

Directed Energy and Related References Through May 2020

We have more than 450 papers published with >50 being on DE. A larger list of references is on our website and on

ResearchGate: https://www.researchgate.net/profile/Philip_Lubin

Website: www.deepspace.ucsb.edu/projects/starlight, web.deepspace.ucsb.edu/projects/starlight

<http://www.deepspace.ucsb.edu/projects/directed-energy-planetary-defense>

<http://www.deepspace.ucsb.edu/directed-energy-interstellar-precursors>

<http://www.deepspace.ucsb.edu/projects/implications-of-directed-energy-for-seti>

Directed Energy for Relativistic Flight and Interstellar Mission Related Papers:

Books:

World Scientific – Lubin, P. – “*The Path*” – 650 page book on the physics and engineering of large scale directed energy systems for space application, its overall ramifications and its transformative uses in propulsion - In press 2020

NASA-World Books (Children’s book) – P. Lubin – “*Out of this world Meets NASA Inventor Philip Lubin and his Teams Laser Sailing Starships*” - 2017

L 795.L37 2017 Bookstacks

http://www.nasa.gov/centers/hq/library/find/bibliographies/childrens_space_resources

Journal Articles:

Acta Astronautica – Sheerin, T, Petro, E, Winters, K., Lozano, P., Lubin, P. “*Fast Solar System Transportation with Electric Propulsion Powered by Directed Energy*” in press 2020

ESA – Acta Futura

Lubin, P. and Hettel, W. “*The Path to Interstellar Flight*” *Acta Futura* 12, 9-45, April 2020

www.esa.int/gsp/ACT/acta_futura/issue12

Advances in Space Research

She, S., Hettel, W. and Lubin, P. “*Directed Energy Interception of Satellites*”, *Advances in Space Research* 63, 3795, 2019

Astrophysical Journal (Ap J):

Lubin, P., Messerschmidt, D. and Morrison, I. “*Interstellar Mission Communications – Low Background Regime*”, submitted Jan 2018, <http://arxiv.org/abs/1801.07778>

Kulkarni, N., Lubin, P., Zhang, Q. “*Relativistic Spacecraft Propelled by Directed Energy*”, Vol 55, 4, March 2018, <http://arxiv.org/abs/1710.10732>

Journal of the British Interplanetary Society (JBIS):

Lubin, P. “*The Roadmap to Interstellar Flight*”, *Journal of the British Interplanetary Society* – JBIS, vol. 69, pp.40-72, 20 (2016). <http://arxiv.org/abs/1604.01356>

Journal of the British Interplanetary Society (JBIS) – from ICARUS 2013:

Lubin, P., Hughes, G.B., Bible, J. and Johansson, I. “Directed Energy for Planetary Defense and Exploration: Applications to Relativistic Propulsion and Interstellar Communications,” *Journal of the British Interplanetary Society* – JBIS, vol. 68, no. 5/6, pp. 172-182 (May/June 2015).

Astronomical Journal (AJ)

Zhang, Q., P. M. Lubin and, Hughes, G.B.. “Orbital Deflection of Comets by Directed Energy,” *Astronomical Journal* , Vol. 157, No. 201 (April 2019). <http://arxiv.org/abs/1904.12850>

Publications of the Astronomical Society of the Pacific (PASP):

Zhang, Q., Walsh, K.J., Melis, C., Hughes, G.B. and Lubin, P.M. “Orbital Simulations on Deflecting Near Earth Objects by Directed Energy,” *Publications of the Astronomical Society of the Pacific*, Vol. 128, No. 962, pp. 045001 (April 2016).

