Dr. David John Erskine

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Professional Preparation

University of Illinois	Physics (Magna Cum Laude)	B.S., 1979
Cornell University	Experimental Solid State Physics	Ph.D., 1984

Thesis: Optically measured relaxation time of electron-hole carriers in semiconductors using femtosecond pulsed lasers; Invented "equal-pulse" relaxation time measurement technique. Prof. C.L. Tang advisor.

Univ. of Calif., Berkeley	High Pressure Physics	Postdoc, 1984-1987

Discovered new superconducting high pressure crystalline phases of Si predicted by Prof. Marvin Cohen. Measured electrical conductivity of silicon squeezed to 450 Megabars between diamond tips at liquid helium temperatures; Prof. Peter Yu advisor.

Appointments

UC Berkeley Space Sciences	Sabbatical research (EDI interferometry theory)	(2000-2001)
Lawrence Livermore Nat. Lab.:	Staff Physicist (Doppler interferometry specialist)	(1987-present)
UC Berkeley Physics Dept.	Postdoctoral researcher (high pressure physics)	(1984-1987)
Cornell Univ.	Graduate student (semiconductor optics)	(1979-1984)
Argonne Nat. Lab.	Summer Research Associate (heat flow)	(1977, 1978)

Research Foci

- **Optical measurement techniques innovation** (white light interferometry[A, A2, A3], 2-D velocity interferometry[F, F2], externally dispersed interferometry for Doppler planet search[B, B2, B3, B4], externally dispersed interferometry for astronomical high resolution spectroscopy[B5, B6, B7]);
- **Data analysis & signal processing algorithm development** (ghost fringe removal via vector subtraction[C], holographic interpretation of defocussed 2d-velocimetry fringes[D, D2], speckle-adaptive fringe analysis algorithm[E])

History

Erskine has performed nearly 37 years of experimental research in a wide variety of disciplines: femtosecond lasers, semiconductor physics, superconductivity, material science, diamond anvil cell high pressure physics, shock physics, optical diagnostics, Fourier signal processing, high speed recording technology, velocity interferometry, high resolution spectroscopy, and astronomical instrumentation innovation (Doppler planet search). Experienced at multidisciplinary research, he has provided technical leadership in many collaborations between academic researchers and students and the National Laboratory. He loves creating novel instrumental techniques, especially involving optics.

Professional Memberships

Amer. Astr. Soc., Optical Soc. of Amer., SPIE (Intrntnl. Soc. for Optics), Amer. Phys. Soc., Planetary Soc.

Honors

R&D 100 Magazine Innovation Award 2006[B3], Physics Directorate Award 2006, DNT Directorate Award 2007.

Example Astro/Optical Publications from last 20 years. Earlier publications available in **full CV**.

"***Glasses for Mr. Magoo's Spectrograph***", Astronomy Beat, newsletter for Astr. Soc. Pacific, D. Erskine, edited by L. Shore, vol. 154, p1-7, March 8, 2017. AstroBeatGen.pdf	History and photos of EDI over the years
"**Spectral resolution boosting Gemini Planet Imager's Integral Field Spectrograph using a small Externally Dispersed Interferometer addition**", D. J. Erskine, briefing, GPI 2.0 Mtg, Stanford Univ., March 9, 2017, host Prof. Bruce Macintosh. Erskine-SpecResBoostingGPI.pdf	Briefing for GPI folks considering possible upgrades. Adding 0.6 cm interferometer boosts R=40 to effectively R=4000 for CO2 feature

