Bipin Bihari, Ph.D.

EXPERIENCE & ACCOMPLISHMENTS

04/04-Present Energy Systems Division, Argonne National Laboratory, Argonne, IL

- Designing the fiber optic laser delivery for laser based ignition application in large bore multi-cylinder reciprocation natural gas engine.
- Developing optical diagnostics techniques for natural gas engines.
- Laser induced breakdown spectroscopy (LIBS) as diagnostic tools in engines.

07/97-10/2003 Sr. Scientist/ SBIR Program manager, Omega Optics, Inc./Radiant Photonics, Austin, TX/ Microelectronics Research Center, UT-Austin, TX

- Managed a group of Ph.D. level scientists and engineers at Radiant Photonics, Inc. I was responsible to oversee the smooth functioning of sponsored projects.
- Conducted, managed, and directed SBIR programs including project management, proposals & report preparation. Served as a principal investigator/project manager for several SBIR programs that involved managing these programs from initiation (i.e., responding to RFPs) to successful closing along with final deliverables and reporting. The titles and sponsoring agencies for some of these projects are listed below.
  - Polymer-based Packaging-Compatible Board-Level Optical Bus (Principal Investigator, Phase I&II, funded by Missile Defense Agency (MDA))
  - Multiplexed Photo-polymeric Holograms for Guided-wave Optical Back-plane aimed at High Performance Computer Applications (Principal Investigator, Phase II funded by MDA)
  - Multi-Wavelength Guided-wave Optoelectronic Interconnects For High-throughput Optical Memories, (Principal Investigator, Phase I & II, funded by Air force research labs. (AFRL))
  - Ultra Low-loss Optoelectronic Packaging Using Transparent Optical Polymer (TOP)-Based Channel Waveguides, (Investigator, Phase II funded by BMDO).
  - Active multi-functional polymeric material with modulation, switching and amplification capabilities, (Technical coordinator/Investigator, Phase II funded by BMDO)
  - Planarized Optical Clock Signal Distribution on Si-Based VLSI Circuits for High Performance Computing and Signal Processing, (Technical Manager/Investigator, Phase II funded by BMDO).
  - Throughput-Enhanced Multi-Wavelength Guided-wave Optoelectronic Interconnects For High-Density Holographic Memory, (Co-Principal Investigator, Phase I funded by AFRL)
- Designed and developed devices for optical, electro-optical, fiber-optic and optoelectronic applications. The tasks included clean room processing such as photolithography, wet etching, reactive-ion/dry etching, spin coating and e-beam deposition, and test and measurement lab experiments involving precision optical alignments, variety of CW and

pulsed lasers and high speed instrumentation. Fabricated waveguide gratings on polymer thin films that involved holographic recording and clean room processing.

- Demonstrated bi-directional data-communications using the 32-channel free-space WDM devices, laser transceivers, and optical fibers. Developed a 4-plus method, successfully, to show the performance over entire channel span just using 4-laser transmitters to reduce the project cost, while fully satisfying the sponsors.
- The important works include, a waveguide based optical clock distribution scheme, demonstration of gain in planar waveguide using polymer-rare-earth composite, tapered waveguide for interconnecting two mode mismatched optical devices, waveguide gratings based optical coupler, board level optical interconnects, etc.

10/95 – 06/97 Virginia Polytechnic Institute and State University, Blacksburg, VA

- Studied nano-phase materials for phosphor applications. Synthesized nano-crystalline Y_2O_3, Eu^{3+}:Y_2O_3, and Eu_2O_3 by gas phase condensation technique using CO2 laser heating of bulk material under controlled environments.
- Performed physical characterization including crystalline phases, sizes and shapes of nano-materials produced under different synthesis parameters using X-ray diffraction (XRD), and transmission-electron microscopy (TEM).
- Studied spectral behavior of nano-crystals laser fluorescence, time resolved, and excitation spectroscopic methods. Wrote sub-routines in **LabView** environment to acquire experimental data. Used curve fitting routines, and spreadsheets to analyze obtained results.

