Welcome to the
Center for Detectors

The Future Photon Initiative

CfD Annual Report 2015

Welcome to the Center for Detectors. CfD designs, develops, and implements new advanced sensor technologies through collaboration with academic researchers, industry engineers, government scientists, and university/college students. The CfD operates four laboratories and has approximately a dozen funded projects to advance detectors in a broad array of applications, e.g. astrophysics, biomedical imaging, Earth system science, and inter-planetary travel. Our observational astrophysics programs include studies of massive stars, massive star clusters, the Galactic center, the interstellar medium, and the cosmology of structure formation in the Universe.

Student involvement is central to all CfD projects. To obtain a PhD degree with us, apply to Astrophysical Sciences and Technology, Microsystems Engineering, or Imaging Science. To obtain an MS degree with us, contact the CfD Director.

CfD feature article in RIT Research Magazine

School of Design Collaboration with CfD

Welcome to the
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CfD News

February, 2016

CfD Part of the Future Photon Initiative

November, 2015

CfD Wins NSF Funding to Develop Next Generation Infrared Detectors

October, 2015

CfD Welcomes New Faculty Member Parsian Mohseni

CfD Alumni are featured in the Winter 2015-2016 issue of University Magazine

September, 2015

CfD is featured in RIT's University News Campus Spotlight

August, 2015

CfD Faculty Member Stefan Preble's work is featured in the cover article of the September issue of Rochester Engineering Society magazine

July, 2015

CfD Faculty Member Michael Zemcov Part of Team Chosen to Develop Space Mission to Study Neutron Stars, Black Holes and More

CfD Welcomes New Faculty Member Jing Zhang

CfD Welcomes New Faculty Member Stefan Preble and His Nanophotonics Group

CfD to be part of New Rochester-based Photonics Center

June, 2015

CfD Welcomes New Faculty Member Michael Zemcov

May, 2015

RIT Convocation Speaker, NASA Administrator Maj. Gen. Charles F. Bolden Jr., Visits CfD, Pixieset

Welcome to the Center for Detectors

April, 2015

CfD Director Gives Invited Presentation at the Hartford Club

CfD Director's image of the Pistol Star featured in Jersey Post Stamps commemorating 25 years of the Hubble Space Telescope RIT News Jersey Post

NASA Astronaut Dr. Donald Pettit Visits CfD Facebook Flickr RIT News

March, 2015

CfD Student Kim Kolb Defends PhD Thesis

CfD Hosts Sloane Wiktorowicz's presentation "Characterizing Exoplanet Atmospheres through Our Own"Announcement Video

February, 2015

CfD Hosts Michael Zemcov's presentation "Mapping the Large Scale Structure of the Cosmos from the Big Bang to the Present"Announcement Video

CfD Hosts Roger O'Brient's presentation "Moore's Law and Astrophysics: Detectors that Teach Us About Physics Beyond the Standard Model"Announcement Video

September, 2014

CfD Annual Report 2014

August, 2014

CfD Director appears on Connections: Science Roundtable with Evan Dawson on WXXI AM 1370 News

April, 2014

CfD Hosts Minh Nguyen's presentation "Nanoscale Semiconductor Hybrids: Fundamental Physics and Advanced Devices"

February, 2014

Infrared Detector Technology at RIT's Center for Detectors

November, 2013

CfD Shedding light on Earth-like planets

October, 2013

CfD Graduate Student Kimberly Kolb Studies Tiny Details of Vast Universe

September, 2013

CfD Annual Report 2013

Welcome to the
Center for Detectors

April, 2013

CfD Ph.D. Gives Christine Trombley Momentum

CfD Hosts Christoph Baranec's Presention "Rayleigh Laser Guide Stars Pioneering the Next Decade of Astronomical Adaptive Optics"

CfD Executive Assistant Allison Conte Helps Brand The Research Center

March, 2013

CfD Ph.D. Student Christine Trombley wins the NASA/Cornell University Graduate Research Fellowship in Astrophysical Sciences and Technology

January, 2013

NASA Awards CfD $1.1 million (RBJ Article)

September, 2012

CfD Annual Report 2012

July, 2012

CfD Leads Development of Next-generation Infrared Detectors

Detector Virtual Workshop: Hooman Mohseni presents "Nano-injection Detectors and Imagers" on 7/13/2012 at RIT

June, 2012

Secret Spy Telescopes Made in Rochester Video

CfD Student Brian Glod Completes Master's Degree

CfD Administrative Assistant Adena Thomson Thrives at RIT

Detector Virtual Workshop: Jim Bangs presents on Single and Dual Band HgCdTe Detectors on 6/4/2012 at RIT

May, 2012

Detector Virtual Workshop: Sanjay Krishna presents "The Infrared Retina: Ushering in the Fourth Generation of Infrared Detectors" on 5/14/2012

April, 2012

Detector Virtual Workshop: Michael Krainak presents "Candidate detectors for space-qualified time-resolved photon counting" on 4/23/2012

March, 2012

Detector Virtual Workshop: Jim Beletic presents "The Fantastical Discoveries of Astronomy made possible by the Wonderful Properties of II-VI Materials" on 3/26/2012 at

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Center for Detectors

Detector Virtual Workshop: Mark Itzler presents "Photon Counting with InGaAsP Single Photon Avalanche Diodes" on 3/12/2012 at RIT

February, 2012

Detector Virtual Workshop: Kieran O'Brien presents "MKIDs" on 2/27/2012 at RIT

Detector Virtual Workshop: Bernard Rauscher presents "Reducing Read Noise of JWST Detectors" on 2/6/2012

December, 2011

Detector Virtual Workshop: Craig Mackay presents "EMCCDs" on 12/5/2011

November, 2011

Detector Virtual Workshop: Alan Migdall presents "Quantum Communication Detectors" on 11/28/2011 at RIT

Detector Virtual Workshop: Karl Berggren presents "Superconducting Single Photon Detectors" on 11/14/11 at RIT

Jon Morse presents "Frontiers in Astrophysics and the Federal Budget Landscape"
Announcement Adobe Connect Video PDF

Mysterious Absorption Lines Could Illuminate 90-year Puzzle

October, 2011

Bahram Mobasher presents "Future Big Telescopes"

Detector Virtual Workshop: Andy Shearer presents "High Time Resolution Astrophysics"

CfD Annual Report 2011

Hans Zinnecker presents "SOFIA Infrared Observatory and its recent results"

September, 2011

CfD Initiates Detector Virtual Workshop speaker series

CfD Graduate Student Christine Trombley Wins Prestigious NASA Graduate Student Researchers Program Fellowship

Detector Virtual Workshop: Dr. Robert Hadfield presents "Infrared Superconducting Single Photon Detectors" Announcement Video

CfD Student Member Adena Thomson wins Accounting Scholarship

August, 2011

CfD Director Invited to Speak at Central Kiloparsec in Galactic Nuclei Conference
Powerpoint Adobe Connect Video

CfD Director Invited to Speak at Single Photon Imaging Conference Powerpoint PDF

CfD Director Invited to Speak at Techniques and Instrumentation for Detection of Exoplanets Conference Powerpoint PDF

July, 2011

CfD Graduate Student Kimberly Kolb Completes M.S. Thesis

June, 2011

CfD Director Invited to Speak at Single Photon Workshop 2011 Adobe Connect Video

May, 2011

Donald Hall Presents at Center for Detectors

Announcement Adobe Connect Video Quicktime File

April, 2011

Center for Detectors Featured in Rochester Business Journal

March, 2011

School of Design collaborates with RIDL

February, 2011

Center for Detectors is Established

CfD Student Chris Maloney Reports on FiOS Conference

December, 2010

Chris Packham Presents at Center for Detectors

Announcement Powerpoint Quicktime File Adobe Connect Video

RIDL Director Invited to Speak at NASA/JPL

October, 2010

Joss Hawthorn Presents at Center for Detectors

Announcement WMV File Quicktime File

June, 2010

RIDL Presents at SPIE, San Diego, CA

Kolb et al., Hybridization of a sigma-delta-based CMOS hybrid detector
PDF Powerpoint

Hanold et al., Characterization of a sigma-delta-based Monolithic CMOS Detector
PDF Powerpoint

Welcome to the

Center for Detectors

May, 2010

RIDL Director Invited to Give NRO Technology Seminar

February, 2010

RIDL Selected by NASA to Develop Photon Counting Imaging Detectors for Space Exoplanet Finding Missions

January, 2010

RIDL Director Invited to Speak at Keck Institute for Space Studies, Caltech (PDF) (VIDEO)

October, 2009

RIDL Director Invited to Speak at AstroMed09, Sydney, Australia

RIDL Director Invited to Speak at Detectors for Astronomy 2009, Munich, Germany

September, 2009

Youtube Video of RIDL on The History Channel (part 1) (part 2) (part 3)

RIDL Student Kim Kolb Awarded Prestigious BAE Fellowship (Photo and caption)

RIDL Featured on Rochester CBS/Fox News Channel 8 and 31 (video)

July, 2009

A Day in the Life of the RIDL Director in Astronomy Magazine

RIDL to be Featured on History Channel

May, 2009

RIDL Featured in RIT Research Magazine

Bruce Tromberg Presents at Center for Detectors

MP4 File Adobe Connect Video

March, 2009

RIDL Hosts Quantum Limited Detector Workshop

Press Release
RIT Presents: The Next Generation of Imaging Detectors

Agenda with Recorded Presentations and Slides
Workshop Web Site

October, 2008

Moore Foundation Awards RIDL $2.8 Million to Develop “Noiseless” Detector

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Center for Detectors

Moore Foundation Awards RIDL $2.8 Million to Develop "Noiseless" Detector

Press Release
Moore Foundation Awards RIT Scientist $2.8 Million to Develop "Noiseless" Detector

News Articles
Rochester Democrat and Chronicle
Laser Focus World

Shouleh Nikzad Presents at Center for Detectors

Announcement WMV File

Michael Hoenk Presents at Center for Detectors

Announcement WMV File

April 2008

RIDL Receives NASA Planetary and Earth Sciences Detector Development Grant

Press Release
LIDAR Imaging Detector Could Build 'Super Road Maps' of Planets and Moons

News Articles
Channel 10 News Video (Associated article)
MIT Technology Review
Optics.org
Astrobiology Magazine
United Press International
Popular Science
Spacemart.com
PHYSORG.com
Universe Today
Science Daily
Photonics.com
The Times of India
RIT University News

Bedabrata Pain Presents at Center for Detectors

WMV File

August 2007

RIDL Receives NASA Planetary Science Detector Development Grant

Press Release
New Imaging Detectors Could Take Snapshots from Deep Space

News Articles
MSNBC: New Cameras Can Withstand Space Radiation

Welcome to the
Center for Detectors

Press Release
LIDAR Imaging Detector Could Build 'Super Road Maps' of Planets and Moons

News Articles
Channel 10 News Video (Associated article)
MIT Technology Review
Optics.org
Astrobiology Magazine
United Press International
Popular Science
Spacemart.com
PHYSORG.com
Universe Today
Science Daily
Photonics.com
The Times of India
RIT University News

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WMV File

August 2007

RIDL Receives NASA Planetary Science Detector Development Grant

Press Release
New Imaging Detectors Could Take Snapshots from Deep Space

News Articles
MSNBC: New Cameras Can Withstand Space Radiation
Space.com: Tougher cameras Designed to Withstand Space Radiation
Photonics.com: Detector Resists Radiation

May 2007

RIDL Selected by NASA to Develop New Deep Space Detectors

March 2007

RIDL Achieves First Light with 4Kx4K SiPIN Detector

October 2006

RIDL Chosen to Lead the LSST Guider Project

RIDL Chosen to Perform SNAP Prototype Detector Testing

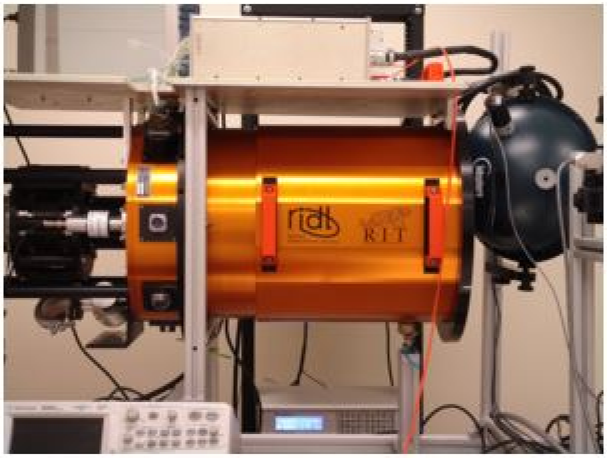
February 2006

RIDL Director Receives NYSTAR Faculty Development Award

Figer Massive Stars Group News

Facilities, Capabilities, and Equipment at the Center for Detectors

The Center for Detectors (CfD) is located in the IT Collaboratory and has large contiguous spaces for offices and labs, including offices for 17 people, and four research laboratories: the Rochester Imaging Detector Laboratory, The Imaging LIDAR Laboratory, the Quantum Dot Detector Laboratory, and the Wafer Probe Station Laboratory. There are approximately 5000 square feet of space, divided equally between labs and offices. The laboratories contain special facilities and equipment dedicated to the development of detectors.



