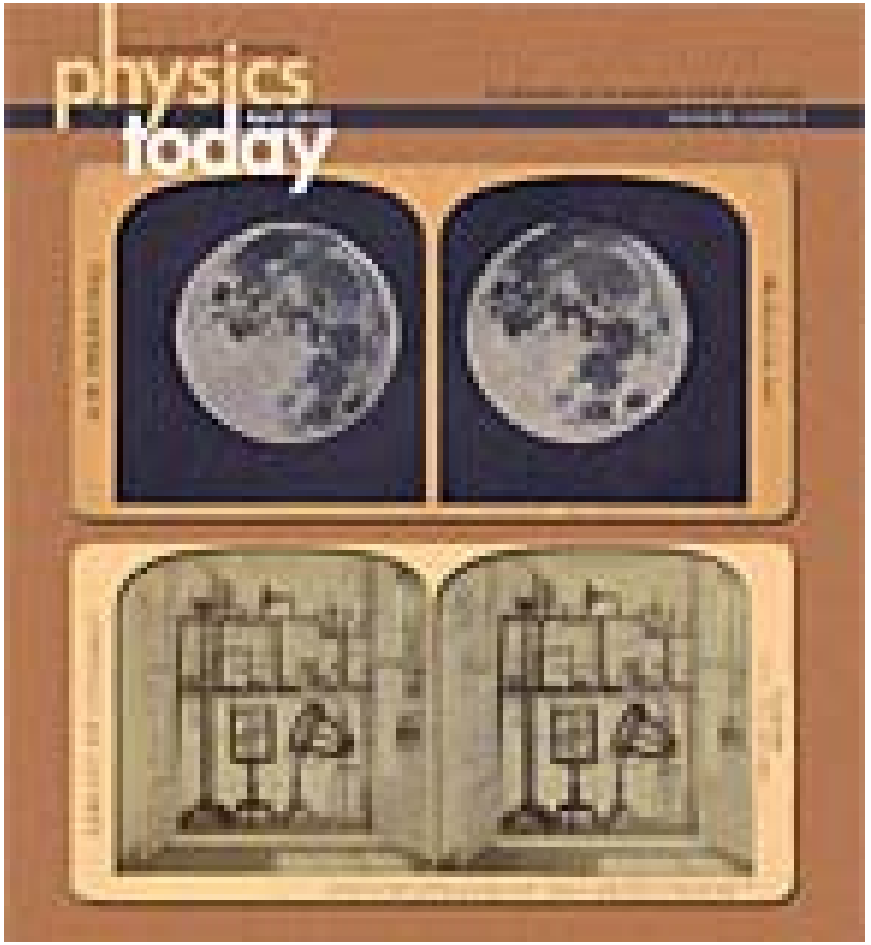

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