05/94 – 09/95 Illinois Inst. of Tech. Chicago, IL & Chem. Div., Argonne National Lab., Argonne, IL

- Put together a state of the art Laser Assisted Experimentation (LAE) laboratory from scratch to performed second and third order nonlinear optical experiments on organic and polymeric materials.
- Materials for the high power laser threat protection to personnel and equipment.
- Also carried out computer interfacing & laboratory automation using LabView & HP-VEE software.

05/92 – 04/94 Department of Physics, University of Massachusetts-Lowell, Lowell, MA

- Performed experiments, analyzed results and studied barium titanate thin-films and liquid crystals for optical frequency doubling, novel asymmetric polydiacetylenes for second and third order nonlinear optics.
- Developed fiber-optic biosensors.

09/88 – 04/92 Center for Laser Technology, Indian Institute of Technology, Kanpur, INDIA

- Established a high-resolution laser spectroscopy and nonlinear optics laboratory.
- Successfully built a vertical-cavity argon-ion pumped dye-laser.
- Carried out computer interfacing and automation of experimental set-ups.
- Designed and performed nonlinear optics experiments.

- Performed optical diagnostics of biological samples.
- Supervised graduate and undergraduate students.

07/81 – 08/88 Department of Physics, Indian Institute of technology, Kanpur, INDIA

- As doctoral student performed spectroscopic studies of rare earth doped single crystals that included Optical absorption, Laser induced fluorescence and excitation spectroscopy. To analyze the experimental results, performed extensive computer programming and theoretical simulation.
- Taught several college level lab courses in physics.

Computers and Networking Skills:

Have successfully completed a networking course provided by "Global Knowledge".

Programming languages: Basic, Fortran, C++

Data-acquisition and analysis using: LabView, LabView for windows, and HPVEE

Spreadsheets and mathematical software: Microsoft Excel, Origin, and MathCAD

Optical simulation software: ZEMAX, OSLO and BeamProp

Other software: MSWORD, MS-PROJECT,

Instrumentation and Laboratory skills

- Laser systems: CW and pulsed lasers, Ar-ion, Nd:YAG, Ti-sapphire laser, Ring dye lasers, femto and pico-second pulsed lasers, regenerative amplifiers etc.
- Optical systems: monochromators, Febry-Perot interferometers, wave meters, ellipsometers, prism couplers, UV-Vis, FTIR and FT Raman spectrometers and variety of fast photo sensors.
- Signal acquisition and processing systems: optical multi-channel analyzer, lock-in-amplifiers, photon counters, boxcar averagers, digital and analog oscilloscopes and personal computers.
- Other Instruments: X-ray diffraction (XRD), and transmission and scanning electron microscope (TEM, SEM).
- Hands on cleanroom experience including photolithography, wet etching, reactive ion etching technique, electron beam evaporation, thermal sputtering, spin coating.
- Designed and fabricated waveguide gratings and mirror coupler to couple-in and -out the light radiation in and out of a waveguide device.
- Developed a compression-molding technique for polymeric waveguide device fabrication.
- Fabricated a prototype Ar-ion laser pumped dye laser using folded cavity configuration.
- A high voltage controller for base line correction in optical absorption experiments.
- Contrived a facility at Indian Institute of Technology, Kanpur, India, for ultra-high resolution spectroscopy and nonlinear optics experiments on rare-earth crystals, dye doped glasses, and gases.

- Planned and constructed a state of the art Laser Assisted Experimentation (LAE) facility at Dept. of Chemistry, Illinois Institute of Technology, Chicago for nonlinear optical experiments on organic and polymeric materials.