Dewar 1

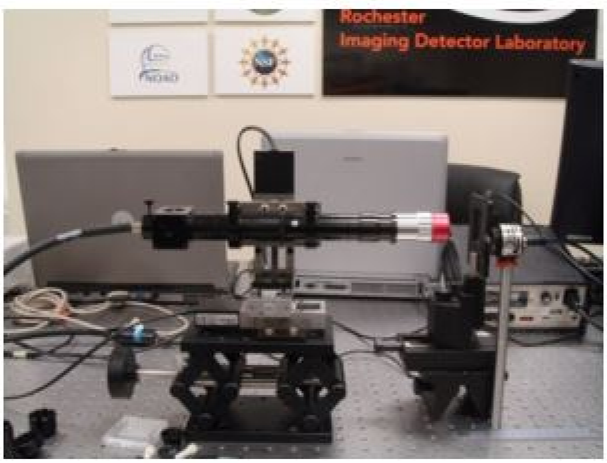
The RIDL detector testing systems use cylindrical vacuum cryogenic dewars. Each individual system uses a cryo-cooler that has two cooling stages: one at ~10 K (7 W) and another at ~60 K (70 W). The cold temperatures yield lower detector dark current and read noise. The systems use Lakeshore Model 340 temperature controllers to sense temperatures at 10 locations within the dewars and control a heater in the detector thermal path. This thermal control system stabilizes the detector thermal block to 400 micro-K RMS over timescales greater than 24 hours.

Dewar 2

The detector readout systems include an Astronomical Research Cameras controller having 32 digitizing channels with 1 MHz readout speed and 16-bit readout capability, two Teledyne SIDECAR ASICs having 36 channels and readout speeds up to 5 MHz at 12-bits and 500 kHz at 16-bits, and custom FPGA systems based on Altera and Xilinx parts. The controllers drive signals through cable harnesses that interface with Detector Customization Circuits (DCCs), which are designed in-house and consist of multi-layer cryogenic flex boards. The DCCs terminate in a single connecter, which then mate to the detector connector. Three-axis motorized stages provide automated lateral and piston target adjustment.

Dewar 3

Two of the dewars have a side-looking port that is useful for exposing detectors to high energy radiation beams. The lab has a large integrating sphere that provides uniform and calibrated illumination from the ultraviolet to through the infrared. The dewars are stationed on large optical tables that have vibration-isolation legs.



Spot projector with automated three axis motion control system

The Rochester Imaging Detector Laboratory has a Pico Quant pulsed laser for LIDAR system characterization and other testing that requires pulsed illumination.

RIDL also has monochromators with specialized light sources for illumination from the UV into the IR (250 nm – 2500 nm).

NIST-traceable calibrated photodiodes (with a wavelength range of 200 nm – 1100 nm) provide for absolute flux measurements.

RIDL also has a spot projector to characterize the inter-pixel response of the detectors, including optical and electrical crosstalk. The image to the left shows a laser spot projection system on a 3D motorized stage that produces a small point source for measurements of intrapixel sensitivity.

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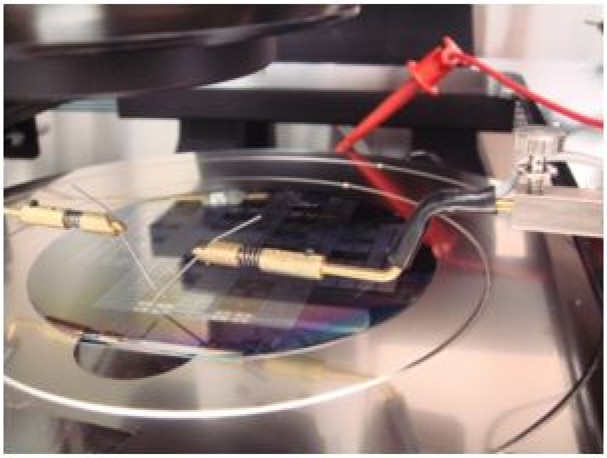
Lab Area in RIDL

The lab contains eight data reduction PCs each with eight processors and up to 16 GB memory for data acquisition, reduction, analysis and simulations and 25 TB of data storage. Custom software runs an automated detector test suite of experiments. The test suite accommodates a wide variety of testing parameters through the use of parameter files. A complete test suite takes a few weeks to execute and produces ~0.5 TB of data. The data reduction computers reduce and analyze the data using custom automated code, producing publication-quality plots in near-real time as the data are taken.

RIDL Clean Room

CfD has a dedicated class 1000 cleanroom (by FED Standard 209E), located in the SMFL. The SMFL has 10,000 ft2 of additional cleanroom space in class 1000, 100, and 10. Using the SMFL's resources, the Center can fabricate detectors with custom process flows and the freedom to use multiple process variations.



Testing a p-i-n diode device wafer using the probe station

The Center's cleanroom and probe stations allow wafer-level testing, even during the fabrication process, allowing mid-process design changes. The probe station accommodates electrical and circuit analysis of both wafers and packaged parts, including low current and radio frequency (RF) probing. Also available for the CfD's use are the Amray 1830 Scanning Electron Microscope (SEM), used for high-magnification imaging of devices, and the WYKO white light interferometer, used for surface topography measurements. The SMFL also has other in-line fabrication metrology capabilities, including material layer thickness, refractive index, and wafer stress characterization tools.

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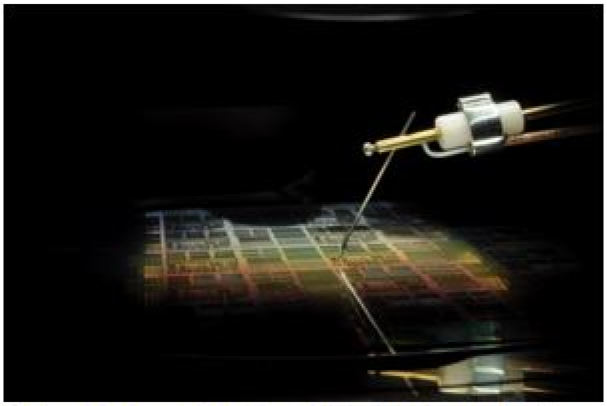
PhD student Kimberly Kolb conducts electrical experiments on one of the cutting edge devices being characterized at the Center for Detectors.

The customized setup shown here is comprised of two voltage power supplies, an Agilent oscilloscope, an LCD screen for viewing the devices through the microscope probe station, and a custom circuit board for specific device diagnostics. The dedicated lab computer also runs a specially-designed data acquisition program to collect and analyze data from the device.



This image is a close-up of a device wafer being tested on the probe station under dark conditions.

The entire probe station is covered so that no stray light enters the testing environment. These conditions provide the basis for valuable testing and data analysis. The probe tip is contacting a single test device via a metal pad with dimensions of only 70 microns by 70 microns (an area of 0.0049 mm^2).

Many other RIT facilities are available for use by the Center for Detectors. The Brinkman Lab is a state of the art facility devoted to manufacturing, and CfD uses it for precision machining, e.g., using a CNC machine. The Center for Electronics Manufacturing and Assembly (CEMA) focuses on electronics packaging, including semiconductor chip packaging, printed circuit board assemblies and electronics/optoelectronics. The CfD utilizes CEMA to populate surface mount components onto printed circuit boards (PCBs) that are designed in house. The facilities at CEMA are also ideal for reworking PCBs that need to be repaired or that require modifications.

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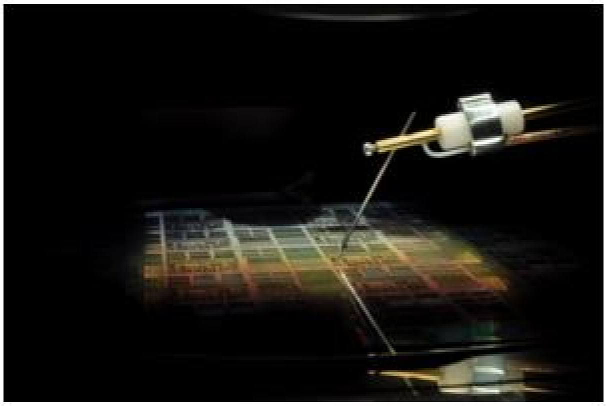

This image is a close-up of a device wafer being tested on the probe station under dark conditions.

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Cryogenic multi-layer circuit board designed in the CfD and populated in CEMA. Components on this board will be exposed to temperatures as low as 40 K, nanoTorr pressure, and high energy particle radiation.

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In addition to fabrication and testing capabilities, the Center for Detectors has access to sophisticated simulation software to predict the performance of devices, from fabrication processes to performance of a completed device. Silvaco Athena and Atlas are powerful software engines that simulate the effects of processing on device substrates and the electrical characteristics of a fabricated device. Athena simulations can describe all of the processes available in the RIT SMFL, building a physics-based model in 3D space of a device from initial substrate to completed device. From this model, the user can determine doping profiles, carrier densities, depletion widths, junction depths, and dielectric layer thickness, among other parameters, all from initial conditions set by actual fabrication process recipes. Multiple devices can be simulated in a single model, so both inter- and intra-pixel performance can be characterized. Atlas can then simulate performance by deriving, e.g., current-voltage, photovotaic, charge distribution, point spread function, and quantum efficiency (both internal and external) through user-defined operating conditions.

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CfD Projects

Cosmic Radiation Damaged Image Repair project (CRDIR)

RIT has embarked on the Cosmic Radiation Damaged Image Repair project (CRDIR) involving Dr. Donald Pettit, NASA Astronaut & International Space Station astrophotographer. This project is being by graduate and undergraduate student researchers under the guidance of Dr. Donald Figer, Director of CfD.

Students will have a unique opportunity to communicate with an active American astronaut in the process of solving a significant image processing issue. The scientific process these students will follow toward a solution will provide valuable experience that these students will carry with them in their professional lives.

RIT will be providing a sophisticated "image enhancement" software program which specifically addresses degraded images taken by astronauts "on orbit", extending the useful lives of cameras, and in many cases making unacceptable "noisy" images visually acceptable.

Characterization of Inter-Pixel Capacitive Coupling in Hybridized HgCdTe Arrays

Inter-Pixel Capacitance (IPC) is a mechanism for deterministic electronic cross talk that results from coupling fields between adjacent pixels as a signal is collected and stored. Simulation of small arrays from first principles using software which simultaneously solves Poisson's equation and the Drift Diffusion equations allows for characterization of this coupling across a broad range of design parameters as well as across various environment parameters. Due to the deterministic nature of this cross-talk characterization results in correction.

This project is currently working on characterization of HgCdTe arrays hybridized using indium bumps to H2RG readout circuits akin to those to be used in the James Webb Space Telescope's (JWST) NIRcam. Successful characterization across environment parameters will result in an increase in final image quality from JWST's NIRcam and any device using a similar detector while also introducing new design considerations for future generations of sensor.

Development of Si-MOSFET CMOS Technology for Terahertz Detection

RIT is developing a silicon MOSFET CMOS imager to detect terahertz (THz) frequencies in a collaboration with the Center for Emerging and Innovative Sciences (CEIS) at the University of Rochester and Exelis Geospatial Systems. Creating an asymmetrical design within the FETs, increases the THz response. The current device being tested was designed with 15 individual test transistors with varying design dimensions and antennas along with an array of transistors for an imager. These test structures are being evaluated at RIT to determine the best design for terahertz detection for future imager designs. An advantage of this detector technology is that these MOSFETs will not have to be cooled to extreme temperatures like microbolometers. This project will advance knowledge of the detection mechanism, lead to the creation of an integrated imaging system, and has many different applications.

THz frequencies have been largely unexplored due to high absorption within water, however there has been an increase in interest with the rise in high-altitude and space-based telescopes. Emission lines in spectra within the THz regime exhibit cool molecular gas which traces protoplanetary disks and star formation rates within galaxies. This technology will also have other applications within the medical and security fields because of the non ionizing, non-harmful nature of THz radiation.