Reviews in Human Space Exploration (REACH)

Lubin, P. “The Search for Directed Intelligence”, *Reviews in Human Space Exploration (REACH)*, vol. 1, pp. 20-45 (March 2016). <http://arxiv.org/abs/1604.02108>

Journal of the British Interplanetary Society (JBIS):

Lubin, P. “The Roadmap to Interstellar Flight” - *Journal of the British Interplanetary Society* – JBIS, Vol. 69, pp.40-72, 20 (2016). <http://arxiv.org/abs/1604.01356>

Advances in Space Research (ASR):

Lubin, P., Hughes, G.B., Eskenazi, M., Kosmo, K., Johansson, I., Griswold, J., Pryor, M., O’Neill, H., Meinhold, P., Suen, J., Riley, J., Zhang, Q., Walsh, K.J., Melis, C., Kangas, M., Motta, C. and Brashears, T. “Directed Energy Missions for Planetary Defense,” *Advances in Space Research*, 58(6), pp. 1093–1116 (2016).

Journal of the British Interplanetary Society (JBIS):

Lubin, P., Hughes, G.B., Bible, J. and Johansson, I. “Directed Energy for Planetary Defense and Exploration: Applications to Relativistic Propulsion and Interstellar Communications,” *Journal of the British Interplanetary Society*, vol. 68, no. 5/6, pp. 172-182 (May/June 2015).

Handbook of Cosmic Hazards and Planetary Defense:

Lubin, P. and Hughes, G.B. “Directed Energy for Planetary Defense.” Chapter in: Allahdadi, Firooz, and Pelton, Joseph N. (Eds.), *Handbook of Cosmic Hazards and Planetary Defense*, Springer Reference, 1127 p., ISBN 978-3-319-03951-0 (2015).

Optical Engineering (OE):

Lubin, P., Hughes, G.B., Bible, J., Bublitz, J., Arriola, J., Motta, C., Suen, J., Johansson, I., Riley, J., Sarvian, N., Clayton-Warwick, D., Wu, J., Milich, A., Oleson, M., Pryor, M., Krogen, P., Kangas, M., and O’Neill, H. “Toward directed energy planetary defense,” *Optical Engineering*, Vol. 53, No. 2, pp 025103-1 to 025103-18 (Feb. 2014), doi: 10.1117/1.OE.53.2.025103.

Conference Proceedings

International Electric Propulsion Conference IEPC-2019 – Vienna September 2019

Brophy et al “Directed-Energy Propulsion Architecture for Deep-Space Missions with Characteristic Velocities of Order 100 km/s”

SPIE Proceedings – Nanophotonics - August 2019

Cohen et al, “Standoff Molecular Composition of Asteroids and Other Targets – Current Status”

Ehlikman et al “Optical Systems for Large Aperture Laser Phased Array Including Diffractive Optics”

Srinivasan et al “Directed Energy Phased Array for Space Exploration: Phase Noise Tests Using Polarization Diversity Topology”

Srinivasan et al “Directed Energy Phased Array for Space Exploration: 1064 nm Amplifier Design and Characterization”

SPIE Proceedings – Astronomical Optics – August 2018

Sucich, A., Snyder, T., Bittencourt, R., Cirilo, E.H., Madajian, J., Wang, Y., Miller, B., Srinivasan, P., Lubin, P.M., and Hughes, G.B., "Experimental design for remote laser evaporative molecular absorption spectroscopy sensor system concept," *CubeSats and NanoSats for Remote Sensing II*, edited by Thomas S. Pagano and Charles D. Norton, Proc. of SPIE Vol. 10769, pp. 1076924 (2018).

Madajian, J., Hughes, G.B., Miller, B., Wang, Y., Brouwer, D., Cohen, A., Su, J., Srinivasan, P., Brashears, T., Rupert, N., and Lubin, P. "Remote laser evaporative molecular absorption (R-LEMA) spectroscopy laboratory experiments," *CubeSats and NanoSats for Remote Sensing II*, edited by Thomas S. Pagano and Charles D. Norton, Proc. of SPIE Vol. 10769, pp. 1076928 (2018).

Srinivasan, P., Krogen, P., Menihold, P., Hettel, W., Lubin, P.M., Blasey, N., and Hughes, G.B. "Beamed-energy propulsion: optical phase noise in fiber links and 1064 nm fiber amplifiers," *Optical Modeling and Performance Predictions X*, edited by Mark A. Kahan and Marie B. Levine-West, Proc. of SPIE Vol. 10743, pp. 10743-13 (2018).