PUBLICATIONS

Authored and co-authored more than 58 articles in Journals and Proceedings (list available on request)

AFFILIATIONS with PROFESSIONAL SOCIATIES

- Materials Research Society
- American Chemical Society
- SPIE- The International Society of Optical Engineers
- IMAPS- International Microelectronics and Packaging Society

AWARDS

- National Merit Scholarship, 1974-78, Government of India

WORKSHOPS and CONFERENCES

- Sessions Chair at Optoelectronics ’99, & 2000 Photonics West (SPIE-conferences)
- Invited paper at International Symposium on Image Processing Molecular Systems (IPMS ’98), Japan High Polymer Center, Tsukuba, JAPAN, MAR. 9-10, 1998.
- Participated in more than 16 conferences and symposiums as a speaker and delegate.

EDUCATION

- Ph. D. (Physics/Laser spectroscopy), Indian Institute of Technology Kanpur, INDIA, 1989

Thesis title: Spectroscopic study of Europium doped $LiYF_4$ single crystal.

- M. Sc. (Physics, solid state electronics), Kanpur University, Kanpur, INDIA, 1980

LIST OF ARTICLES PUBLISHED IN INTERNATIONAL JOURNALS AND PROCEEDINGS:

Published in refereed international journals:

1. Wavelength division multiplexers/demultiplexers for optical interconnects in massively parallel processing, Feng Zhao, Yun Zhang, Jizuo Zou, Zhong Shi, **Bipin Bihari,** Xuegong Deng, Jie Qiao, Zan Shi, Ray T. Chen, *Optical Engineering 42(01), 273-280 (Jan 2003).*
2. Interconnection with Optics, Ray T. Chen and **Bipin Bihari**, *Invited book Chapter in "Introduction to Information Optics" edited by Francis T. S. Yu, S. Jutamulia and S. Yin, Academic Press 2001*
3. Optoelectronic integration of polymer waveguide array and MSM photodetector through micro-mirror couplers, Yujie Liu, Lei Lin, Chulchae Choi, **Bipin Bihari**, Ray T. Chen, *Photonics Technology letters, 13(4) 355-357 (2001)*
4. Demonstration of optical gain at 1.06 m in a Neodymium-doped polyimide waveguide, Gauri Karve, **Bipin Bihari**, Ray T. Chen, *Applied Physics letters (Aug. 28, 2000 issue)*
5. Fully Embedded Board Level Guided Wave Optoelectronic Interconnects R. T. Chen, L. Lin, C. Choi, Y. J. Liu, **B. Bihari,** L. Wu, S. Tang, R. Wickman, B. Picor, M. Hibbs-Brenner, J. Bristow, and Y. S. Liu, *Special issue of the PROCEEDINGS on Optical Interconnections for Digital Systems,.(PROCEEDINGS OF THE IEEE 88 (6): 780-793 JUN 2000)*
6. A fast algorithm for chirp transform with zooming-in ability and its applications, Xuegong Deng, **Bipin Bihari**, Jianhua Gan, Feng Zhao and Ray T. Chen, *The Journal of Optical Society of America A **17(**4) 762-771 (2000).*
7. Si CMOS Process Compatible Guided-wave Optical Interconnects for Supercomputer Boards**, Bipin Bihari**, Linghui Wu, Yujie Liu, Lei Lin and Ray T. Chen, *Accepted for publication in Recent research developments in optical engineering, ed. S.G. Pandalai*
8. Two-dimensional 45-degree surface-normal micro-coupler array for guided-wave optical clock distribution, Jianhua Gan, Linghui Wu, Hongfa Luan, **Bipin Bihari** and Ray T. Chen, *IEEE Photonics Technology Letters, **11(11)** 1452-1454 (1999).*
9. Preparation and fluorescence spectroscopy of bulk monoclinic Eu^{3+}:Y_2O_3 and comparison to Eu3+:Y2O3 nanocrystals, D. K. Williams, **B. Bihari**, and B. M. Tissue, *J. Phys. Chem. **B 102** 916-920 (1998).*
10. Lanthanide Luminescence as a probe of nanocrystalline Materials, Brian M. Tissue and **Bipin Bihari,** *Journal of Fluorescence **8**(4) 289-294 (1998).*
11. Compression-molded three dimensional tapered polymeric waveguides for low-loss optoelectronic packaging, Linghui Wu, Feiming Li, Suning Tang, **Bipin Bihari** and Ray T. Chen, *IEEE Photonics Technology Letters, **9(12)** 1601-1603 (1997).*
12. Spectral hole burning in nanocrystalline Eu_2O_3 and Y_2O_3:Eu^{3+}, K. S. Hong, R. S. Meltzer, **B. Bihari**, D. K. Williams, and B. M. Tissue, *Journal of Luminescence, **76/77** 223-227 (1998).*
13. Spectra and dynamics of monoclinic Eu_2O_3 and Eu^{3+}:Y_2O_3 nanocrystals, **Bipin Bihari**, H. Eilers and Brian M. Tissue, *Journal of Luminescence**, 75**(1) 1-10 (1997).*
14. Nonlinear optical properties of a new porphyrin-containing polymer, Arun K. Sinha, **Bipin Bihari**, Braja K. Mandal and Lin Chen, *Macromolecules, **28**(16) 5681-5683 (1995).*