Phase II: New Infrared Detectors for Astrophysics

This program will have a profound impact across ground-based and space-based astronomy by dramatically reducing the cost of infrared detectors for existing facilities, as well as the next generation of extremely large telescopes. The project will continue development of a new material system for use in astronomical infrared array detectors. The devices use HgCdTe grown on Silicon using Molecular Beam Epitaxy. In Phase I of this project, the NSF ATI program funded two cycles of design, fabrication, and testing. The devices made in this phase of the project show that the technology will be successful for astronomy requirements pending further development. Testing shows that there are several challenges that prevent the devices in hand from satisfying these requirements. In this second phase, the effort will develop a series of devices with improved design and processing. The approach is to reduce the number of material defects while maintaining high short-wavelength quantum efficiency by using proven designs. Given that these previous designs have successfully been used to address the observed non-idealities, it is believed that the new activities will be successful. The work includes: growth of new material using a thick buffer layer design, fabrication of twelve FPAs in two designs, and extensive testing between the fabrication of the two designs.

This project will advance the knowledge of a material system that has great promise for infrared detector technology. It will enhance the capabilities of infrared instrumentation in astronomy by reducing cost and potentially improving performance when compared to what is available with existing technology. The technical approach has great merit because it was developed over the past 15 years and during Phase I of the project. The plan features a tight connection between design at Raytheon Vision Systems (RVS) and testing in the Center for Detectors at the Rochester Institute of Technology, continuing over 15 years of collaboration between RVS and the PI.

Single Photon Counting Detectors for NASA Astronomy Missions

Single photon counting detectors have the potential to be the next big advancement for NASA astronomy missions. The ability to count single photons facilitates science goals that are impossible even with current state-of-the-art detectors. Single photon counting detectors are the future, and many different implementations are in development. In the next 20 years, many NASA missions requiring single photon counting will be proposed, but which single photon counting detector implementations best suit the performance needs of NASA's astronomy programs? The goal of the proposed research is to characterize (theoretically and physically) three unique implementations of single photon counting detectors, benchmark their operation over a range of performance characteristics, and provide comprehensive justification for the superiority of one of the implementations for each of these NASA astronomy applications: exoplanet detection, high-contrast imaging, adaptive optics, and array-based LIDAR.

The research plan in this project includes simulation, characterization, and evaluation of the performance of three types of semiconductor photon counting detectors for use in NASA astronomy missions: Geiger-mode (GM) APDs, linear-mode (LM) APDs, and Electron Multiplying (EM) CCDs.

The main goal of this project is to provide the basis of comparisons for several types of fundamentally different single photon counting detectors by producing a table of comparisons and recommendations for various applications. All detectors must be sensitive to single photons, be scalable to large array formats, and have high QE (in the visible, UV, NIR, IR, and Far-IR wavelengths). This research will advance preliminary work by adding new characterization methods and performance benchmarks, and by comparing the different devices at predetermined milestones during the project. The recommended detector(s) should function well at high readout frequencies without significant read noise (leading to improved temporal sampling), have very low noise for increased SNR at low fluence levels, and be implemented (or able to be in the near future) on large arrays. Even though single-photon counting detectors share a common

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sampling), have very low noise for increased SNR at low fluence levels, and be implemented (or able to be in the near future) on large arrays. Even though single-photon counting detectors share a common performance benchmark (discerning individual quanta), differences between various implementations make some more efficient than others.

New Infrared Detectors for Astrophysics

Infrared arrays with HgCdTe as the light-sensitive layer, such as have been developed up to sizes 2048x2048 pixels for the James Webb Space Telescope, are near-ideal detectors for imaging and spectroscopy in the region ~1-5 microns. However current construction requires fabrication on CdZnTe substrates, which are expensive and limited in availability. The key to making larger (up to 14,000x14,000 pixels) and less expensive infrared detectors lies in using silicon wafer substrates, since large silicon wafers are common in the high volume semiconductor industry and their coefficient of thermal expansion is well-matched to that of the silicon readout circuits.

While the use of silicon substrates has been a major goal in the field of developing infrared detectors, the main limitation over the past 15 years has been the large lattice spacing mismatch between silicon and commonly-used infrared light-sensitive materials. The mismatch causes defects that can result in higher dark current, or valence holes that lead to reduced quantum efficiency and image persistence.

Enlisting the expertise and fabrication capabilities of Raytheon Vision Systems, detector expert Dr. D. Figer of the Rochester Institute of Technology plans to deposit the HgCdTe light-sensitive layer on silicon using the very promising technique of Molecular Beam Epitaxy (MBE). By maintaining vacuum during MBE processing, defect density has been shown to be reduced and the resulting prototype devices have achieved the anticipated performance. Very large, affordable infrared arrays will be essential for making optimum use of the proposed ~30m class ground-based telescopes and their availability has clear implications for fields beyond astronomy, including medical imaging and remote sensing.

A Zero Read Noise Detector for Thirty Meter Telescope (TMT)

The key objective of this project is to develop a new type of imaging detector that will enable the most sensitive possible observations with the world's largest telescopes, i.e. the TMT. The detector will effectively quadruple the collecting power of the TMT, compared to detectors currently envisioned in TMT instrument studies, for the lowest light level observations. It would have fundamental importance in ground-based and space-based astrophysics, Earth and planetary remote sensing, exo-planet identification, consumer imaging applications, and homeland safety, among many others. Measurable outcomes include being able to see further back into the infancy of the Universe to taking a better picture (less grainy) of a smiling child blowing out the candles at her birthday party. The detector will be quantum-limited (zero read noise), be resilient against the harsh effects of radiation in space, consume low power, operate over an extremely high dynamic range, and be able to operate with exposure times over one million times faster than typical digital cameras. The RIDL is teaming with MIT/Lincoln Laboratory to leverage their Geiger-mode Avalanche Photodiode technology for developing the imaging detector. The project is funded through the Gordon and Betty Moore Foundation.

A Photon Counting Detector for Exoplanet Missions

The objective of this project is to advance photon-counting detectors for NASA exoplanet missions. A photon counting detector will provide zero read noise, ultra-high dynamic range, and ideal linearity over the relevant flux range of interest. It could be the best realizable detector for a planet finding spectrograph, and it would have outstanding properties as a wavefront sensor or detector in the imaging focal plane. The benefit of this device is that it will dramatically improve sensitivity beyond what is capable with non-photon it would have outstanding properties as a wavefront sensor or detector in the imaging focal plane. The benefit of this device is that it will dramatically improve sensitivity beyond what is capable with non-photon counting detectors, thereby increasing science return for a fixed mission life; for low-light-level cases, such as spectroscopy, the device will reduce the necessary exposure time for detecting planetary features by 50-80%. The device always operates in photon counting mode and is thus not susceptible to excess noise factor that afflicts other technologies. It continues operating with shot-noise limited performance up to extremely high flux levels. Its performance is expected to be maintained at a high level throughout mission lifetime in the presence of the expected radiation dose.

Past Projects

LIDAR Imaging Detector

In collaboration with MIT/Lincoln Laboratory, the RIDL is developing an imaging Light Detection and Ranging (LIDAR) detector for NASA planetary space misisons. The device will have a pixelated array of independent Geiger-mode Avalanche Photodiodes that can asynchronously measure laser light time of flight. The output will be three-dimensional images providing distance measurements for each pixel. The device will have a timing accuracy of ~100 picoseconds, thus enabling a ranging accuracy ~1 cm, or roughly two orders of magnitude better than existing LIDAR instruments.

The nature of GLIMPSE 81: a star cluster to rival Westerlund 1

This project uses Chandra/ACIS observations of a young star cluster. The X-ray emission from this cluster, already observed in previous low-resolution observations, will be resolved by Chandra into many components. Analysis will include separation of the diffuse X-ray emission from the point-sources, and a spectral analysis of each source. The data from this project will be combined with those from other observations in order to perform a multiwavelength analysis.

Clumping in OB-star winds

Massive stars, their nature and evolution, play a important role at all stages of the Universe. Through their radiatively driven winds they influence on the dynamics and energetics of the interstellar medium. The winds of OB stars are the most studied case. Commonly, the mass-loss rates of luminous OB stars are inferred from several types of measurements, the strengths of UV P Cygni lines, H-alpha emission and radio and FIR continuum emission. Recent evidence indicates that currently accepted mass-loss rates may need to be revised downwards when small-scale density inhomogeneities (clumping) are taken into account. This project uses Herschel Space Telescope data to consistently treat ALL possible diagnostics, scanning different parts of the winds, and analyzed by means of 'state of the art' model atmospheres, will permit the determination of true mass-loss rates.

Guide Detector Evaluation for the Large Synoptic Survey Telescope (LSST)

The RIDL is testing prototype optical guide detectors for LSST. We have developed a guider testbed that simulates the expected image motion that the LSST focal plane will experience. The testbed will be used to validate guide detector performance against LSST requirements.

Sigma-Delta Detector

In collaboration with the University of Rochester, the RIDL is developing very low noise CMOS imaging detectors for NASA space astrophysics and planetary missions. These devices promise sub-electron read noise in a direct-readout architecture that is resilient against the transient and long-term effects of radiation.

detectors for NASA space astrophysics and planetary missions. These devices promise sub-electron read noise in a direct-readout architecture that is resilient against the transient and long-term effects of radiation. The novel readout circuit uses a one-bit sigma-delta oversampling comparator design developed by Zeljko Ignjatovic and Mark Bocko (University of Rochester). The light-sensitive silicon wafer is being designed and fabricated by RIDL and the RIT Semiconductor & Microsystems Fabrication Laboratory. NASA/JPL will delta-dope the backside of the detector for enhanced ultraviolet sensitivity. The wafer and the readout will be bump bonded together to produce a hybrid detector with good sensitivity from the ultraviolet through near-optical infrared.

A NICMOS survey of newly-identified young massive clusters

We are on the cusp of a revolution in massive star research triggered by 2MASS and Spitzer/GLIMPSE, and now is the ideal time to capitalize on these projects by performing the first survey of massive stars in young stellar clusters throughout the Galactic plane. A search of the 2MASS and GLIMPSE surveys has produced over 450 newly-identified massive stellar cluster candidates in the Galactic plane which are hidden from our view at optical wavelengths due to extinction. In this project, we are using 29 HST orbits to image the most promising candidate clusters in broad and narrow band filters using NICMOS. The observations will be complemented with approved Spitzer and Chandra programs, numerous approved and planned groundbased spectroscopic observations, and state-of-the-art modelling. We expect to substantially increase the numbers of massive stars known in the Galaxy, including main sequence OB stars and post-main sequence stars in the Red Supergiant, Luminous Blue Variable and Wolf-Rayet stages. Ultimately, this program will address many of the fundamental topics in astrophysics: the slope to the initial mass function (IMF), an upper limit to the masses of stars, the formation and evolution of the most massive stars, gamma-ray burst (GRB) progenitors, the chemical enrichment of the interstellar medium, and nature of the first stars in the Universe.

Mid-Infrared Spectroscopy of the Most Massive Stars

The most massive star that can form is presently defined by observations of a class of very rare stars having inferred initial masses of ~200 solar masses. There are only a few such stars in the Galaxy, including the Pistol Star, FMM362, and LBV 1806-20, the first two being located near the Galactic center, and third located in the disk near W31. Each has only recently been identified as so massive within the past 10 years through the analysis of infrared observations, but they are otherwise too faint, due to extinction, to observe at shorter wavelengths. These stars appear to be very luminous (L>10^6.3 solar luminosities), "blue" (T>10000 K), and variable (delta K~1 mag.), and the Pistol Star has ejected 10 solar masses of material in the past 10000 years. In addition, these stars have near-infrared spectra similar to those of prototypical Luminous Blue Variables, i.e. Eta Car and AG Car. Given their apparent violation of the Humphries-Davidson limit, they are presumably in a short-lived phase of stellar evolution that is often associated with rapid mass-loss through episodic eruptions of their outer atmospheres. We propose to determine the physical properties of these stars and the velocity and ionization structure in their winds by using spectra obtained with the high resolution modes of the Infrared Spectrograph (IRS) on the Spitzer Space Telescope. The 10 to 40 micron wavelength region is ideally suited for accessing a variety of lines from transitions of hydrogen, helium, iron, silicon, sulfur, among others; indeed, through our models, we predict that sufficiently sensitive spectra will yield over 300 spectral lines. In addition, we predict that the mid-infrared continuum will be dominated by free-free emission generated in the thick winds associated with these stars, an effect that should be clearly detectable in the spectra.

