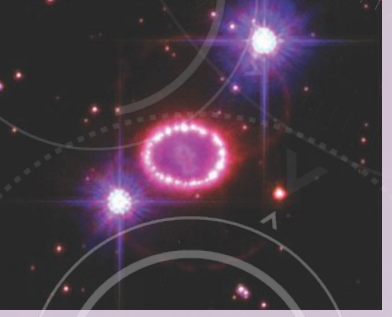
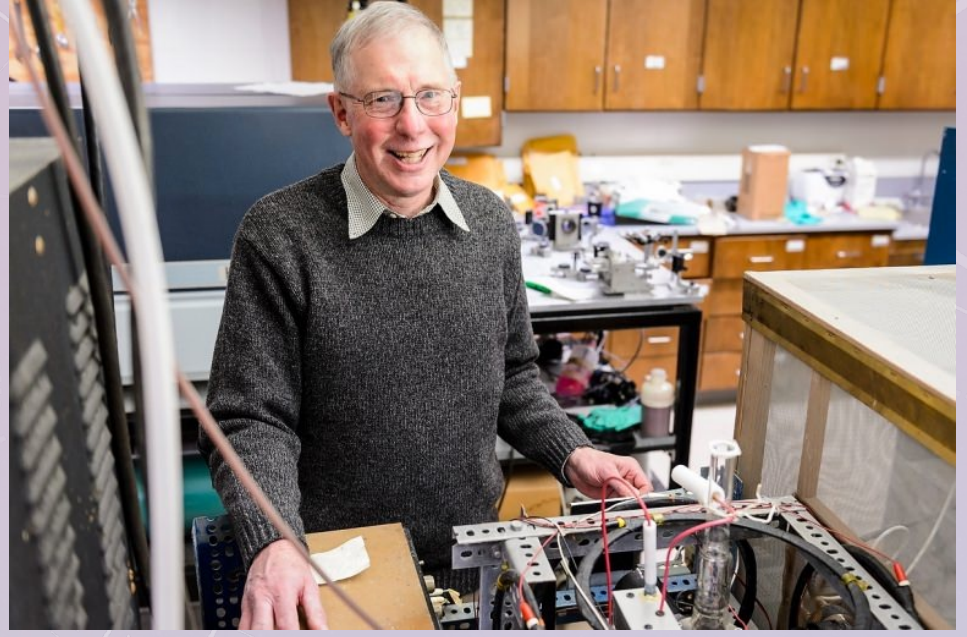
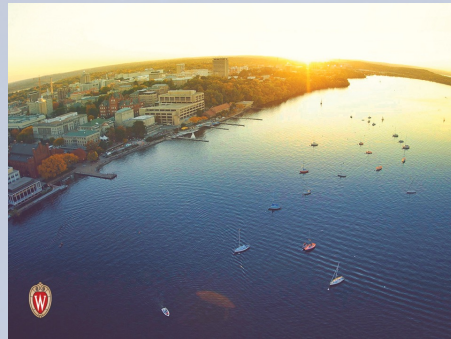




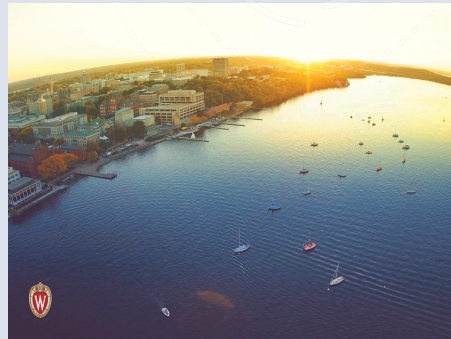
JIM LAWLER'S SCIENCE: ABOVE AND BELOW THE H-LINE