15. Self-assembled asymmetrically substituted polydiacetylene as a novel second order NLO material, S. K. Tripathy, W. H. Kim, **B. Bihari**, R. Moody, and J. Kumar, *Synthetic Metals **71**(1-3) 1675-78 (1995).*

16. Large and stable second harmonic generation in a crystalline ferroelectric liquid crystal, S. Sprunt, J. Naciri, B. R. Ratna, R. Shashidhar, **B. Bihari**, J. Kumar and S. K. Tripathy, *Applied Physics Letters **66**(12) 1443-45 (1995).*

17. Third order nonlinear optical response in a multi-layered Phthalocyanine composite, B. K. Mandal, **Bipin Bihari**, A. K. Sinha, M. Kamath, and L. Chen, *Applied Physics Letters **66**(8) 932-4 (1995).*

18. Self-assembled spin coated and bulk films of a novel polydiacetylene as second order NLO polymers, W. H. Kim, **B. Bihari**, R. Moody, N. B. Kodali, J. Kumar and S. K. Tripathy, *Macromolecules, **28**(2) 642-47 (1995).*

19. Investigation of barium titanate thin films on MgO substrates by second harmonic generation, **Bipin Bihari**, J. Kumar, G. T. Stauf, P. C. Van Buskirk and C. S. Hwang, *Journal of Applied Physics, **76**(2) 1169-74 (1994).*

20. Measurements of temporal coherence of light with copolarized and cross-polarized beams using laser induced gratings, K. Divakara Rao, Rajan Gurjar, **Bipin Bihari**, G. Ravindra Kumar and K. K. Sharma, *Applied Physics Letters **60**(25) 3108 (1992).*

21. Spectroscopy of $LiYF_4:Eu^{3+}$ single crystal, **Bipin Bihari**, K. K. Sharma, and L. E. Erickson, *Journal of Physics: Condens. Mater **2** 5703 (1990).*

Publications & presentation in international conference proceedings

1. Advanced Laser Ignition System Development Consortium, **Bipin Bihari**, Sreenath Gupta, and Raj Sekar (**Submitted to** *2nd Annual Advanced Stationary Reciprocating Engines Conference, March 15 – 16, 2005, Diamond Bar, CA)*

2. Ignition Characteristics of Methane-air Mixtures at Elevated Temperatures and Pressures, Gregory M. Klett, Sreenath Gupta, **Bipin Bihari**, and Raj Sekar, (**submitted to** *Proceedings of ASME ICE 2005, Spring Technical Conference, April 5-7 2005, Chicago IL)*

3. Ignition Characteristics of Methane-air Mixtures at Elevated Temperatures and Pressures**,** Sreenath Gupta, Gregory M. Klett, Keng Leong, **Bipin Bihari,** and Raj R. Sekar *(A poster presentation at Natural Gas Technologies conference, Jan 30 – Feb 2, 2005, Orlando, Florida)*