Sandia FPGA Imaging Acquisition Software Development

RIDL developed HDL (Hardware Description Language) software for a FPGA (Field Programmable Gate Array) evaluation board for Sandia National Laboratories. The HDL software programs the FPGA chip to loss through episodic eruptions of their outer atmospheres. We propose to determine the physical properties of these stars and the velocity and ionization structure in their winds by using spectra obtained with the high resolution modes of the Infrared Spectrograph (IRS) on the Spitzer Space Telescope. The 10 to 40 micron wavelength region is ideally suited for accessing a variety of lines from transitions of hydrogen, helium, iron, silicon, sulfur, among others; indeed, through our models, we predict that sufficiently sensitive spectra will yield over 300 spectral lines. In addition, we predict that the mid-infrared continuum will be dominated by free-free emission generated in the thick winds associated with these stars, an effect that should be clearly detectable in the spectra.

Sandia FPGA Imaging Acquisition Software Development

RIDL developed HDL (Hardware Description Language) software for a FPGA (Field Programmable Gate Array) evaluation board for Sandia National Laboratories. The HDL software programs the FPGA chip to transfer digital video rate image data from the evaluation board to a windows based PC using the Camera Link data transfer format. Once the Camera Link data format became available, data acquisition software for the PC was developed to capture and display the imagery on the PC.

The Pre-Supernova Mass-Loss Behavior of Red Supergiants

The mass lost by massive stars as they pass through the Red Supergiant (RSG) phase is a crucial determinant in the terminal mass of the star, the nature of the resulting supernova explosion and the stellar end-state. However, up until now studies of this quantity have been problematic, owing to the low numbers of known RSGs and the difficulty of observing in the mid-IR. Here, we capitalize on the recent discoveries of two remarkable Galactic clusters containing unprecedented numbers of RSGs, and use the capabilities of Spitzer to undertake a comprehensive and unique study of the pre-SN mass-loss of massive stars. We will use Spitzer/IRS observations in conjunction with state-of-the-art dust models to provide the first quantitative investigation of the mass and composition of the pre-SN ejecta as a function of age and metallicity. This study is vital in determining the mass-loss behaviour of RSGs in particular, and the nature of supernova progenitors in general.

A Very Low Noise CMOS Detector Design for NASA

The purpose of this project is to design, fabricate, and test a novel new detector having many advantages over present CCD and CMOS devices. The hybrid CMOS detector is expected to have low noise, radiation tolerance, low power dissipation, low mass and robust electronics. Its low noise is derived from a novel on-die digitization circuit based on a sigma-delta feedback loop.

The Most Massive Stars

Until the Spitzer Space Telescope, there was no wide area survey that could identify massive stars at all distances in the Galaxy. Indeed, the sample of known O-stars is woefully incomplete, as it has largely been generated using optical observations that suffer from the absorption produced by dust in the disk. We will find and measure the physical properties of the most massive stars in the Galaxy using HST, Spitzer, Chandra, SOFIA, and ground-based observatories, using a survey technique that probes the majority of the Galaxy. This program addresses fundamental questions whose answers are basic requirements for studying many of the most important topics in Astrophysics: the formation and evolution of the most massive stars, the effects of massive stars on lower mass protostellar/protoplanetary systems, gamma-ray burst progenitors, nature of the first stars in the Universe, chemical enrichment of the interstellar medium, Galactic gas dynamics, star formation in starbursts and merging galaxies (particularly in the early Universe). The results of our program will influence the science programs for future NASA projects, i.e. JWST, SOFIA, SIM, TPF-C, and TPC-I.

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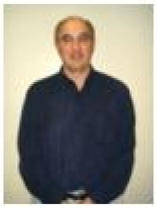

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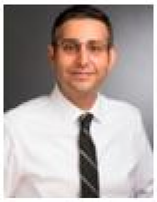

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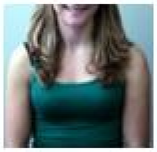

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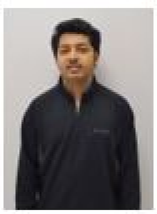

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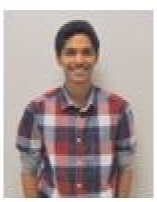

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Publications

2015

Evolved massive stars in W33 and in GMC G23.3-0.3
PDF M. Messineo, J. S. Clark, D. F. Figer, K. M. Menten, R.-P. Kudritzki, F. Najarro, R. M. Rich, V. D. Ivanov, E. Valenti, C. Trombley,C.-H. R. Chen, B. Davies, J. W. MacKenty, IAU Symposium 316

Large format MBE HgCdTe on silicon detector development for astronomy
PDF Hanold, Brandon, Figer, Donald, Lee, Joong, Kolb, Kimberly, Marcuson, Iain, Corrales, Elizabeth, Getty, Johnathan, Mears, Lynn, SPIE Proceedings

---

Hunting for exploding red supergiant stars
PDF Messineo, M., Menten, K., Figer, D., Ivanov, V., Zhu, Q., Kudritzki, R., Davies, Ben., Clark, J., Rich, M., Chen, R., Trombley, C., MackKenty, J., Habing, H., Churchwell, E. 2015, IAU XXIX General Assembly

---

PDF **Massive stars in the W33 giant molecular complex**
Messineo, M., Clark, J., Figer, D., Kudritzki, R. P., Najarro, F., Rich, R., Menten, K., Ivanov, V., Valenti, E., Trombley, C., Chen, C.-H., & Davies, B. 2015, The Astrophysical Journal, 805, 110

PDF **GM-APD Imaging Arrays for Direct Imaging of Exoplanets**
Kolb, K., Figer, D. 2015, Proceedings of the IEEE Aerospace Conference, Big Sky, USA

Investigation of infrared-selected candidate star clusters: [BDS2003] 52
Trombley, C., Figer, D., & Davies, B. 2015, The Astrophysical Journal, submitted

---

PDF **The Massive Star Population at the Center of the Milky Way**
Najarro, F., de la Fuente, D., Geballe, T. R., Figer, D. F., & Hillier, D. J. 2015, IAU Symposium 307, 426-430

PDF **Herschel/PACS: Constraining clumping in the intermediate wind region of OB stars**
Rubio-Díez, M. M., Najarro, F., Sundqvist, J. O., Traficante, A., Puls, J., Calzoletti, L., Herrero, A., Figer, D., & Martín-Pintado, J. 2015, IAU Symposium 307, 137-139

ADS **FS CMa stars in clusters. Evolutionary state as constrained by coeval massive stars**
de la Fuente, D., Najarro, F., Trombley, C., Davies, B., & Figer, D. F. 2015, Astronomy & Astrophysics, 575, A10

2014

ADS **Compact polarimeters based on polarization-sensitive focal plane arrays**
Vorobiev, Dmitry; Ninkov, Zoran 2014, SPIE, 91435F

PDF **The nature of FS CMa stars as revealed by host young clusters**
de la Fuente, D., Najarro, F., Trombley, C., Davies, B., & Figer, D. F. 2014, Highlights of Spanish Astrophysics VIII, Proceedings of the XI Scientific Meeting of the Spanish Astronomical Society held on September 8 – 12, 2014, in Teruel, Spain

ADS **Astrophysics: Monster star found hiding in plain sight**
Figer, D. F. 2014, Nature, 515, 42

ADS **Near-infrared spectroscopy of candidate red supergiant stars in clusters**
Messineo, M., Qingfeng, Z., Ivanov, V. D., Figer, D. F., Davies, B., Menten, K. M., Kudritzki, R. P., & Chen, R. C.-H. 2014, Astronomy & Astrophysics, 571, A43

ADS **Massive stars in the giant molecular cloud G23.3-0.3 and W41**
Messineo, M., Menten, K. M., Figer, D. F., Davies, B., Clark, J. S., Ivanov, V. D., Kudritzki, R. P., Rich, R. M., MacKenty, J. W., & Trombley, C. 2014, Astronomy & Astrophysics, 569, A20

PDF **Evaluation of GM-APD array devices for low-light-level imaging**
Kolb, Kimberly, Hanold, Brandon, Lee, Joong, Figer, & Donald F. 2014, SPIE Proceedings 9114-12

PDF **Signal-to-noise ratio of Geiger-mode avalanche photodiode single-photon counting imaging detectors**
Kolb, Kimberly, Opt. Eng. 53 (8), 081904 (March 31, 2014); doi: 10.1117/1.OE.53.8.081904

ADS **Emission lines in the Near-infrared Spectra of the IR Quintuplet Stars in the Galactic Center**
Geballe, T., Najarro, F., de la Fuente, D., & Figer, D. F. 2014, American Astronomical Society, AAS meeting #223, #346.22

ADS **Imaging Polarimetry With Polarization-Sensitive Focal Planes**
Vorobiev, D. & Ninkov, Z. 2014. 2014, American Astronomical Society, AAS meeting #223, #149.38

2013

ADS **First report on quantum dot coated CMOS CID arrays for the UV and VUV**
Robinson, R., Ninkov, Z., Cormier, D., Raisanen, A., Bhaskaran, S., Beam, Carey, Ziegler, H., Arp, U., & Vest, R. 2013. SPIE Proceedings 8859-6

PDF **Characterization of a Large Format HgCdTe on Si Focal Plane Array**
Hanold, B., Figer, D., Lee, J., Corrales E., Mears, L., Bangs, J., Getty, J., Mitani, M., & Keasler, C. 2013, Proceedings of The Scientific Detector Workshop

PDF **Test Results for an Array-Based GM-APD Detector Before and After Irradiation**
Kolb, K., Hanold, B., Lee, J., & Figer, D. F. 2013, Proceedings of the Scientific Detector Workshop

ADS PDF **Far-Infrared Herschel-PACS flux observations of OB stars**
Rubio-Diez, M. M., Najarro, F., Traficante, A., Cazoletti, L., Puls, J., Figer, D., Sundqvist, J., Herrero, A., Martin-Pintado, J., & Trombley, C. 2013, Massive Stars: From α to Ω held on June 10 - 14, 2013, in Rhodes, Greece

ADS PDF **Hot stars in young massive clusters**
de la Fuente, D., Najarro, F., Davies, B., Trombley, C., Figer, D. F., & Herrero, A. 2013, Massive Stars: From α to Ω held on June 10 - 14, 2013, in Rhodes, Greece

2012

ADS **A newly-discovered young massive star cluster at the end of the Galactic Bar**
Davies, B., de La Fuente, D., Najarro, F., Hinton, J. A., Trombley, C., Figer, D. F., & Puga, E. 2012, Monthly Notices of the Royal Astronomical Society, 419, 1860

ADS **Young Massive Stellar Clusters in the Milky Way: the Cl1813-178 and GLIMPSE 9 Clusters**
Messineo, M., Davies, B., Figer, D. F., Trombley, C., Valenti, E., Najarro, F., MacKenty, J., Menten, K., Rich, R. M., Kudritzki, R. P., Clark, S., & Ivanov, V. 2012, Star Clusters in the Era of Large Surveys, Astrophysics and Space Science Proceedings, ISBN 978-3-642-22112-5. Springer-Verlag Berlin Heidelberg, 185

ADS **Multiwavelength Observations of Massive Stellar Cluster Candidates in the Galaxy**
5. Richards, E., Lang, C., Trombley, C., & Figer, D. 2012, The Astronomical Journal, 144, 89

PDF **Discovery and spectroscopic study of the massive Galactic cluster Mercer 81**
de la Fuente, D., Najarro, F., Davies, B., & Figer, D. F. 2012, Highlights of Spanish Astrophysics VII, Proceedings of the X Scientific Meeting of the Spanish Astronomical Society held on July 9 - 13, 2012, in Valencia, Spain. J. C. Guirado, L. M. Lara, V. Quilis, and J. Gorgas (eds.)