JIMFEST 2018



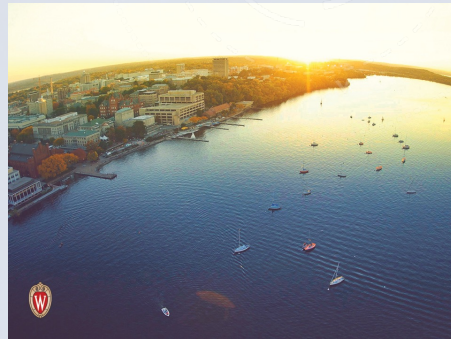
JIM'S CHRONOLOGY

- Raised in St. Louis
- 1973 B.S. Missouri-Rolla
- 1978 PhD UW-Madison
- 1978-80 Post Doc, Stanford
- 1980- Professor, UW-Madison
  - 1994-7 Dept. Chair
  - 1997 Arthur and Aurelia Schawlow Professor of Physics



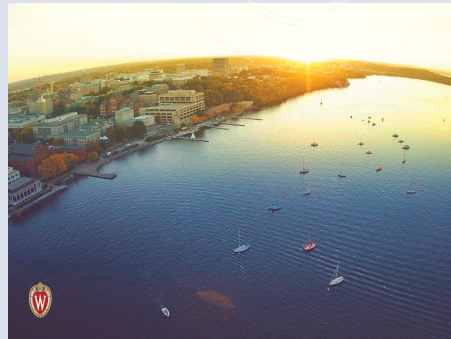
OTHER RANDOM FACTS

- 21 PhD Students
- 260+ refereed papers, h=44=h(Einstein)
- 50+ extramural research grants
- Laboratory teaching focus (307, 625)



PH.D. STUDENTS

- David W. Duquette, 1985
- Subhi K. Salih, 1985
- Douglas A. Doughty, 1987
- Eric Benck, 1988.
- Elizabeth Den Hartog, 1989
- Timothy J. Sommerer, 1990
- Hae Nuh Chu, 1991
- Thomas R. O'Brian, 1991
- Robert C. Wamsley, 1993.
- Gregory J. Parker, 1994.
- Paula Wamsley, 1994.
- Michael A. Childs 1995.
- Kenneth L. Menningen, 1995
- Scott D. Bergeson, 1995.
- Krista Mullman, 1998.
- Heidi Anderson, 1999.
- Amanda Goyette, 1999.
- Geoff Bonvallet, 2005.
- Maria Teresa Herd 2006.
- Pavle Juranic, 2007.
- Jason Corliss, 2011



SCIENTIFIC THEMES

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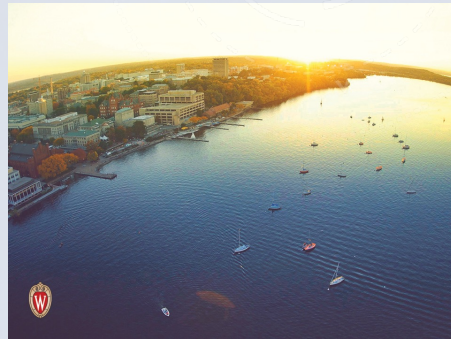