4. Performance Analysis of a Natural Gas Generator using Laser Ignition*,* Munidhar S. Biruduganti, Sreenath B. Gupta, **Bipin Bihari**, Gregory Klett, and Raj Sekar, *(Proceedings of ASME ICE 2004:Fall Technical Conference, Oct 24–27 2004, Long Beach CA)*

5. Wavelength division multiplexers/demultiplexers for high-throughput optical links, Feng Zhao, Yun Zhang, Jizuo Zou, Wei Jiang, Zhong Shi, Xuegong Deng, Jie Qiao, Gary C. Marsden, **Bipin Bihari**, Ray T. Chen, *WDM and Photonic Switching Devices for Network Applications III. (SPIE Proceedings, Vol. 4653, pp. 172-181, Jun 2002)*

6. Integrated High Speed GaAs MSM photodetector and polyimide channel waveguide array for board level data communications, Lei Lin, Chulchae Choi, Yujie Liu, Gauri Karve, **Bipin Bihari,** and Ray Chen, *Optoelectronic Interconnects VIII (SPIE Proceedings, Vol.4292, pp.10-16, 2001).* Integrated

7. Polymer-based board-level optoelectronic interconnects via micromirror coupler, Yujie Liu, Lei Lin, Chulchae Choi, **Bipin Bihari,** and Ray Chen, *Optoelectronic Interconnects VIII (SPIE Proceedings, Vol.4292, pp.141-149, 2001).*

8. Rare-earth-doped polymer optical amplifiers, Gauri V. Karve, **Bipin Bihari,** and Ray T. Chen, *Optoelectronic Integrated Circuits IV (SPIE Proceedings, 2000, Vol.3950).*

9. High Speed Si MSM Photo-detector and VCSEL for Optoelectronic Interconnects, Lei Lin, Chulchae Choi, Yujie Liu, Gauri Karve, **Bipin Bihari,** and Ray Chen, *Optoelectronic Interconnects VII; Photonic Packaging and Integration II, (SPIE Proceedings, Vol.3952, pp.312-317, 2000).*

10. Guided-wave Si CMOS process-compatible optical interconnects, Chen, Ray T.; Wu, Linghui; Lin, Lei; Choi, Chulchae; Liu, Yujie; **Bihari, Bipin**; Tang, Suning; Wickman, Randy W.; Pecor, Bruce R.; Liu, Y. S., *CAS Proceedings of the 1999 International Semiconductor Conference (CAS'99), Vol. 2, pp. 467-471 (1999).*

11. Multifunctional photonic devices based on polymeric materials, Gauri V. Karve, **Bipin Bihari,** Dechang An, Suning Tang and Ray T. Chen, *Organic photorefractives, photoreceptors, waveguides, and Fibers (SPIE Proceedings, 1999, Vol.3799, pp. 230-240).*

12. High-throughput optoelectronic interconnects for holographic memory devices, **Bipin Bihari,** Jinghuai Fa, Xuegong Deng, Brian M. Davies, Suning Tang and Ray T. Chen, *Optoelectronic Interconnects VI (SPIE Proceedings, 1999, Vol.3632, pp.297-308).*

13. Optical Clock Distribution in Supercomputers using Polyimide-based waveguides, **Bipin Bihari**, Linghui Wu, Jianhua Gan, Yujie Liu, Suning Tang and Ray T. Chen, *Optoelectronic Interconnects VI (SPIE Proceedings, 1999, Vol.3632, pp.123-133).*

14. Si CMOS process-compatible guided-wave optical interconnects, Chen, Ray T.; Wu, Linghui; Lin, Lei; Choi, Chulchae; Liu, Yujie; **Bihari, Bipin**; Tang, Suning; Wickman, Randy W.; Pecor, Bruce R.; Liu, Y. S. *Optoelectronic Interconnects VI (SPIE Proceedings, 1999, Vol.3632, pp.22-27).*