SPIE Proceedings – Astronomical Optics – August 2017

Stewart, A. and Lubin, P. “TPS - The Trillion Planet Survey: An Optical Search for Directed Intelligence in M31,” *Astronomical Optics: Design, Manufacture and Test of Space and Ground Systems*, edited by Tony B. Hull, DaeWook Kim, Pascal Hallibert, Gary B. Hughes, Ronald G. Pirich, Proc. of SPIE Vol. 10401, pp. 104010C (Aug, 2017).

Zhang, Q., Lubin, P., and Hughes, G.B., “Long-period comet impact risk mitigation with Earth-based laser arrays,” *Astronomical Optics: Design, Manufacture and Test of Space and Ground Systems*, edited by Tony B. Hull, DaeWook Kim, Pascal Hallibert, Gary B. Hughes, Ronald G. Pirich, Proc. of SPIE Vol. 10401, pp. 1040104 (Aug, 2017).

Sucich, A., Snyder, T., Hughes, G.B., Srinivasan, P., Lubin, P., Zhang, Q., Cohen, A., Madajian, J., Brashears, T., and Rupert, N. “Near field optical model for directed energy propelled spacecraft,” *Astronomical Optics: Design, Manufacture and Test of Space and Ground Systems*, edited by Tony B. Hull, DaeWook Kim, Pascal Hallibert, Gary B. Hughes, Ronald G. Pirich, Proc. of SPIE Vol. 10401, pp. 1040101 (Aug, 2017).

IEEE Aerospace Conference – March 2017

Hughes, G.B., Lubin, P., Cohen, A.N., Madajian, J., Kulkarni, N., Zhang, Q., Griswold, J., and Brashears, T. Directed Energy Stand-Off Molecular Composition Analysis, *Aerospace Conference 2017 IEEE Proceedings*, pp. 1-9, 4-10 March 2017, ISBN:978-1-5090-1613-6.

SPIE Proceedings – Planetary Defense and Space Environment Applications – August 2016

Macasaet, V.P., Hughes, G.B., Lubin, P., Madajian, J., Zhang, Q., Griswold, J., Kulkarni, N., Cohen, A., and Brashears, T. “Target tracking and pointing for arrays of phase-locked lasers,” *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998101 (Aug, 2016).

Brashears, T., Lubin, P., Hughes, G.B., Meinhold, P., Batliner, P., Motta, C., Madajian, J., Mercer, W., and Knowles, P. “Directed energy reflection laboratory measurements of common space based targets,” *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998102 (Aug, 2016).

Brashears, T., Lubin, P., Rupert, N., Stanton, E., Mehta, A., Knowles, P., and Hughes, G.B. “Building the future of wafersat spacecraft for relativistic spacecraft,” *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998103 (Aug, 2016).

- Srinivasan, P., Hughes, G.B., Lubin, P., Zhang, Q., Madajian, J., Brashears, T., Kulkarni, N., Cohen, A., and Griswold, J. "Stability of laser-propelled wafer satellites," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998104 (Aug, 2016).
- Kulkarni, N., Lubin, P.M., and Zhang, Q. "Relativistic solutions to directed energy," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998105 (Aug, 2016).
- Gandra, A., Jadajian, J., Griswold, J., Hughes, G.B., and Lubin, P. "Comet deflection by directed energy: a finite element analysis," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998106 (Aug, 2016).
- Zhang, Q., Lubin, P.M., and Hughes, G.B. "Simulations of directed energy comet deflection," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998107 (Aug, 2016).
- Madajian, J., Cohen, A., Hwang, R., Bishman, C., Reyes, R., Xu, X., Tsukamoto, R., Rommelfanger, N., Bautista, M., Ho, I., Lin, L., Po, B., Vanmali, D., Ruehl, P., Brashears, T., Rupert, N., and Lubin, P. "LAST: laser array space telescope," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998110 (Aug, 2016).
- Lubin, P. "Implications of directed energy for SETI," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998116 (Aug, 2016).
- Hughes, G.B., Lubin, P., Cohen, A., Madajian, J., Kulkarni, N., Zhang, Q., Griswold, J., and Brashears, T. "Remote laser evaporative molecular absorption spectroscopy," *Planetary Defense and Space Environment Applications*, edited by Gary B. Hughes, Proc. Of SPIE Vol. 9981, pp. 998119 (Aug, 2016).