2011

ADS **The Extended Duration Sounding Rocket (EDSR): Low Cost Science and Technology Missions**
Cruddace, R. G., Chakrabarti, S., Cash, W., Eberspeaker, P., Figer, D., Figueroa, O., Harris, W., Kowalski, M., Maddox, R., Martin, C., McCammon, D., Nordsieck, K., Polidan, R., Sanders, W., Wilkinson, E., & Asrat 2011, American Geophysical Union, abstract #SA31A-1962

ADS **Massive Stars in the Cl 1813-178 Cluster: An Episode Of Massive Star Formation in the W33 Complex**
Messineo, M., Davies, B., Figer, D. F., Kudritzki, R. P., Valenti, E., Trombley, C., Najarro, F., & Rich, R. M. 2011, The Astrophysical Journal, 733, 41

ADS **Infrared diffuse interstellar bands in the Galactic Centre region**
Geballe, T. R., Najarro, F., Figer, D. F., Schlegelmilch, B. W., & de La Fuente, D. 2011, Nature, 479, 200-202

ADS **Star Formation in the Central Molecular Zone of the Milky Way**
Kim, S. S., Saitoh, T. R., Jeon, M., Merritt, D., Figer, D. F., & Wada, K. 2011, Computational Star Formation, Proceedings of the International Astronomical Union, IAU Symposium, 270, 359-362

ADS **Sustained Star Formation in the Central Molecular Zone of the Milky Way, The Galactic Center: a Window to the Nuclear Environment of Disk Galaxies.**
Kim, S. S., Saitoh, T. R., Jeon, M., Merritt, D., Figer, D. F., & Wada, K. 2011, The Galactic Center: a Window to the Nuclear Environment of Disk Galaxies. Proceedings of a workshop held at Shanghai, China on October 19-23, 2009. Edited by Mark R. Morris, Q. Daniel Wang, and Feng Yuan. San Francisco: Astronomical Society of the Pacific, 79

ADS **A photon-counting detector for exoplanet missions, Techniques and Instrumentation for Detection of Exoplanets.**
Figer, D. F., Lee, J., Hanold, B. J., Aull, B. F., Gregory, J. A., & Schuette, D. R. 2011, Techniques and Instrumentation for Detection of Exoplanets, V. Edited by Shaklan, Stuart, Proceedings of the SPIE, 8151, 81510K-81510K-13

ADS **The G305 star-forming complex: the central star clusters Danks 1 and Danks 2**
Davies, B., Clark, J. S., Trombley, C., Figer, D. F., Najarro, F., Crowther, A., Kudritzki, R. P., Thompson, M., Urquhart, J., & Hindson, L. 2011, Monthly Notices of the Royal Astronomical Society, 419, 1871

ADS **A photon-counting detector for exoplanet missions**
Figer, D. F., Lee, J., Hanold, B. J., Aull, B. F., Gregory, J. A., & Schuette, D. R. 2011, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 8151,

ADS **Sustained Star Formation in the Central Molecular Zone of the Milky Way**
The Galactic Center: a Window to the Nuclear Environment of Disk Galaxies
Kim, S. S., Saitoh, T. R., Jeon, M., Merritt, D., Figer, D. F., & Wada, K. 2011, 439, 79

ADS **Star Formation in the Central Molecular Zone of the Milky Way**
Kim, S. S., Saitoh, T. R., Jeon, M., Merritt, D., Figer, D. F., & Wada, K. 2011, Computational Star Formation, 270, 359

ADS **Stellar metallicities beyond the Local Group: the potential of J-band spectroscopy with extremely large telescopes**
Evans, C. J., et al. 2011, Astronomy and Astrophysics, 527, A50

ADS **The Stellar Populations of the Milky Way and Nearby Galaxies with LSST**
Olsen, K. A., et al. 2011, Bulletin of the American Astronomical Society, 43, #252.15

ADS **Multiwavelength Observations of the Most Massive Stellar Clusters in the Galaxy**
Richards, E., Lang, C. C., Trombley, C., Figer, D. F., & HST/NICMOS GC Paschen Alpha Team 2011, Bulletin of the American Astronomical Society, 43, #241.07

ADS **Infrared diffuse interstellar bands in the Galactic Centre region**
Geballe, T. R., Najarro, F., Figer, D. F., Schlegelmilch, B. W., & de La Fuente, D. 2011, Nature, 479, 200

ADS **Nuclear Star-forming Ring of the Milky Way: Simulations**
Kim, S. S., Saitoh, T. R., Jeon, M., Figer, D. F., Merritt, D., & Wada, K. 2011, Astrophysical Journal Letters, 735, L11

ADS **Massive Stars in the Cl 1813-178 Cluster. An Episode of Massive Star Formation in the W33 Complex**
Messineo, M., Davies, B., Figer, D. F., Kudritzki, R. P., Valenti, E., Trombley, C., Najarro, F., & Rich, R. M. 2011, Astrophysical Journal, 733, 41

2010

2010

ADS **Centroid precision as a function of total counts in a windowed CMOS image of a point source**
Wurtz, R., Olivier, S., Riot, V., Hanold, B. J., & Figer, D. F. 2010, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 7742

PDF **Hybridization of a sigma-delta-based CMOS hybrid detector**
Kolb, K. E., Maloney, C. W., Stoffel, N. C., Raisanen, A. D., Ashe, B., & Figer, D. F. 2010, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 7742-12

ADS **The potential of red supergiants as extragalactic abundance probes at low spectral resolution**
Davies, B., Kudritzki, R. P., & Figer, D. F. 2010, Monthly Notices of the Royal Astronomical Society, 407, 1203

ADS **Near-infrared spectroscopy in NGC 7538**
Puga, E., Marin-Franch, A., Najarro, F., Lenorzer, A., Herrero, A., Acosta, J., Chavarria, L., Figer, D., & Ramirez, S. 2010, Astronomy & Astrophysics, 517, 2

PDF **Characterization of a sigma-delta-based CMOS monolithic detector**
Hanold, B. J., Figer, D., Ashe, B., Montagliano, T., Stauffer, D., Ignjatovic, Z., Maricic, D., & Nikzad, S. 2010, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 7742-10

ADS **Fully digital image sensor employing sigma-delta indirect feedback ADC with high-sensitivity to low-light illuminations for astronomical imaging applications**
Ignjatovic, Z., Maricic, D., Figer, D., Ashe, B., Hanold, B. J., Montagliano, T., & Stauffer, D. 2010, Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 7742-43

ADS **Infrared Surveys of Galactic Star Clusters**
Ivanov, V. D., Messineo, M., Zhu, Q., Figer, D., Borissova, J., Kurtev, R., & Ivanov, G. R. 2010, IAU Symposium 266

2009

ADS **The progenitor mass for the magnetar SGR1900+14**
Davies, B., Figer, D. F., Kudritzki, R. P., & Trombley, C. 2009, Astrophysical Journal, 707, 844

ADS **HST/NICMOS observations of the GLIMPSE9 stellar cluster**
Messineo, M., Figer, D. F., Davies, B., Kudritzki, R. P., Rich, R. M., MacKenty, J., & Trombley, C. 2009, Astrophysical Journal, 708, 1241

ADS **The stellar population of the star forming region G61.48+0.09**
Martin-Franch, A., Herrero, A., Lenorzer, A., Najarro, F., Ramirez, S., Font-Ribera1, A., & Figer, D. 2009, Astronomy & Astrophysics, 502, 559

ADS **A Near-Infrared Study of the Stellar Cluster: [DBS2003] 45**
Zhu, Q., Davies, B., Figer, D., & Trombley, C. 2009, Astrophysical Journal, 702, 929

ADS **A Third Red Supergiant Rich Cluster in the Scutum-Crux Arm**
Clark, J. S., Negueruela, I., Davies, B., Larionov, V. M., Ritchie, B. W., Figer, D. F., Messineo, M., Crowther, P. A., & Arkharov, A. 2009, Astronomy & Astrophysics, 498, 109

ADS **Chemical abundance patterns in the inner Galaxy: the Scutum Red Supergiant Clusters**
Davies, B., Origlia, L., Kudritzki, R. P., Figer, D. F., Rich, R. M., Najarro, F., Negueruela, I., & Clark, J. S. 2009, Astrophysical Journal, 696, 2014

ADS **Near-infrared spectra of Galactic stellar clusters detected on Spitzer/GLIMPSE images**
Messineo, M., Davies, B., Ivanov, V. D., Figer, D. F., Schuller, F., Habing, H. J., Menten, K. M., & Petr-Gotzens, M. G. 2009, Astrophysical Journal, 697, 701

ADS **The Chemical Abundances in the Galactic Centre from the Atmospheres of Red Supergiants**
Davies, B., Origlia, L., Kudritzki, R. P., Figer, D. F., Rich, R. M., & Najarro, F. 2009, Astrophysical Journal, 694, 46

ADS **Metallicity in the Galactic Center: The Quintuplet cluster**
Najarro, F., Figer, D. F., Hillier, D. J., Geballe, T. R., & Kudritzki, R. 2009, Astrophysical Journal, 691, 1816

ADS **Telescope guiding with a HyViSI H2RG used in guide mode**
Simms, L. M., Figer, D. F., Hanold, B. J., Kahn, S. M., & Gilmore, D. K. 2009, SPIE, 7439

PPT (13.7 MB) **A Proposed Student Built and Operated Satellite: The Gamma Ray Burst Polarization Observer (PolOSat)**
Malphrus, B. K., Jernigan, J. G., Bloom, J. S., Boggs, S., Butler, N. R., Cominsky, L. R., Doering, T. J., Doty, J. P., Erb, D. M., Figer, D. F., Hurley, K. C., Kimel, K. W., Lumpp, J. E., & Labov, S. 2009, AAS, 213, #476.03

2008

PDF (2.43 MB) **Fabrication of a Photodetector Array on Thin Silicon Wafers**
Manser, K. 2008, ImagineRIT Festival

PDF (1.58 MB) **Sigma-delta Analog to Digital Converter for CMOS Image Sensors**
Singh, N. 2008, ImagineRIT Festival

PDF (3.64 MB) **Spot Projector System for the Measurement of Intra-pixel Response**
Yu, Y. S. 2008, ImagineRIT Festival

PDF (4.03 MB) **SIDECAR ASIC Characterization**
Pontillo, D. 2008, ImagineRIT Festival

ADS **Discovery of a young massive stellar cluster near HESS J1813-178**
Messineo, M., Figer, D. F., Davies, B., Rich, R. M., Valenti, E., & Kudritzki, R. P. 2008, Astrophysical Journal, 683, L155

Nature **Detection of an Infrared Ring around the magnetar SGR1900+14**
Wachter, S., Ramirez-Ruiz, E. Dwarkadas, V. V., Kouveliotou, C., Granot, J., Patel, S. K., & Figer, D. F. 2008, Nature, 453, 626

RITdml **Radial Velocities of Stars in the Galactic Center**
Zhu, Q., Kudritzki, R. P., Figer, D. F., Najarro, F., & Merritt, D. 2008, Astrophysical Journal, 681, 1254

THE MASGOMAS PROJECT: A Spectroscopic Study of G61.48+0.09
Herrero, A., Marin-Franch, A., Lenorzer, A., Font, A., Najarro, F., Figer, D., & Davies, B. 2008, IAU250, 7, 551

2007

ADS **The cool supergiant population of the massive young star cluster RSGC1**
Davies, B., Figer, D. F., Law, C. J., Kudritzki, R. P., Najarro, F., Herrero, A., & MacKenty, J. 2007, Astrophysical Journal, 676, 1016

ADS **A massive cluster of Red Supergiants at the base of the Scutum-Crux arm**
Davies, B., Figer, D. F., Kudritzki, R. P., MacKenty, J., Najarro, F., & Herrero, A. 2007, Astrophysical Journal, 671, 781

ADS **Spitzer Space Telescope Observations of SGR and AXP Environments**
Wachter, S., Kouveliotou, C., Patel, S., Figer, D. F., & Woods, P. 2007, Astrophysics and Space Science, 308, Issue 1-4, 67

ADS **Young Massive Clusters**
Figer, D. 2007, IAU250, 3, 247-256

A Systematic Search for Stellar Clusters in the Galactic Plane
Messineo, M. & Figer, D. 2007, IAU250, 7, 552

ADS **The Massive Galactic Red Supergiant Clusters**
Davies, B., Figer, D., Kudritzki, R. P., MacKenty, J., Law, C. J., Najarro, F., & Herrero, A. 2007, IAU250, 7, 549

OSTI **Characterization of Near Infrared Detectors for SNAP**
Schubnell, M., Bebek, C., Brown, M.G., Bower, C., Cole, D., Figer, D. F., Lorenzon, W., Mostek, N., Mufson, S., Seshadri, S., Smith, R., & Tarlé, G. 2007, N15-85 Nuclear Science Symposium and Medical Imaging Conference

---

PDF **Comparing the low-temperature performance of megapixel NIR InGaAs and HgCdTe imager arrays**
Seshadri, S. 2007, SPIE, 6690, 06

PDF **First use of a HyViSI H4RG for astronomical observations**
Simms, L., Figer, D. F., Hanold, B., Kerr, D., Gilmore, K., Kahn, S., & Tyson, A. 2007, SPIE, 6690, 0H