15. Integration of 45-degree micro-couplers in guided-wave optical clock signal distribution system for supercomputers, Jianhua Gan, Linghui Wu, **Bipin Bihari**, Hongfa Luan and Ray T. Chen, *SPIE Proceedings, Vol. 3582, pp.359-363, 1998.*

16. Board level optical clock signal distribution using Si C-MOS compatible polyimide-based 1-to-48 fanout H-tree, Linghui Wu, **Bipin Bihari**, Jianhua Gan, Ray T. Chen and Suning Tang, *in Integrated Optoelectronics (SPIE proceedings, 1998, Vol. 3551, p.130-136).*

17. Si CMOS process compatible polyimide-based guided-wave multi-Gbit/sec optical clock signal distribution system for supercomputer, Ray T. Chen, L. Wu, **B. Bihari**, Suning Tang, R. Wickman, B. Picor and Y. S. Liu, *In Proceedings of "International symposium on image processing molecular systems IPMS" March 9-10, 1998 AIST-Tsukuba Research Center, Tsukuba, Japan.*

18. Polyimide-based guided-wave multigigabit per second optical clock signal distribution system for cray T-90 super computer, H. Luan, L. Wu, **B. Bihari,** J. Gan and Ray T. Chen, *in Photopolymer Device Physics, Chemistry, and Applications, IV (SPIE proceedings, 1998, Vol. 3417, p.96-100).*

19. Fabrication and characterization of a 1-to-48 fanout H-tree structure for clock signal distribution, Linghui Wu, **Bipin Bihari**, Jianhua Gan, Ray T. Chen, Suning Tang and Randy Wickman, *in Integrated Photonics Research (Technical digest series Vol. IV, 1998, Published by OSA, p. 282-285).*

20. Efficient surface-normal waveguide grating couplers for optoelectronic interconnect, Jianhua Gan, **Bipin Bihari,** Linghui Wu, Feiming Li, Michael Dubinovsky, Ray T. Chen and Suning Tang, *in Optoelectronic Interconnects V (SPIE proceeding, 1998, Vol. 3288).*

21. Fabrication of three-dimensional tapered polymeric using compression molding technique, Linghui Wu, Feiming Li, Suning Tang, **Bipin Bihari** and Ray T. Chen, *in Optoelectronic Interconnects V, (SPIE proceeding, 1998, Vol. 3288, p. 73-78).*

22. Compression-molded three-dimensional tapered polymeric waveguides for low-loss optoelectronic packaging, Linghui Wu, Feiming Li, Suning Tang, **Bipin Bihari** and Ray T. Chen, *in Microelectronic packaging and laser processing (SPIE Proceedings 1997, Vol. 3184, p. 95-101).*

23. Fluorescence spectra and dynamics of Eu_2O_3 and Eu^{3+}:Y_2O_3 nanocrystals, B. M. Tissue and **B. Bihari**, *Abstracts of papers of the ACS, Vol. 213,pp. 315, April, 1997.*

24. Synthesis and laser spectroscopy of monoclinic Eu^{3+}:Y_2O_3 nanocrystals, **Bipin Bihari** and Brian M. Tissue, *(Mater. Res. Soc. Proc. (in press)1996 Fall Meeting, Boston).*

25. Thin film processing and NLO properties of stacked macrocyclic compounds, A. K. Sinha, **B. Bihari**, B. K. Mandal, M. Kamath and L. Chen, *in Nonlinear Optical Properties of Organic Materials VIII, (SPIE Proceedings 1995, Vol. 2527, p. 18-31).*

26. Structure-function relationship of nonlinear optical properties in 2-D conjugated molecules, L. X. Chen, B. K. Mandal**, B. Bihari**, A. K. Sinha, and M. Kamath, *in Nonlinear Optical Properties of Organic Materials VIII, (SPIE Proceedings 1995, Vol.* ***2527*** *p. 61-70).*