13th Hypervelocity Impact Symposium –April 2016

- Zhang, Q., Walsh, K.J., Melis, C., Hughes, G.B. and Lubin, P., "Orbital Simulations for Directed Energy Deflection of Near-Earth Asteroids", in: Schonberg, W.P., Ed., Proceedings of the 2015 Hypervelocity Impact Symposium (HVIS 2015), *Procedia Engineering*, Vol. 103:671-678 (2015)

SPIE Proceedings – Photonic Instrumentation – February 2016

- Hughes, G.B., Macasaet, V.P., Griswold, J., Sison, C.A., Lubin, P., Meinhold, P., Suen, J., Brashears, T., Zhang, Q. and Madajian, J. "A fast, high-precision six-degree-of-freedom relative position sensor," *Photonic Instrumentation Engineering III*, edited by Yakov G. Soskind and Craig Olson, Proc. Of SPIE Vol. 9754, pp. 975403-975403 (Feb, 2016).

IEEE Aerospace Conference –March2015

- Kosmo, K., Lubin, P., Hughes, G.B., Griswold, J., Zhang, Q. and Brashears, T. "Directed Energy Planetary Defense," *Aerospace Conference 2015 IEEE Proceedings*, 7-14 March 2015, ISBN: 978-1-4799-5379-0.

SPIE Proceedings - Nanophotonics and Space Environments – August 2015

- Griswold, J., Madajian, J., Johansson, I., Pfau, K., Lubin, P., Hughes, G.B., Gilkes, A., Meinhold, P., Motta, C., Brashears, T., and Zhang, Q. "Simulations of directed energy thrust on rotating asteroids," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).
- Zhang, Q., Walsh, K.J., Melis, C., Hughes, G.B., and Lubin, P. "Orbital simulations on the deflection of Near Earth Objects by directed energy," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).
- Brashears, T., Lubin, P., Hughes, G.B., McDonough, K., Arias, S., Lang, A., Motta, C., Meinhold, P., Batliner, P., Griswold, J., Zhang, Q., Alnawakhtha, Y., Prater, K., Madajian, J., Sturman, O., Gergieva, J., Gilkes, A., and Silverstein, B. "Directed Energy Interstellar Propulsion of WaferSats," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).

- Brashears, T., Lubin, P., Hughes, G.B., Meinhold, P., Suen, J., Batliner, P., Motta, C., Griswold, J., Kangas, M., Johansson, I., Alnawakhtha, Y., Prater, K., Lang, A., and Madajian, J. "Directed Energy Deflection Laboratory Measurements," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).
- Zhang, Q., Walsh, K.J., Melis, C., Hughes, G.B., and Lubin, P. "Orbital simulations of laser-propelled spacecraft," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).
- Hughes, G.B., Lubin, P., Meinhold, P., O'Neill, H., Brashears, T., Zhang, Q., Griswold, J., Riley, J., and Motta, C. "Stand-off molecular composition analysis," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).
- Steffanic, P., Johannes, B.T., Sison, C.A., Hughes, G.B., Lubin, P., Meinhold, P., Suen, J., O'Neill, H., Kangas, M., Brashears, T., Zhang, Q., Griswold, J., Riley, J., and Motta, C. "Local phase control for a planar array of fiber laser amplifiers," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).
- Brashears, T., Lubin, P., Turyshev, S., Shao, M., and Zhang, Q. "Solar Lens Mission Concept for Interstellar Exploration," *Nanophotonics and Macrophotonics for Space Environments IX*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9616 (Aug, 2015).