ADS **The LSST Sensor Development Program**
Radeka, V., Geary, J. C., Gilmore, K., Nordby, M., Tyson, J. A., Oliver, J., Figer, D. F., & Stubbs, C. 2007, AAS, 0.86 LSST

ADS **Spitzer Space Telescope Observations of SGR and AXP Environments**
Wachter, S., Kouveliotou, C., Patel, S., Figer, D., & Woods, P. 2007, AAS, 131

ADS **High Resolution Radio Observations of the Nebulae of Luminous Blue Variable Stars**
Mercer, A., Chizek, M., Lang, C. C., Figer, D. F., & Najarro, F. 2007, AAS, 101

2006

ADS **The Arches Cluster Mass Function**
Kim, S. S., Figer, D. F., Kudritzki, R. P., & Najarro, F. N. 2006, Astrophysical Journal Letters, 653, L113

ADS **Pinwheels in the Quintuplet Cluster**
Tuthill, P., Monnier, J., Tanner, A., Figer, D., Ghez, A., & Danchi, W. 2006, Science, 313, 935

ADS **Discovery of an Extraordinarily Massive Young Stellar Cluster**
Figer D. F., MacKenty, J. W., Robberto, M., Smith, K., Najarro, F., & Kudritzki R. P. 2006, ApJ, 643, 1166

ADS **High Spectral Resolution Observations of the Massive Stars in the Galactic Center**
Tanner, A., Figer, D. F., Najarro, F., Kudritzki, R. P., Gilmore, D., Morris, M., Becklin, E. E., McLean, I. S., Gilbert, A. M., Graham, J. R., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2006, Astrophysical Journal, 641, 891

PDF **Filters for HST Wide Field Camera 3**
Baggett, S., Brown, T., Boucrarut, R., Figer, D. F., Hartig, G. F., Kimble, R., MacKenty, J., Robberto, M., Telfer, R. C., Quijada, M. A., Quijano, J., Arsenovic, P., Allen, G., Hilbert, B., Lupie, O. L., & Townsend, J., M 2006, SPIE, 6265, 32

PDF **Silicon Sensor Thickness Optimization for LSST**
O'Connor, P., Figer, D. F., Geary, J. C., Gilmore, K., Oliver, J., Stubbs, C. W., Takacs, Z., & Tyson, J. A. 2006, SPIE, 6276, 1W

ADS **The Arches Cluster Mass Function**
Kim, S. S., Figer, D. F., Kudritzki, R. P., & Najarro, F. N. 2006, Astrophysical Journal Letters, 653, L113

ADS **The LSST sensor technologies studies**
Geary, J., Figer, D., Gilmore, D. K., O'Connor, P., Oliver, J., Radeka, V., Stubbs, C., Takas, P., & Tyson, J. A. 2006, SPIE, 6276, 1

ADS **Near infrared detectors for SNAP**
Schubnell, M. et al. 2006, SPIE, 6276, 23

Mass Distribution in the Central Few Parsecs of Our Galaxy
Seshadri, S. et al. 2006, Black Holes: From Stars to Galaxies - Across the Range of Masses, International

Mass Distribution in the Central Few Parsecs of Our Galaxy
Seshadri, S. et al. 2006, Black Holes: From Stars to Galaxies - Across the Range of Masses, International Astronomical Union. Symposium no. 238, held 21-25 August, 2006 in Prague, Czech Republic, S238, #120

ADS **Characterization of NIR InGaAs imager arrays for the JDEM SNAP mission concept**
Oh, S. K., Kim, S. S., Figer, D. F., & Morris, M. 2006, SPIE, 6276, 25

Filters for WFC3
Baggett, S., Brown, T., Boucrarut, R., Figer, D., Hartig, G. F., Kimble, R., MacKenty, J., Robberto, M., Telfer, R. C., Quijada, M. A., Quijano, J., Arsenovic, P., Allen, G., Hilbert, B., Lupie, O. L., & Townsend, J. 2006, SPIE, 6265

ADS **Development of NIR Detectors and Science Driven Requirements for SNAP**
Brown, M. G., Schubnell, M., Tarle, G., Smith, R., Bonati, M., Guzman, D., Figer, D., Mostek, N., Mufson, S., Cole, D., Seshardi, S., SNAP Collaboration, & SNAP Simulation Team 2006, AAS, #73.04

JPG (1MB) **LSST Poster at AAS 205**

2005

ADS **Nonlinear Reddening Behavior in the Near-Infrared Color-Magnitude Diagram**
Kim, S. S., Figer, D. F., & Lee, M. G. 2005, AAS, #133.12

ADS **Improved Infrared Focal Plane Arrays for HST/Wide Field Camera 3**
Kimble, R. A. (NASA's GSFC), MacKenty, J. W. (STScI), Hill, R. J. (NASA's GSFC), Robberto, M.(STScI), Delo, G., Foltz R., Malumuth, E. M., Reed, S., Russell, A. M. , Waczynski, A., Wen, Y. (NASA's GSFC), Figer, D. F. (STScI), & WFC3 Team 2005, AAS 207, #125.02, 37

ADS **Characterization Tests of WFC3 Filters**
Baggett, S., Boucarut, R., Telfer, R., Kim-Quijano, J., Quijada, M., Arsenovic, P., Brown, T., Dailey, M., Figer, D., Hartig, G., Hilbert, B., Kimble, R. A., Lupie, O., MacKenty J., Madison, T., Robberto, M., Rice, S., Shu, J., & Townsend, J. 2005, AAS, #73.04

Abstract **Issues and Science Driven Specifications for the Near Infrared Detector System for SNAP**
Tarle, G. et al. 2005, AAS, #131.05

ADS **Massive Stars in the SGR 1806-20 Cluster**
Figer, D. F., Najarro, F., Geballe, T. R., Blum, R. D., & Kudritzki, R. P. 2005, Astrophysical Journal Letters, 622, L49

PDF **An upper limit to the masses of stars**
Figer, D. F. 2005, , Nature, 34, 192

ADS **Theoretical Isochrones with Extinction in the K Band**
Kim S. S., Figer, D. F., Lee, M. G., & Oh, S. 2005, PASP, 117, 445

Abstract **Design study for a WIYN high resolution infrared camera**
Meixner, M., Churchwell, E. B., Knezek, P., Figer, D. F., Doering, R., Barkhouser, R. H., & Smee, S. 2005, AAS, #49.12

Abstract **LSST Focal Plane and Detector Development**
O'Connor, P., Figer, D., Geary, J., Gilmore, K. Oliver, J., Radeka, V., Stubbs, C., Takacs, P., & Tyson, A. 2005, AAS, #108.07

PDF **Independent Testing of Silicon PIN Detector Arrays for LSST**
Figer, D. F., Regan, M. W., Morse, E., & Balleza, J. 2005, AAS

2004

ADS **Mass Distribution in the Central Few Parsecs of Our Galaxy**
Oh, S., Kim, S. S., Figer, D. F., & Morris, M. 2004, AAS, #24.03

ADS **Design study for the WIYN high resolution infrared camera**
Meixner, M., Churchwell, E. B., Knezek, P., Figer, D. F., Doering, R., Barkhouser, R. H., & Smee, S. 2004, AAS, #49.12

ADS **Si PIN Detector Testing for LSST**
Figer, D. F., Regan, M., & Morse, E. 2004, AAS, #108.08

RITdml **The Stellar Initial Mass Function in the Galactic Center**
Figer, D. F. 2004, Sienna, Italy, at IMF at 50, Invited Talk, in press

---

ADS **Design study for the WIYN high resolution infrared camera**
Meixner, M., Knezek, P., Churchwell, E., Doering, R., Indebetouw, R., Figer, D., MacKenty, J. W., Fruchter, A., Barkhouser, R., & Smee, S. A. 2004, SPIE, 5492, 1440

ADS **Young Massive Clusters in the Galactic Center**
Figer, D. F. 2004, in ASP Conf. Ser. 322, The formation and evolution of massive young star clusters, eds. H.J.G.L.M. Lamers, L.J. Smith & A. Nota (San Francisco: ASP), 49

ADS **Metallicity in the Galactic Center: The Arches cluster**
Najarro, F., Figer, D. F., Hillier, D. J., & Kudritzki, R. 2004, Astrophysical Journal Letters, 611, L105

ADS **The Double-lined Spectrum of LBV 1806-20**
Figer, D. F., Najarro, F., & Kudritzki, R. 2004, Astrophysical Journal Letters, 610, L109

ADS **Dynamical Friction on Galactic Center Star Clusters with a Central Intermediate-Mass Black Hole**
Kim S. S., Morris, M., & Figer, D. F. 2004, Astrophysical Journal, 607, L123

ADS **An Extended Star Formation History for the Galactic Center from Hubble Space Telescope/NICMOS Observations**
Figer, D. F., Rich, R. M., Kim, S. S., Morris, M., & Serabyn, E. 2004, Astrophysical Journal, 601, 319

PDF **Limits on routine wavefront sensing with NIRCam on JWST**
Sivaramakrishnan, A., Acton, D. S., Atcheson, D., Makidon, R. B., Morse, E., & Figer, D. F. 2004, SPIE 5487, 909

PDF **RITMOS: a micromirror-based multi-object spectrometer**
Meyer, R., Kearney, K., Ninkov, Z., Cotton, C., Hammond, P., Statt, B. P. 2004, SPIE 5492, 200

PDF **Detectors for the James Webb Space Telescope near-infrared spectrograph**
Rauscher, B. J. et al. 2004,SPIE 5487, 710

PPT **Detectors for the James Webb Space Telescope near-infrared spectrograph**
Rauscher, B. J., Figer, D. F., Jakobsen, P., Hill, R. J., Moseley, S. H., Regan, M. W., & Strada, P. 2004, AAS, #11.02

2003

PPT **Detectors for the JWST Near-Infrared Spectrometer**
Rauscher, B. J., Strada, P., Regan, M. W., Figer, D. F., Jakobsen, P., Moseley, H. S., & Boeker, T. 2003, Detectors for the JWST Near-Infrared Spectrometer, BAAS, 35, 1411

PDF (8KB) WORD **IDTL Article for STScI Annual Report 2003**
Figer, D. F., Rauscher, B. J., & Regan, M. W. 2003

ADS **High Precision Stellar Radial Velocities in the Galactic Center**
Figer, D. F., Gilmore, D., Kim, S. S., Morris, M., Becklin, E. E., McLean, I. S., Gilbert, A. M., Graham, J. R., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2003, Astrophysical Journal, 599, 1139

PDF (8KB) WORD **IDTL Article for STScI Annual Report 2003**
Figer, D. F., Rauscher, B. J., & Regan, M. W. 2003

PDF WORD **IDTL Article for STScI Fall 2003 Newsletter**
Figer, D. F. & DeJong, R. 2003

The IMF in the Galactic Center
Figer, D. F. 2003, in proceedings of The Centers of Galaxies, A Workshop held at Castle Ringberg

ADS **Massive Stars and The Creation of our Galactic Center**
Figer, D. F. 2003, in Astron. Nachr., Vol. 324, No. S1 (2003), Special Supplement "The central 300 parsecs of the Milky Way," Eds. A. Cotera, H. Falcke, T. R. Geballe, S. Markoff, 255

ADS **Dynamical Friction Near the Galactic Center**
Kim, S. S., Figer, D. F., & Morris, M. 2003, in Astron. Nachr., Vol. 324, No. S1 (2003), Special Supplement "The central 300 parsecs of the Milky Way", Eds. A. Cotera, H. Falcke, T. R. Geballe, S. Markoff, 321

ADS **NIRCAM Image Simulations for NGST Wavefront Sensing**
Stolte, A., Brandner, W., Grebel, E. K., Figer, D. F., Eisenhauer, F., Lenzen, R., & Harayama, Y. 2003, 201, BAAS, 82.03

ADS **Stellar Distribution and Population in the Central Few Parsecs of Our Galaxy**
Kim, S. S., Lee, M. G., & Figer, D. F. 2003, BAAS, 201, 145.01

ADS **The Independent Detector Testing Laboratory and the JWST Detector Program**
Figer, D. F. et al. 2003, BAAS, 201, 131.05

ADS **Massive Stars and The Creation of our Galactic Center**
Figer, D. F. 2003, in proceedings of IAU symposium 212 on "A Massive Star Odyssey,From Main Sequence To Supernova," 487

PDF **NAOS-CONICA performance in a crowded field - The Arches Cluster**
Sivaramakrishnan, A., Figer, D. F., Bushouse, H., Stockman, H. S., Ohara , C., Redding, D., Im, M., & Offenberg, J. 2003, The Messenger, 111, 9-13