ABOVE THE H-LINE: IRON LIFETIMES

Lifetimes, transition probabilities, and level energies in Fe I

T. R. O'Brian, M. E. Wickliffe, and J. E. Lawler

University of Wisconsin—Madison, Madison, Wisconsin 53706

W. Whaling

California Institute of Technology, Pasadena, California 91125

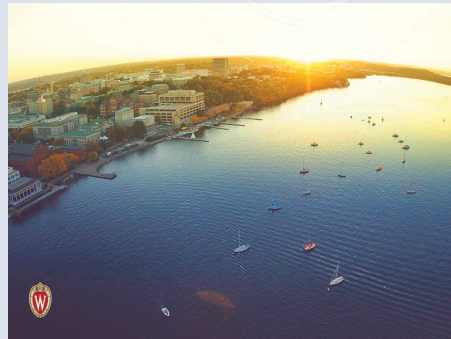
J. W. Brault

National Solar Observatory, Tucson, Arizona 85726

Received October 1, 1990; accepted December 13, 1990

We use time-resolved laser-induced fluorescence to measure the lifetime of 186 Fe I levels with energies between 25 900 and 60 758 cm^{-1}. Measured emission branching fractions for these levels yield transition probabilities for 1174 transitions in the range 225–2666 nm. We find another 640 Fe I transition probabilities by interpolating level populations in the inductively coupled plasma spectral source. We demonstrate the reliability of the interpolation method by comparing our transition probabilities with absorption oscillator strengths measured by the Oxford group [Blackwell *et al.*, Mon. Not. R. Astron. Soc. **201,** 595–602 (1982)]. We derive precise Fe I level energies to support the automated method that is used to identify transitions in our spectra.

JOSA B 8, 1185 (1991), 288 citations



ABOVE THE H-LINE: DISCHARGE DIAGNOSTICS

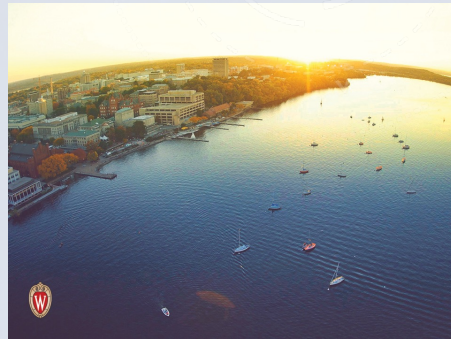
PHYSICAL REVIEW A VOLUME 38, NUMBER 5 SEPTEMBER 1, 1988

Laser optogalvanic and fluorescence studies of the cathode region of a glow discharge

E. A. Den Hartog, D. A. Doughty, and J. E. Lawler
Department of Physics, University of Wisconsin, Madison, Wisconsin 53706
(Received 15 December 1987; revised manuscript received 4 April 1988)

Various laser diagnostics are used to study the cathode-fall and negative-glow regions of a He glow discharge with a cold Al cathode. The electric field and absolute metastable densities are mapped and the gas temperature is measured over a range of current densities from a near-normal (173 V) to a highly abnormal (600 V) cathode fall. These measurements are analyzed to yield the current balance at the cathode surface, the ionization rate in the cathode-fall region, and the metastable production rate in the cathode-fall and negative-glow regions. The experimental results compare favorably with the results of Monte Carlo simulations. The density and temperature of the low-energy electron gas in the negative glow is determined by combining information from the experiments and Monte Carlo simulations.

153 citations



ABOVE THE H-LINE: OPTOGALVANIC DOPPLER-FREE SPECTROSCOPY

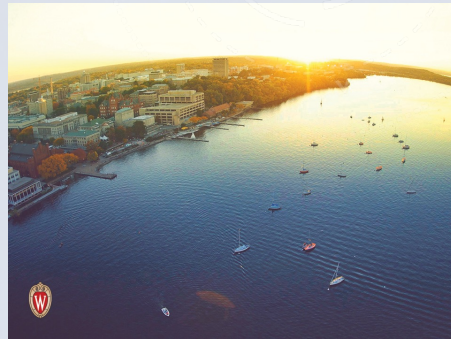
VOLUME 42, NUMBER 16 PHYSICAL REVIEW LETTERS 16 APRIL 1979

Doppler-Free Intermodulated Optogalvanic Spectroscopy

J. E. Lawler, A. I. Ferguson, J. E. M. Goldsmith, D. J. Jackson, and A. L. Schawlow
Department of Physics, Stanford University, Stanford, California 94305
(Received 15 January 1979)

Intermodulated optogalvanic spectroscopy, a new method of Doppler-free saturation spectroscopy, is described. Preliminary values of 725 ± 4 MHz for the ^{3}He $3^3D_2(F=\frac{3}{2})$-$3^3D_1(F=\frac{1}{2})$ hyperfine splitting, and of 5830 ± 6 MHz for the $3^3D_1(F=\frac{1}{2})$-$3^3D_1(F=\frac{3}{2})$ hyperfine splitting obtained using this method are reported. Intermodulated optogalvanic spectroscopy is limited in sensitivity only by shot noise in the direct current sustaining the discharge, and compares favorably in sensitivity with other Doppler-free methods.