SPIE Proceedings - Nanophotonics and Space Environments – August 2014

- Johansson, I., Tsareva, T., Griswold, J., Lubin, P., Hughes, G.B., O'Neill, H., Meinhold, P., Suen, J., Zhang, Q., Riley, J., Melis, C., Walsh, K.J., Brashears, T., Bollag, J., Mathew, S. and Bible, J. "Effects of asteroid rotation on directed energy deflection," *Nanophotonics and Macrophotonics for Space Environments VIII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9226, pp. 922607 (Aug, 2014).
- Hughes, G.B., Lubin, P., Griswold, J., Bozinni, D., O'Neill, H., Meinhold, P., Suen, J., Bible, J., Riley, J., Johansson, I., Pryor, M. and Kangas, M. "Optical modeling for a laser phased-array directed energy system," *Nanophotonics and Macrophotonics for Space Environments VIII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9226, pp. 922603 (Aug, 2014).
- Riley, J., Lubin, P., Hughes, G.B., O'Neill, H., Meinhold, P., Suen, J., Bible, J., Johansson, I., Griswold, J. and Cook, B. "Directed energy active illumination for near-Earth object detection," *Nanophotonics and Macrophotonics for Space Environments VIII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9226, pp. 922606 (Aug, 2014).
- Kosmo, K., Pryor, M., Lubin, P., Hughes, G.B., O'Neill, H., Meinhold, P., Suen, J., Riley, J., Griswold, J., Cook, B.V., Johansson, I., Zhang, Q., Walsh, K.J., Melis, C., Kangas, M., Bible, J., Motta, C., Brashears, T., Mathew, S. and Bollag, J. "DE-STARLITE - a practical planetary defense mission," *Nanophotonics and Macrophotonics for Space Environments VIII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 9226, pp. 922604 (Aug, 2014).

STARDUST Global Virtual Conference – May 2014

- Hughes, G.B., Lubin, P., O'Neill, H., Meinhold, P., Suen, J., Riley, J., Johansson, I., Bible, J., Bublitz, J., Arriola, J., Motta, C., Griswold, J., Cook, B., Sarvian, N., Clayton-Warwick, D., Wu, J., Milich, A., Oleson, M., Kangas, M., Pryor, M. and Krogen, P. "DE-STAR: phased-array laser technology for planetary defense and exploration," *STARDUST 1st Stardust Global Virtual Workshop (SGVW-1) on Asteroids and Space Debris*, Conference Proceedings edited by Massimiliano Vasile (May, 2014).

SPIE Proceedings - Nanophotonics and Space Environments – August 2013

- Lubin, P., Hughes, G.B., Bible, J., Bublitz, J., Arriola, J., Motta, C., Suen, J., Johansson, I., Riley, J., Sarvian, N., Clayton-Warwick, D., Wu, J., Milich, A., Oleson, M., Pryor, M., Krogen, P. and Kangas, M. "Directed energy planetary defense," *Nanophotonics and Macrophotonics for Space Environments VII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 8876, pp. 887602 (Aug, 2013).
- Hughes, G.B., Lubin, P., Bible, J., Bublitz, J., Arriola, J., Motta, C., Suen, J., Johansson, I., Riley, J., Sarvian, N., Wu, J., Milich, A., Oleson, M., and Pryor, M. "DE-STAR: phased-array laser technology for planetary

defense and other scientific purposes,” *Nanophotonics and Macrophotonics for Space Environments VII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 8876, pp. 88760J (Aug, 2013).

Bible, J., Bublitz, J., Johansson, I., Hughes, G.B., and Lubin, P. “Relativistic Propulsion Using Directed Energy,” *Nanophotonics and Macrophotonics for Space Environments VII*, edited by Edward W. Taylor, David A. Cardimona, Proc. of SPIE Vol. 8876, pp. 887605 (2013).

In Review:

Riley, J., Lubin, P., Hughes, G.B., O’Neill, H., Meinhold, P., Suen, J., Bible, J., Johansson, I., Griswold, J. and Cook, B. “Directed energy active illumination for near-Earth object detection,” In Review, *Optical Engineering*.