WORD PDF **Independent Testing of JWST Detector Prototypes**
Figer, D. F., Rauscher, B. J., Regan, M. W., Balleza, J., Bergeron, L., Morse, E., and Stockman, H. S. 2003, SPIE, 5167, 270

PPT **Silicon PIN Diodes: A Promising Technology for UV-Optical Space Astronomy**
Bernard J. Rauscher, Figer, D. F., & Regan, M. W. 2003, NHST Workshop

---

WORD PPT PDF PS (2KB) **The Independent Detector Testing Laboratory and the NGST Detector Program**
Figer, D. F., Rauscher, B. J., Regan, M. W., Balleza, J., Barkhouser, R., Bergeron, L., Greene, G. R., Kim, S., McCandliss, S. R.,Morse, E., Pelton R., Reeves, T., Sharma, U., Stemniski, P., Stockman, H. S., & Telewicz, M. 2003, SPIE, 4850, 981

WORD PPT **Intra-Pixel Sensitivity in NIR Detectors for NGST**
Sharma, U., Figer, D. F., Rauscher, B. J., Regan, M. W., Bergeron, L., Balleza, J., Barkhouser, R., Greene, G. R., Kim, S., McCandliss, S. R., Pelton R., Sivaramakrishnan, A., Reeves, T., Stemniski, P., Stockman, H. S., & Telewicz, M. 2003, SPIE, 4850, 1001

PS **NIRCAM Image Simulations for NGST Wavefront Sensing**
Sivaramakrishnan, A., Makidon, R. B., Figer, D. F., Jedrzejewski, R. I., Bushouse, H. A., Krist, J. E., Stockman H. S. (STScI), Laidler, V. G., Hodge, E., Dencheva, N. M., Rauscher, B. J., Ohara, C., Redding, D. C. (JPL), Im, M. (IPAC), & Offenberg, J. (Raytheon) 2003, SPIE, 4850, 388

WORD PPT **Ultra-Low Background Operation of Near-Infrared Detectors for NGST**
Rauscher, B. J., Figer, D. F., Regan, M. W., Bergeron, L., Balleza, J., Barkhouser, R., Greene, G. R., Kim, S., McCandliss, S. R., Pelton, R., Reeves, T., Sharma, U., Stemniski, P., Stockman, H. S., & Telewicz, M. 2003, SPIE, 4850, 962

2002

PDF WORD **IDTL Article for STScI Annual Report 2002**
Figer, D. F. 2002

ADS **Massive Stars in the Arches Cluster**
Figer, D. F., Najarro, F., Gilmore, D., Morris, M., Kim, S. S., Serabyn, E., McLean, I. S., Gilbert, A. M., Graham, J. R., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2002, Astrophysical Journal, 581, 258

ADS **The Mass Function of the Arches Cluster from Gemini Adaptive Optics Data**
Stolte, A., Grebel, E. K., Brandner, W., & Figer, D. F. 2002, Astronomy &Astrophysics, 394, 459

ADS **Infrared Imaging of the Arches Cluster - Adaptive Optics in the densest region of the Milky Way**
Stolte, A., Grebel, E. K., Brandner, W., & Figer, D. F. 2002, in proceedings of "Extragalactic Star Clusters," IAU Symposium 207 eds. D. Geisler, E.K. Grebel, and D. Minniti, (Provo: ASP), 207, 132

ADS **The Mass Function of the Arches Cluster from Gemini Adaptive Optics Data**
Stolte, A., Grebel, E. K., Brandner, W., & Figer, D. F. 2002, Presented at the IAOC Workshop on "Galactic Star Formation Across the Stellar Mass Spectrum" held in La Serena, Chile, March 2002, to be published in the ASP Conference Series, edited by J. M. De Buizer, 6360

ADS **Starburst Clusters in Galactic Nuclei**
Figer, D. F. & Morris, M. 2002, in "Modes of Star Formation and the Origin of Field Star Populations," conference proceedings, ASP, 285, 381

PDF **Characteristics of the Hubble Space Telescope's radiation environment inferred from charge-collection modeling of Near-Infrared Camera and Multi-Object Spectrometer dark frames**
Ladbury, R., Pickel, J. C., Gee, G., Jordan, T. M., Bergeron, L., Rauscher, B., Reed, R. A., Marshall, P. W., Figer, D., Fodness, B., & Kniffin, S. 2002, Nuclear Science, IEEE Transactions, 49, 2765

2001

RITdml **The Altitude of an Infrared Bright Cloud Feature on Neptune from Near-infrared Spectroscopy**
Roe, H. G., Graham, J. R., McLean, I. S., de Pater, I., Becklin, E. E., Figer, D. F., Gilbert, A. M., Larkin, J. E., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 2001, Astronomical Journal, 122, 1023

ADS **Resolved IR Spectroscopy of Two High Redshift Radio Galaxies**
Carson, J. E., Larkin, J. E., McLean, I. S., Graham, J. R., Becklin, E. E., Figer, D. F., Gilbert, A. M., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 2001, Astrophysical Journal, 563, 63

ADS **Mid-Infrared Imaging and Spectroscopy of the Enigmatic Cocoon Stars in the Quintuplet Cluster**
Moneti, A., Blommaert, J. A. D. L., & Figer, D. F. 2001, Astronomy and Astrophysics, 366, 106

ADS **A Survey of Organic Volatile Species in Comet C/1999 H1 (Lee) Using NIRSPEC at the Keck Observatory**
Mumma, M. J. et al. 2001, Astrophysical Journal, 546, 1183

ADS **Mass Function of the Arches Cluster - Gemini meets HST**
Stolte, A., Grebel, E. K., Brandner, W., & Figer, D. F. 2001, Astronomische Gesellschaft Meeting Abstracts, 18, 125

ADS **High Precision Stellar Velocities in the Galactic Center**
Figer, D. F., Gilmore, D., Morris, M., McLean, I. S., Becklin, E. E., Gilbert, A. M., Graham, J. R., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2001, BAAS, 198, 87.06

ADS **N-Body Simulations of Compact Young Star Clusters near the Galactic Center**
Kim, S. S., Figer, D. F., Lee, H. M., & Morris, M. 2001, ASP Conf. Ser. 228: Dynamics of Star Clusters and the Milky Way, 485

ADS **Mid-Infrared Imaging and Spectroscopy of the Enigmatic Cocoon Stars in the Quintuplet Cluster**
Moneti, A., Blommaert, J. A. D. L., & Figer, D. F. 2001, ASP Conf. Ser. 243: From Darkness to Light: Origin and Evolution of Young Stellar Clusters, 517

2000

ADS **N-body Simulations of Compact Young Clusters Near the Galactic Center**
Kim, S. S., Figer, D. F., Lee, H. M., & Morris, M. 2000, Astrophysical Journal, 545, 301

ADS **Measurement of [OIII] Emission in Lyman Break Galaxies**
Teplitz, H. I. et al. 2000, Astrophysical Journal, 542, 18

ADS **2-micron Spectroscopy within 0.3 arcseconds of Sgr A***
Figer, D. F., Becklin, E. E. , McLean, I. S. , Gilbert, A. M., Graham, J. R., Larkin, J. E., Levenson, N. A., Teplitz, H. I., Wilcox, M. K., & Morris, M. 2000, Astrophysical Journal Letters, 533, L49

ADS **Infrared Spectroscopy of a Massive Obscured Star Cluster in the Antennae Galaxies (NGC 4038/9) with NIRSPEC**
Gilbert, A. M. Graham, J. R., McLean, I. S. , Becklin, E. E. , Figer, D. F., Larkin, J. E., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 2000, Astrophysical Journal Letters, 533, L57

ADS **Hot Stars and Cool Clouds: The Photodissociation Region M16**
Levenson, N. A., Graham, J. R., McLean, I. S. , Becklin, E. E. , Figer, D. F., Gilbert, A. M. Larkin, J. E., Teplitz, H. I., & Wilcox, M. K. 2000, Astrophysical Journal Letters, 533, L53

ADS **Discovery of an Obscured Broad Line Region in the High Redshift Radio Galaxy MRC 2025-218**
Larkin, J. E., McLean, I. S., Graham, J. R., Becklin, E. E., Figer, D. F., Gilbert, A. M., Glassman, T. M., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 2000, Astrophysical Journal Letters, 533, L61

ADS **The Rest-Frame Optical Spectrum of MS 1512-cB58**
Teplitz, H. I., McLean, I. S. , Becklin, E. E. , Graham, J. R., Figer, D. F., Gilbert, A. M. Larkin, J. E., Levenson, N. A. Wilcox, M. K. 2000, Astrophysical Journal Letters, 533, L65

ADS **J-band Infrared Spectroscopy of a Sample of Brown Dwarfs using NIRSPEC on Keck II**
McLean, I. S., Graham, J. R., Becklin, E. E., Figer, D. F., Gilbert, A. M. Larkin, J. E., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 2000, Astrophysical Journal Letters, 533, L45

ADS **A Second Luminous Blue Variable in the Quintuplet Cluster**

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ADS **A Second Luminous Blue Variable in the Quintuplet Cluster**
Geballe, T. R., Najarro, F., & Figer, D. F. 2000, Astrophysical Journal Letters, 530, L97

ADS **Performance and results with the NIRSPEC echelle spectrograph on the Keck II telescope**
McLean, I. S., Graham, J. R., Becklin, E. E., Figer, D. F., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2000, SPIE, 4008, 1048

The IMF in the Galactic Center
Figer, D. F. 2000, in Starburst Galaxies: Near and Far, Proceedings of a Workshop held at Ringberg Castle, Germany, 10-15 September, 2000. Edited by L. Tacconi and D. Lutz. Heidelberg: Springer-Verlag, 2001, 13

RITdml **Stellar Collisions in the Galactic Center**
Figer, D. F. & Kim, S. S. 2000, in "Stellar Collisions and Mergers," conference proceedings, ASP, 263

ADS **A survey of organic volatile species in comet C/1999 H1 (Lee) using NIRSPEC at the Keck**
Mumma, M. J. et al. 2000, DPS, 32, 4404

ADS **NIRSPEC Spectra of High-z Radio Galaxies**
Carson, J. E., Larkin, J. E., McLean, I. S., Graham, J. R., Becklin, E. E., Figer, D. F., Gilbert, A. M., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 2000, BAAS, 196, #50.15

ADS **NIRSPEC Observations of the Galactic Center**
Figer, D. F., McLean, I. S., Becklin, E. E., Graham, J. R., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2000, SPIE, 4005-17

AAS **Keck/NIRSPEC Spectroscopy of Stars Near the Supermassive Black Hole at the Galactic Center**
Figer, D. F., Becklin, E. E., Morris, M., McLean, I. S., Graham, J. R., Gilbert, A. M., Larkin, J. E., Levenson, N. A., & Teplitz, H. I. 2000, BAAS, 195, #62.02

ADS **NIRSPEC brown dwarf spectroscopic survey**
Wilcox, M. K., McLean, I. S., Becklin, E. E., Figer, D. F., Gilbert, A. M., Graham, J. R., Larkin, J. E., Levenson, N. A., Teplitz, H. I., Kirkpatrick, J. D., & Burgasser, A. J. 2000, SPIE, 4005, 296

PDF **Infrared Spectroscopy of the High Redshift Radio Galaxy MRC 2025-218 and a Neighboring Extremely Red Galaxy**
Larkin, J. E., McLean, I. S., Graham, J. R., Becklin, E. E., Figer, D. F., Gilbert, A. M., Glassman, T. M., Levenson, N. A., Teplitz, H., & Wilcox, M. K. 2000, in proceedings of The Hy-Redshift Universe: Galaxy Formation and Evolution at High Redshift, eds. A. J.Bunker and W. J. M. van Breugel, ASP, 193

1999

ADS **Radio Detections of Stellar Winds from the Pistol Star and from other Stars in the Galactic Center Quintuplet Cluster**
Lang, C. C., Figer, D. F., Goss, W. M., & Morris, M. 1999, Astronomical Journal, 118, 2327

ADS **HST/NICMOS Observations of Massive Stellar Clusters Near the Galactic Center**
Figer, D. F., Kim, S. S., Morris, M., Serabyn, E., Rich, R. M., & McLean, I. S. 1999, Astrophysical Journal, 525, 750

ADS **High-Resolution Infrared Imaging and Spectroscopy of the Pistol Nebula: Evidence for Ejection**
Figer, D. F., Morris, M., Geballe, T. R., Rich, R. M., Serabyn, E., McLean, I. S., Puetter, R., & Yahil, A. 1999, Astrophysical Journal, 525, 759