128 citations



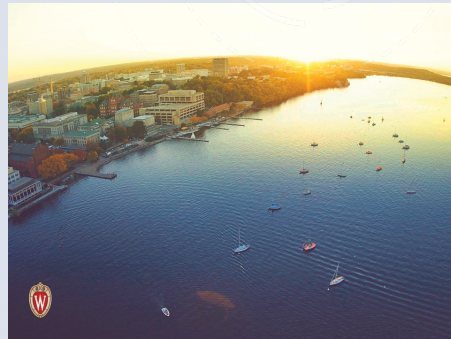
BARELY ABOVE THE H-LINE: PULSED DYE LASER

Narrow bandwidth dye laser suitable for pumping by a short pulse duration N_2 laser

J. E. Lawler, W. A. Fitzsimmons, and L. W. Anderson

The design criteria and performance characteristics are reported of a tunable, narrow bandwidth dye laser that is suitable for pumping by a short pulse duration high power N_2 laser. The dye laser system is characterized by a relatively short over-all length of 15 cm. Bandwidths of from 0.015 nm to 0.05 nm are obtained along with conversion efficiencies in the neighborhood of 10% using a 4–5 nsec pulse duration N_2 pump. Bandwidths of 0.001 nm are observed with an intracavity etalon in the system. More important, however, it is shown that the conversion efficiency of an intracavity etalon dye laser system can be greatly improved if the temporal distribution of the N_2 pump pulse is adjusted so a single dye cell in a dye laser system is used first as an oscillator and then as an amplifier. Finally, using the above technique of processing the N_2 pump pulse, a 5-nsec N_2 laser is used to pump an intracavity etalon dye laser, which is followed by a large gap external etalon and then by an amplifier; the resulting bandwidth is 0.0005 nm at 480 nm with a conversion efficiency of 4.5%.

Appl. Optics 15, 1083 (1976), 53 citations



BELOW THE H-LINE: X-RAY FEL DESIGN

IOP Publishing — Journal of Physics D: Applied Physics

J. Phys. D: Appl. Phys. **46** (2013) 325501 (11pp) doi:10.1088/0022-3727/46/32/325501

Nearly copropagating sheared laser pulse FEL undulator for soft x-rays

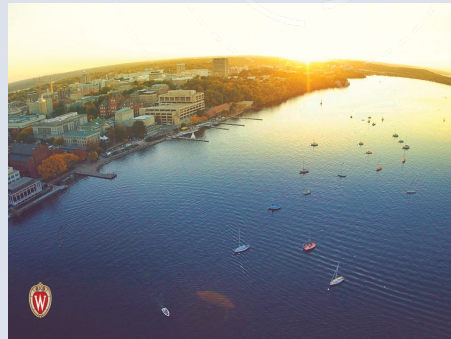
J E Lawler[1], J Bisognano[2], R A Bosch[2], T C Chiang[2,3], M A Green[2], K Jacobs[2], T Miller[2,3], R Wehlitz[2], D Yavuz[1] and R C York[4]

[1] Department of Physics, University of Wisconsin, Madison, WI 53706, USA
[2] Synchrotron Radiation Center, Stoughton, WI 53589, USA
[3] Department of Physics, University of Illinois, Urbana, IL 61801, USA
[4] Facility for Rare Isotope Beams, Michigan State University, East Lansing, MI 48824, USA

Received 7 May 2013, in final form 23 June 2013
Published 26 July 2013
Online at stacks.iop.org/JPhysD/46/325501