27. New developments in second order nonlinear optical polymeric materials, S. K. Tripathy, W. H. Kim, **B. Bihari**, D. W. Cheong and J. Kumar, *in Electrical, Optical and Magnetic Properties of Organic Solid State Materials (Mater. Res. Soc. Proc., 1994, Vol.* ***328*** *p. 433-442).*

28. Large and Stable second harmonic generation in a crystalline phase of novel ferroelectric liquid crystal, S. Sprunt, K. Gruneberg, J. Naciri, B. R. Ratna, R. Shashidhar, **B. Bihari**, J. Kumar & S. K. Tripathy, *Abstracts of APS meetings, San Jose, CA, (March 1995).*

29. Self Assembled Spin Coated Films of Asymmetrically Substituted Polydiacetylene As Second Order NLO Polymers, S. K. Tripathy, W. H. Kim, **B. Bihari**, and R. Moody, *in Functional and high performance polymers, pp. 6-A-02-IL Blackwell Science; 1995, (proceedings of International symposium -- 1994 Nov : Taipei; sponsored by: International Union of Pure and Applied Chemistry Polymer Society, Taipei).*

30. Investigation of second harmonic generation in MOCVD grown barium titanate thin films, **Bipin Bihari**, X. L. Xiang, J. Kumar, G. T. Stauf and P. C. Van Buskirk, *in Metal-Organic Chemical Vapor Deposition of Electronic Ceramics (Mater. Res. Soc. Proc., 1994, Vol.* ***335*** *p. 87-92).*

31. Novel polydiacetylenes as materials for second and third order nonlinear optics, W. H. Kim, C. E. masse, **B. Bihari**, S. K. Tripathy and J. Kumar, *in Electrical, Optical and Magnetic Properties of Organic Solid State Materials (Mater. Res. Soc. Proc., 1994, Vol.* ***328*** *p. 667-672).*

32. Monolayer self assembly on optical fiber based fluorescence sensor, M. Ayyagari, H. Gao, **B. Bihari**, K. G. Chittibabu, J. Kumar, K. A. Marx, D. L. Kaplan, and S. K. Tripathy, *in Chemical, Biological and Environmental Fiber Sensors V, ed. Robert A. Lieberman (SPIE Proceedings, 1993, Vol.* ***2068*** *p.168-178).*

33. Photovoltaic effects and charge transport studies in phycobiliprotiens, N. N. Beladekere, T. Ravindran, **B. Bihari**, S. Sengupta, K. A. Marx, J. Kumar, S. K. Tripathy, B. Wiley and D. L. Kaplan, *in Biomolecular Materials* (*Mater. Res. Soc. Proc., Vol.* ***292****, 193-198,1993).*

34. Chemical vapor deposition of epitaxial $BaTiO_3$ films for frequency doubling devices, P. C. Van Buskirk, G. Stauf, R. Gardiner, P. S. Kirlin, **B. Bihari**, X. Xiang & J. Kumar, *in Ferroelectric Thin Films III (Mater. Res. Soc. Proc., 1993, Vol.* ***310,*** *p.119-124).*

35. Ar ion laser excited fluorescence of Eu^{3+} in $LiYF_4$ host, **Bipin Bihari** & K. K. Sharma, *First National Symposium on Lasers and Applications, IPA/DST ,Dec. 2-5 1987, Indian Institute of Technology, Kanpur.*

36. Second harmonic generation in novel ferroelectric and electroclinic liquid crystals, S. Sprunt, J. Naciri, B. R. Ratna, R. Shashidhar, **B. Bihari**, J. Kumar & S. K. Tripathy, *International Liquid Crystal Conference, Budapest, Hungary (1995) (Unpublished).*

Published Reports:

1. Throughput enhanced multi-wavelength guided wave optoelectronic interconnects for high-density holographic memory, **Bipin Bihari**, Suning Tang, and Ray T. Chen, *Final Technical Report, AFRL-IF-RS-TR-1999-93, May 1999.*