ADS **Massive Stars in the Quintuplet**
Figer, D. F., McLean, I. S., & Morris, M. 1999, Astrophysical Journal, 514, 202

ADS **The Pistol Star: A Supergiant Among its Ponderous Peers**
Figer, D. F. 1999, Mercury, 28, #6, 32

ADS **Near-Infrared Spectroscopic Investigation of Neptune's Hazes and Storms at the Keck Telescope**
Roe, H., Graham, J. R., de Pater, I., Gibbard, S., Macintosh, B., Max, C., Baines, K., Gilbert, A. M., McLean, I. S., Becklin, E. E., Figer, D. F., Larkin, J. E., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 1999, American Astronomical Society, DPS meeting #31, #51.09

ADS **Detection of ethane, methane, OH and other volatile species in comet C/1999 H1 (Lee) with NIRSPEC at the Keck Observatory**
Mumma, M. J., Dello Russo, N., Disanti, M., Gilbert, A. M., Graham, J. R., McLean, I. S., Becklin, E. E., Figer, D. F., Larkin, J. E., Levenson, N. A., Teplitz, H. I., & Wilcox, M. K. 1999, American Astronomical Society, DPS meeting #31, #32.06

ADS **Infrared Spectroscopy of a Massive Obscured Star Cluster in NGC 4038/4039 with NIRSPEC**
Gilbert, A. M., Graham, J. R., McLean, I. S., Becklin, E. E., Figer, D. F., Larkin, J., Levenson, N. A., Teplitz, H. I., & Wilcox, M. 1999, in Proceedings of SOFIA-Star Formation Workshop in Santa Cruz, CA, July 12-17, 1999

ADS **Super star clusters in the Galactic Center as revealed by HST NICMOS**
Figer, D. F. 1999, in: K.A. van der Hucht, G. Koenigsberger & R. J. Eenens (eds.), Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies, Proc. IAU Symposium No. 193 (San Francisco: ASP), 459

ADS **Massive Young Stars in the Arches Cluster**
Serabyn, E., Shupe, D., & Figer, D. F. 1999, in Proceedings of "The Central Parsecs: Galactic Center Workshop '98", ASP Conf. Series, Vol. 186, 320

ADS **HST/NICMOS Imaging of the Quintuplet and Arches Clusters**
Figer, D. F. 1999, in proceedings of "The Central Parsecs: Galactic Center Workshop '98," ASP Conf. Series, Vol. 186, 329

ADS **Theoretical Modelling of Hot Stars**
Najarro, F., Hillier, D. J., Figer, D. F., & Geballe, T. R. 1999, in Proceedings of "The Central Parsecs: Galactic Center Workshop '98", ASP Conf. Series, Vol. 186, 340

Galactic Center Workshop '98", ASP Conf. Series, Vol. 186, 340

A Superbubble Surrounding The Quintuplet at the Galactic Center?
Levine, D., Morris, M., & Figer, D. F. 1999, in Cox and M. F. Kessler (eds.), "The Universe as seen by ISO", (ESA-SP 427), 699

The Pistol, the Pistol Star, and the Quintuplet in the Galactic Centre: Results from ISO CVF imaging and SWS spectroscopy
Moneti, A., Blommaert, J., Figer, D. F., Najarro, F., & Stolovy, S. 1999, in Cox and M. F. Kessler (eds.), "The Universe as seen by ISO", (ESA-SP 427), 723

1998

Nature **An Extraordinary Cluster of Massive Stars in the Milky Way's Core**
Serabyn, E., Shupe, D., & Figer, D. 1998, Nature, 394, 448

ADS **The Pistol Star**
Figer, D. F., Najarro, F., Morris, M., McLean, I. S., Geballe , T. R., Ghez, A. M., & Langer, N. 1998, Astrophysical Journal, 506, 384

ADS **The Pistol Star and Massive Stars in the Galactic Center**
Figer, D. F., Najarro, F., Langer, N. 1998, in proceedings of "Unsolved Problems in Stellar Evolution," STScI, 272

ADS **Design and development of NIRSPEC: a near infrared echelle spectrograph for the Keck II Telescope**
McLean, I. S. et al. 1998, SPIE Vol. 3354, 566

PDF **FLITECAM: a 1-5 micron camera for testing the performance of SOFIA**
Figer, D. F., McLean, I. S., & Becklin, E. E. 1998, SPIE Vol. 3354, 1179

ADS **Cryogenic performance of the NIRSPEC three mirror anastigmat**
Robichaud, J. L., Zellers, B., Philippon, R., McLean, I. S., & Figer, D. F. 1998, SPIE Vol. 3354, 1068

ADS **Wavefront error budget and optomechanical tolerancing for NIRSPEC**
Figer, D. F. & McLean I. S. 1998, SPIE Vol. 3354, 1005

ADS **The Pistol Star**
Figer, D. F., Morris, M., McLean, I. S., Ghez, A. M., Najarro, F., Geballe, T. R., Serabyn, E., & Rich, R. M. 1998, BAAS 191

ADS **The Stellar Content in the Quintuplet Cluster**
Figer, D. F., McLean, I. S., Morris, M., & Najarro, F. 1998, in Proceedings of the 184th symposium of the International Astronomical Union, held in Kyoto, Japan, August 18-22, 1997. Edited by Yoshiaki Sofue. (Dordrecht: Kluwer), 61

ADS **12.5 Micron Imaging of Sgr A West with the Keck Telescope**
Becklin, E., Morris, M., Figer, D. F., Puetter, R., & Jones, B. 1998, Proceedings of the 184th symposium of

ADS **12.5 Micron Imaging of Sgr A West with the Keck Telescope**
Becklin, E., Morris, M., Figer, D. F., Puetter, R., & Jones, B. 1998, Proceedings of the 184th symposium of the International Astronomical Union, held in Kyoto, Japan, August 18-22, 1997. Edited by Yoshiaki Sofue. (Dordrecht: Kluwer), 293

1997

ADS **A K band Spectral Atlas of Wolf Rayet Stars**
Figer, D. F., McLean, I. S., & Najarro, F. 1997, Astrophysical Journal, 486, 420

ADS **H Band Spectroscopic Classification of OB Stars**
Blum, R. D., Ramond, T. M., Conti, S., Figer, D. F., & Sellgren, K. 1997, Astronomical Journal, 113, 1855

1996

ADS **Wolf-Rayet Stars in the Galactic Center, in Wolf Rayet Stars in the Framework of Stellar Evolution**
Cotera, A. S., Figer, D. F., & Blum, R. D. 1996, eds. J.-M. Vreux, A. Detal, D. Fraipont-Caro, E. Gosset, G. Rauw

ADS **An LBV-candidate in the Quintuplet (AFGL2004) near the Galactic Center**
Figer, D. F., Najarro, F., McLean, I. S., Morris, M., & Geballe, T. R. 1996, in "Luminous Blue Variables: Massive Stars in Transition," eds. A. Nota, H. J. G. L. M. Lamers, ASP Conference Series Vol. 120, 196

ADS **Hot Stars in the Quintuplet**
Figer, D. F., Morris, M., & McLean, I. S. 1996, 4th ESO/CTIO Workshop on the Galactic Center, La Serena, Chile, ed. R. Gredel, 263

1995

ADS **Two New Wolf-Rayet Stars and a Luminous Blue Variable Star in the Quintuplet (AFGL 2004) Near the Galactic Center**
Figer, D. F., McLean, I. S., & Morris, M. 1995, Astrophysical Journal Letters, 447, L29

ADS **A Circumstellar H2O Maser Associated with the Circumnuclear Molecular Disk at the Galactic Center?**
Levine, D. A., Figer, D. F., Morris, M., & McLean, I. S. 1995, Astrophysical Journal Letters, 447, L101

ADS **NIRSPEC: a near infrared cross dispersed echelle spectrograph for the Keck II telescope**
McLean, I. S., Becklin, E. E., Figer, D. F., Larson, S., Liu, T., & Graham, J. 1995, SPIE Vol. 2475: Infrared Detectors and Instrumentation for Astronomy, 350

ADS **Discovery of Two Wolf-Rayet Stars Near the Galactic Center**
Figer, D. F., McLean, I. S., Morris, M. 1995, BAAS, 26, 1348

ADS **Two New Wolf-Rayet Stars and a Luminous Blue Variable Star in the Quintuplet (AFGL 2004) Near the Galactic Center**
Figer, D. F., McLean, I. S., & Morris, M. 1995, Astrophysical Journal Letters, 447, L29

ADS **A Circumstellar H2O Maser Associated with the Circumnuclear Molecular Disk at the Galactic Center?**
Levine, D. A., Figer, D. F., Morris, M., & McLean, I. S. 1995, Astrophysical Journal Letters, 447, L101

ADS **NIRSPEC: a near infrared cross dispersed echelle spectrograph for the Keck II telescope**
McLean, I. S., Becklin, E. E., Figer, D. F., Larson, S., Liu, T., & Graham, J. 1995, SPIE Vol. 2475: Infrared Detectors and Instrumentation for Astronomy, 350

ADS **Discovery of Two Wolf-Rayet Stars Near the Galactic Center**
Figer, D. F., McLean, I. S., Morris, M. 1995, BAAS, 26, 1348

1994

ADS **Discovery of Luminous NIR Sources Associated with Ionized Gas near the Galactic Center**
Figer, D. F., Becklin, E. E., McLean, I. S., & Morris, M. 1994, Infrared Astronomy with Arrays, ed. I. S. McLean, 545

ADS **Performance and Results with a Double-Beam Infrared Camera**
McLean, I. S., Macintosh, B., Liu, T., Casement, L. S., Figer, D. F., Teplitz, H., Larson, S., Lacayanga, F., Silverstone, M., & Becklin, E. E. 1994, SPIE Vol. 2198: Instrumentation in Astronomy VI, 457

1993

ADS **Polarization of the Thermal Emission from the Dust Ring at the Center of the Galaxy**
Hildebrand, R. H., Davidson, J. A., Dotson, J., Figer, D. F., Novak, G., Platt, S. R., & Tao, L. 1993, Astrophysical Journal, 417, 565

ADS **The UCLA Double-beam Infrared Camera System**
McLean, I. S., Becklin, E. E., Brims, G., Canfield, J., Casement, L. S., Figer, D. F., Henriquez, F., Huang, A., Liu, T., Macintosh, B., & Teplitz, H. 1993, SPIE Vol. 1946: Infrared Detectors and Instrumentation, 513

ADS **Far infrared Polarization of the Sagittarius B2 Molecular Cloud**
Novak, G., Platt, S. R., Goldsmith, F., Hildebrand, R. H., Dotson, J., Figer, D. F., & Davidson, J. A. 1993, BAAS 182, 34.07

1992

ADS **Polarization of the Thermal Arches at the Galactic Center**
Morris, M., Davidson, J. A., Werner, M., Dotson, J., Figer, D. F., Hildebrand, R. H., Novak, G., & Platt, S. R. 1992, Astrophysical Journal Letters, 399, L63

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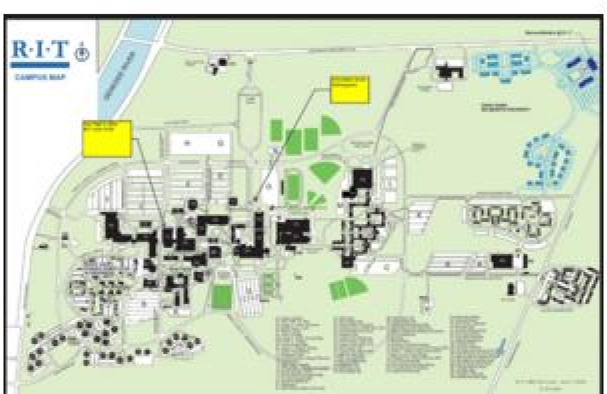

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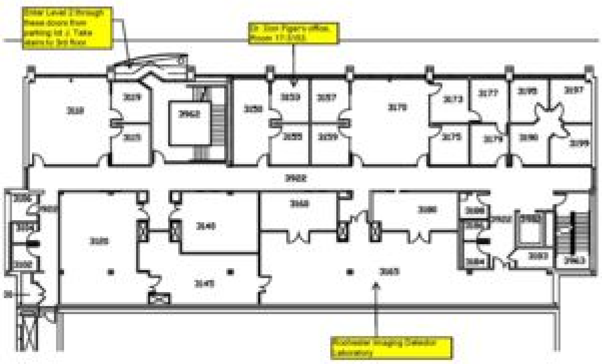

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