Abstract

A conceptual design for a soft x-ray free-electron laser (FEL) using a short-pulsed, high energy near infrared laser undulator and a low-emittance modest-energy (~170 MeV) electron beam is described. This low-cost design uses the laser undulator beam in a nearly copropagating fashion with respect to the electron beam, instead of the traditional 'head-on' fashion. The nearly copropagating geometry reduces the Doppler shift of scattered radiation to yield soft, rather than hard x-rays. To increase the FEL gain a sheared laser pulse from a Ti : sapphire or other broadband laser is used to extend the otherwise short interaction time of the nearly copropagating laser undulator beam with a relativistic electron beam.



BELOW THE H-LINE: HIGH SENSITIVITY WHITE-LIGHT ABSORPTION SPECTROSCOPY

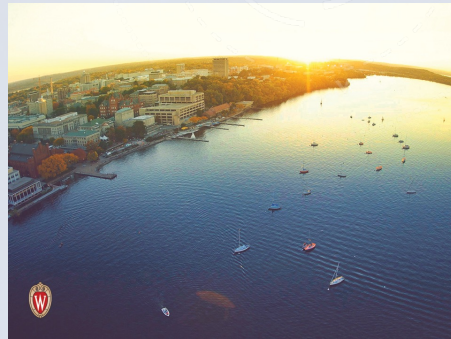
High sensitivity absorption spectroscopy in glow discharge plasmas

R. C. Wamsley, K. Mitsuhashi, and J. E. Lawler
Department of Physics, University of Wisconsin, Madison, Wisconsin 53706

(Received 2 July 1992; accepted for publication 9 April 1992)

A highly sensitive absorption experiment for diagnosing glow discharge plasmas is described. This experiment is applicable from the VUV to the IR. A very stable Xe arc lamp is used as a source of continuum radiation. An echelle spectrometer equipped with a gated, image-intensified, charge-coupled device detector array is used to disperse and detect the continuum, with absorption features, after it has traversed the glow discharge. Digital subtraction is used to discriminate against the line emission from the glow discharge and detect only the continuum emission from the arc discharge. Estimates of the relative spectral radiances of glow and arc discharges suggests the subtraction technique is broadly applicable to glow discharge studies. A fractional absorption of 10^{-3} is detectable with a signal-to-noise ratio limited primarily by shot noise. A detection limit for excited Hg atoms of 7×10^{9} cm^{-2} is demonstrated in a 400-mA Hg–Ar glow discharge. Further improvements in the experiment are proposed.

Review of Scientific Instruments **64**, 45 (1993);



BELOW THE H-LINE: CO_2 FORCING

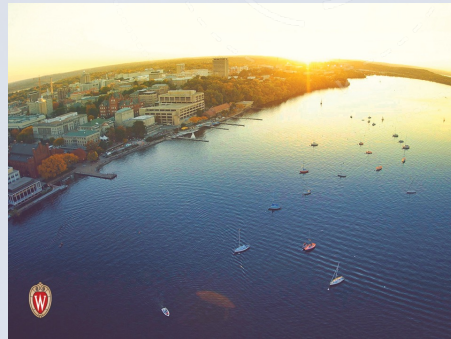
The spectroscopic foundation of radiative forcing of climate by carbon dioxide

Martin G. Mlynczak[1], Taumi S. Daniels[1], David P. Kratz[1], Daniel R. Feldman[2], William D. Collins[2], Eli J. Mlawer[3], Matthew J. Alvarado[3], James E. Lawler[4], L. W. Anderson[4], David W. Fahey[5], Linda A. Hunt[6], and Jeffrey C. Mast[6]

[1]NASA Langley Research Center, Hampton, Virginia, USA, [2]Lawrence Berkeley National Laboratory, Berkeley, California, USA, [3]Atmospheric and Environmental Research, Lexington, Massachusetts, USA, [4]Physics Department, University of Wisconsin-Madison, Madison, Wisconsin, USA, [5]NOAA Environment Systems Research Laboratory, Boulder, Colorado, USA, [6]Science Systems and Applications, Inc., Hampton, Virginia, USA