"**Greatly enhanced exoplanet biosignature from an interferometer addition to a low resolution spectrograph**", D. J. Erskine, P. S. Muirhead, A. M. Vanderburg, A. Szentgyorgyi, AAS meeting, Austin, TX, June 4-8, 2017, poster 118.07. 37x37-Poster-2017-AAS-Austin-Gen.pdf	Modeling shows adding 0.6 cm interferometer to Gemini Planet Imager boosts R=40 to effectively R=4000 for atmospheric features
"**High-resolution broadband spectroscopy using externally dispersed interferometry at the Hale telescope: Part 2, photon noise theory**", D.J. Erskine, J. Edelstein, E. Wishnow, M. Sirk, P.S. Muirhead, M.W. Muterspaugh, and J.P. Lloyd, J. Astr. Tele. Instrm. Sys. 2(4), 045001 (2016), doi: 10.1117/1.JATIS.2.4.045001. TediTenxPart2gen.pdf	B7. Part 2, photon theory for multiple delay EDI spectroscopy
"**High-resolution broadband spectroscopy using externally dispersed interferometry at the Hale telescope: part 1, data analysis and results**", D.J. Erskine, J. Edelstein, E. Wishnow, M. Sirk, P.S. Muirhead, M.W. Muterspaugh, J.P. Lloyd, Y. Ishikawa, E. McDonald, W. V. Shourt, A. M. Vanderburg, **J. Astr. Tele. Instrm. Sys.**, 2(2), 025004 (2016), doi: 10.1117/1.JATIS.2.2.025004, cover article. TediTenxPart1gen.pdf	B6. Part 1, describes data analysis and results of multi-delay EDI high resolution spectroscopy at Mt. Palomar Obs. 200 inch
(Invited) "**Dispersed Interferometers"** chapter in book **"The WSPC Handbook of Astronomical Instrumentation**", David J. Erskine, **World Scientific Publishing Company**, Editors: David Burrows and Anna Moore, to be published Spring 2017. WorldSciGen.pdf	Review of three kinds of dispersed interferometer techniques
"**Dramatic robustness of a multiple delay dispersed interferometer to spectrograph errors: how mixing delays reduces or cancels wavelength drift**", David J. Erskine, E. Linder, E. Wishnow, J. Edelstein, M. Sirk, P. Muirhead, J. Lloyd, A. Kim, Proc. SPIE 9908, Edinburgh UK, June 26, 2016, Grnd-bsd. Airbrn. Instr. Astrn. VI, 99085Y, EdinburghSPIEgen.pdf,	Nifty analysis technique for dramatically reducing spectrograph wavelength drift errors. Confrnc. Proceed.
"**Canceling Spectrograph PSF Drift Error by Mixing Interferometer Delay Pairs**", poster 9908-224, 2016 Edinburgh SPIE conference. 37x37PosterErskineGen.pdf	Poster for the above nifty technique
"**Developing and deploying an externally dispersed interferometer-testbed for visual-band, high-resolution spectroscopy on 2.0-m class telescopes**", J. Maxwell, M. Muterspaugh, M. Williamson, E. Wishnow, C. Harrison, A. Whitehurst, J. Edelstein, David J. Erskine, D. Fishler, F. Hoff, S. Swihart, SPIE 9908, Edinburgh, UK, June 26 - July 1, 2016, Grnd-bsd. Airbrn. Instr. Astrn. VI, poster 9908-278. Muterspaugh_poster_2016_SPIE Edinburgh.JPG	Collaborator's poster. EDI technique applied to 2m telescope at Mt. Hopkins, TSU graduate student education
"**Giving Cosmic Redshift Drift a Whirl**", Alex G. Kim, Eric Linder, J. Edelstein, and D.J. Erskine, **Astropart. Phys.** 62, pp. 195-205 (2015). CosmicWhirlAstroPart2015.pdf	Theoretically explore measuring redshift drift using externally dispersed interferometry (EDI) and spatially heterodyning spectroscopy (SHS)
"**Precise Stellar Radial Velocities of an M Dwarf with a Michelson Interferometer and a Medium-resolution Near-infrared Spectrograph**", Philip S. Muirhead, Jerry Edelstein, David J. Erskine, J. T. Wright, M. W. Muterspaugh, K. R. Covey, E. Wishnow, K. Hamren, P. Andelson, D. Kimber, T. Mercer, S. Halverson, A. Vanderburg, D. Mondo, A. Czeszumska and J. P. Lloyd, **Publ. Astr. Soc. Pacific** 123, pp 709-724, June (2011). TEDI_PASP2011.pdf	Describes the Doppler velocimetry aspect of using EDI at Hale Telescope. See 2016 papers for spectroscopy aspect.
"**High Resolution Broadband Spectroscopy using an Externally Dispersed Interferometer**", D.J. Erskine, J. Edelstein, M. Feuerstein and B. Welsh, **ApJ.** 592, L103-L106 (2003). BoostApJ16939b.pdf	B5. First reviewed article demonstrating EDI for boosting resolution, on Lick's Hamilton spectrograph, single delay
"**An Externally Dispersed Interferometer Prototype for Sensitive Radial Velocimetry: Theory and Demonstration on Sunlight**", D.J. Erskine, **Publ. Astron. Soc. Pacific** 115, 255-269 (2003). ErskinePASP_Feb03c.pdf	B2. Introduces EDI theory for Doppler, demo on sunlight using 1998 data.
"**Novel Interferometer Spectrometer for Sensitive Stellar Radial Velocimetry**", D.J. Erskine and J. Ge, in "Imaging the Universe in Three Dimensions", Walnut Creek, CA, Mar. 29-Apr. 1, 1999, Ast. Soc. Pacific Conf. Series 195, 501-507 (2000). Erskine3D3f.pdf	B. Introduction of EDI at a conference. Preliminary benchtop data showing ~2 m/s stability comparing iodine and Br cells
US Patent 6,351,307 "**Combined dispersive/interference spectroscopy for producing a vector spectrum**", D.J. Erskine, filed Feb 23, 2000, issued Feb. 26, 2002, (IL-10168). FringingSpec13.pdf, US6351307.pdf	B4. Describes externally dispersed interferometry for Doppler, high resolution spectroscopy, and angular measurement
US Patent 5,642,194 "**White Light Velocity Interferometer**", D.J. Erskine, filed Feb 5, 1996, issued June 24, 1997, (IL-9745). WLVpat10c.pdf, US5642194.pdf	A3. Patent for A.
"**White Light Velocimetry**", D.J. Erskine and N.C. Holmes, **Nature** 377, 317-320 (1995). Nature_WLV_377_1995.pdf	A. Fringes from white light, no lasers needed
"**Holographic & Time-resolving Ability of Pulse-pair Two-dimensional Velocity Interferometry**", D.J. Erskine, R.F. Smith, C.A. Bolme, S. Ali, P.M. Celliers, and G.W. Collins, **Rev. Sci. Instr.** 85, 063115, June 26, 2014. RefocusRSI_gen.pdf	D. Treating 2d velocity interferometry data as a hologram and refocus numerically
"**Finding a Planet in the Stars**", R&D 100 Magazine, p 18, Sept., 2006. RD100_Mag_Page.pdf	B3. We won RD100 award for EDI in 2006
"**Physicist Erskine's velocimeter sees the white light**", LLNL Newsline, Sept. 29, 1995, p. 5, reporter Jon Bashor. Newsline_09-29-95_WLV.pdf	A2. Lab's newspaper describes nifty white light interferometry technique discovery