Abstract The radiative forcing (RF) of carbon dioxide (CO_2) is the leading contribution to climate change from anthropogenic activities. Calculating CO_2 RF requires detailed knowledge of spectral line parameters for thousands of infrared absorption lines. A reliable spectroscopic characterization of CO_2 forcing is critical to scientific and policy assessments of present climate and climate change. Our results show that CO_2 RF in a variety of atmospheres is remarkably insensitive to known uncertainties in the three main CO_2 spectroscopic parameters: the line shapes, line strengths, and half widths. We specifically examine uncertainty in RF due to line mixing as this process is critical in determining line shapes in the far wings of CO_2 absorption lines. RF computed with a Voigt line shape is also examined. Overall, the spectroscopic uncertainty in present-day CO_2 RF is less than 1%, indicating a robust foundation in our understanding of how rising CO_2 warms the climate system.

Geophysical Research Letters **43**, 5318 (2016);

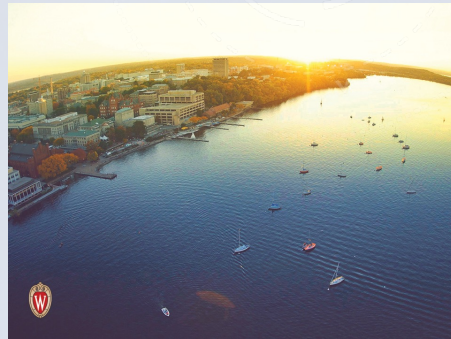


SCIENTIFIC AWARDS

- **1992 APS Will Allis Prize for the Study of Ionized Gases:** "*For the elucidation of cathode fall phenomena in glow discharges through the measurement and analysis of spatial variations in the electric field, and for the development of new methods to determine atomic lifetimes and transition probabilities.*"

- **1995 IUPAP International Penning Award:** *"For his distinguished work in the fields of plasma physics and the behavior of ionized gases"*

- **2017 AAS Laboratory Astrophysics Prize:** *"For his contributions in atomic physics to advance our understanding of galactic nucleosynthesis and chemical evolution. His spectroscopic work has opened a new era of stellar chemistry by advancing our ability to compare nucleosynthesis predictions with accurate relative elemental abundances."*



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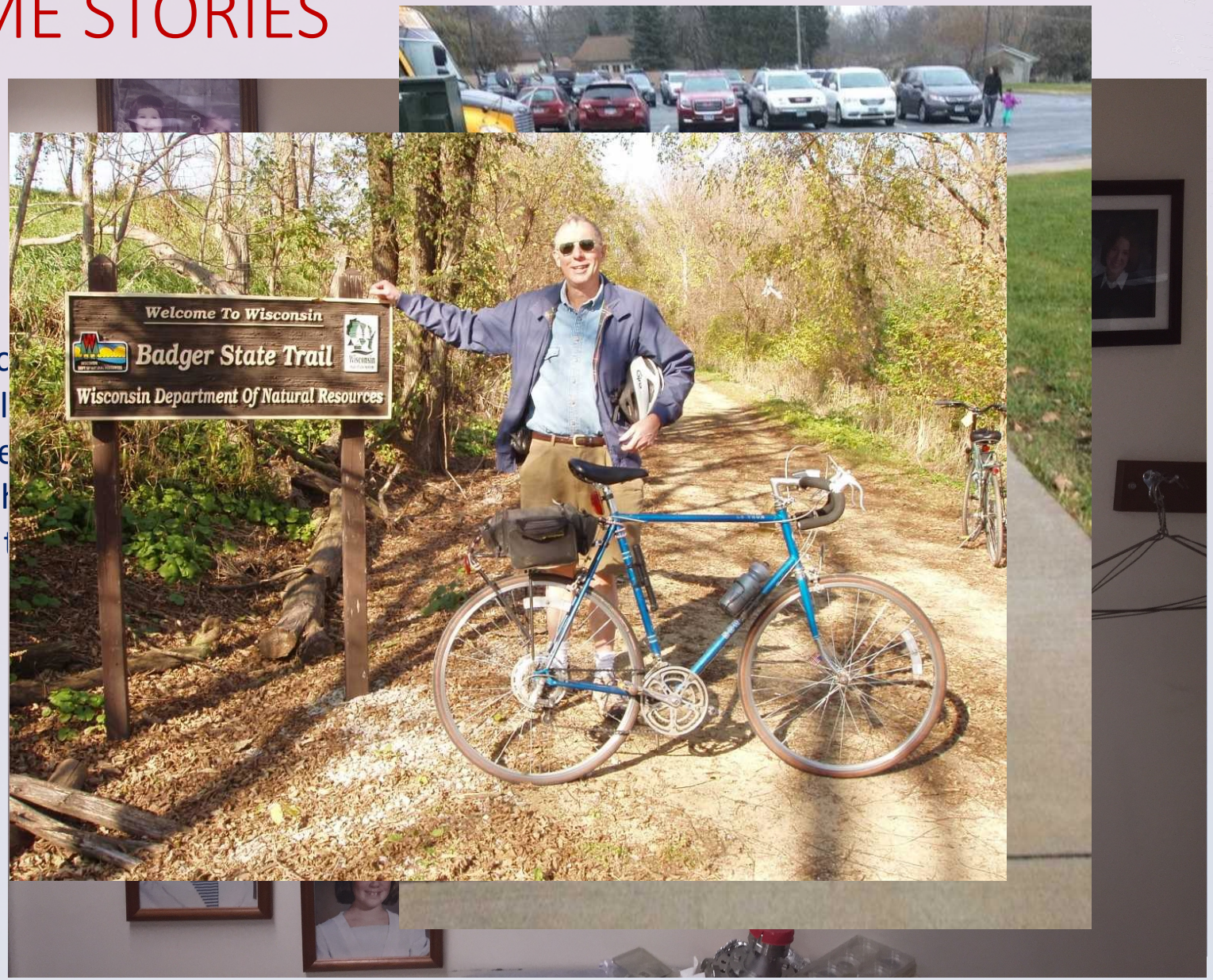
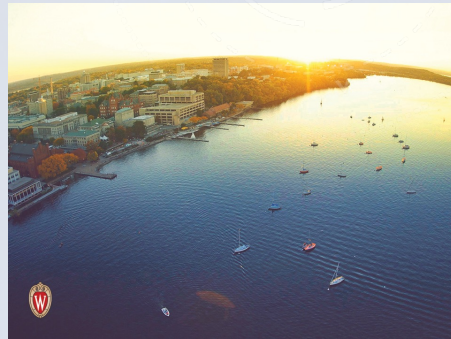
- Christmas Col
- Dredging Lake
- Bicycling “Upl
- The girls and t





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The Laboratory Astrophysics Division
of the
American Astronomical Society
hereby awards the
2017 Laboratory Astrophysics Prize
to
James E. (Jim) Lawler
of the University of Wisconsin
PRESENTED IN JUNE 2017
The American Physical Society
WILL ALLIS PRIZE
FOR
THE STUDY OF IONIZED GASES
endowed by
THE AT&T, GE, GTE, IBM AND XEROX
CORPORATIONS
James C. Lawler
THE PENNING AWARD
Presented to
Professor James E. Lawler
Salk Theory for Pioneers
and Inventors
First, people will tell you
that you are wrong.
Then, they will tell you
that you are right, but
what you are doing isn't
important.
Finally, they will admit
that you are right and
what you are doing is very
important, but after all,
they knew it all the time.


Jimfest2018