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**Ronald G. Driggers, Editor**
*Electro-Optics and Photonics Division Chief*
*U.S. Army Research Laboratory*
*Adelphi, Maryland, U.S.A.*

## *Topical Editors*

**Gary Gilbert** — *Space and Naval Warfare Systems Center, San Diego, California, U.S.A.*

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**Gerald F. Marshall** — *Consultant: Optical Design and Engineering, Niles, Michigan, U.S.A.*

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**Dennis W. Prather** — *Department of Electrical and Computer Engineering, University of Delaware, Newark, Delaware, U.S.A.*

**Bradley W. Schilling**

*U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, Virginia, U.S.A.*

**Mark S. Schmalz**

*Department of Computer and Information Science and Engineering, University of Florida, Gainesville, Florida, U.S.A.*

**Joseph Shamir**

*Department of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel*

**James Sowell**

*School of Physics, Georgia Institute of Technology, Atlanta, Georgia, U.S.A.*

**Eberhard Spiller**

*Spiller X-Ray Optics, Livermore, California, U.S.A.*

**Richard Sutherland**

*Science Applications International Corporation, Dayton, Ohio, U.S.A.*

**Brian H. Tsou**

*U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio, U.S.A.*

**J. Mathieu Valeton**

*TNO–Netherlands Organization for Applied Scientific Research, Human Factors, Soesterberg, The Netherlands*

**Penny Warren**

*Naval Research Laboratory, Washington, District of Columbia, U.S.A.*

**Frank Wise**

*School of Applied Engineering and Physics, Cornell University, Ithaca, New York, U.S.A.*

**Cynthia Y. Young**

*Department of Mathematics, University of Central Florida, Orlando, Florida, U.S.A.*

# List of Contributors


**Ilesanmi Adesida** / *University of Illinois at Urbana–Champaign, Urbana, Illinois, U.S.A.*
**Girish S. Agarwal** / *Physical Research Laboratory, Navrangpura, Ahmedabad, India*
**Fernando Agulló López** / *Universidad Autónoma de Madrid, Madrid, Spain*
**Mohammad S. Alam** / *University of South Alabama, Mobile, Alabama, U.S.A.*
**Javier Alda** / *University Complutense of Madrid, Madrid, Spain*
**José Alonso** / *University Complutense of Madrid, Madrid, Spain*
**Larry C. Andrews** / *University of Central Florida, Orlando, Florida, U.S.A.*
**Mario N. Armenise** / *Politecnico di Bari, Bari, Italy*
**George R. Armstrong** / *Thales Optronics Ltd., Glasgow, United Kingdom*
**John R. Arnold** / *Dymax Corporation, Torrington, Connecticut, U.S.A.*
**Shlomi Arnon** / *Ben-Gurion University of the Negev, Beer-Sheva, Israel*
**Gordon Arthur** / *Thales Optronics Ltd., Glasgow, United Kingdom*
**Andrew G. Bachmann** / *Dymax Corporation, Torrington, Connecticut, U.S.A.*
**Mauro Barni** / *Università di Siena, Siena, Italy*
**Michael F. Barnsley** / *University of Melbourne, Parkville, Victoria, Australia*
**Julia A. Barsi** / *NASA Goddard Space Flight Center, Greenbelt, Maryland, U.S.A.*
**Franco Bartolini** / *Università di Firenze, Firenze, Italy*
**Bruce Batchelor** / *Cardiff University, Cardiff, Wales, United Kingdom*
**Mikhail S. Belen'kii** / *TREX Enterprises Corporation, San Diego, California, U.S.A.*
**Henri Benisty** / *Ecole Polytechnique, Palaiseau, France*
**Jean M. Bennett** / *Naval Air Warfare Center, Weapons Division, China Lake, California, U.S.A.*
**Harold E. Bennett** / *Bennett Optical Research, Inc., Ridgecrest, California, U.S.A.*
**Irving J. Bigio** / *Boston University, Boston, Massachusetts, U.S.A.*
**Piet Bijl** / *TNO–Netherlands Organization for Applied Scientific Research, Soesterberg, The Netherlands*
**Vincent A. Billock** / *Veridian Engineering, Dayton, Ohio, U.S.A.*
**Bill Blecha** / *U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, Virginia, U.S.A.*
**Florian Bociort** / *Delft University of Technology, Delft, The Netherlands*
**Donald Bord** / *University of Michigan, Dearborn, Michigan, U.S.A.*
**Sean Borman** / *University of Notre Dame, Notre Dame, Indiana, U.S.A.*
**Joseph Braat** / *Delft University of Technology, Delft, The Netherlands*
**Sophie Brasselet** / *Institut d'Alembert, Cachan, France*
**Christopher M. Brislawn** / *Los Alamos National Laboratory, Los Alamos, New Mexico, U.S.A.*
**Geoffrey W. Burr** / *IBM Almaden Research Center, San Jose, California, U.S.A.*
**José Manuel Cabrera Castillo** / *Universidad Autónoma de Madrid, Madrid, Spain*
**Frank M. Caimi** / *Florida Institute of Technology, Melbourne, Florida, U.S.A.*
**William H. Carter (Retired)** / *Naval Research Laboratory, Washington, District of Columbia, U.S.A.*
**Alexander N. Cartwright** / *University at Buffalo, The State University of New York, Buffalo, New York, U.S.A.*

**H. John Caulfield** / *Fisk University, Nashville, Tennessee, U.S.A.*
**Lipchen Alex Chan** / *U.S. Army Research Laboratory, Adelphi, Maryland, U.S.A.*
**F. Chen** / *Oracle Corporation, Sunnyvale, California, U.S.A.*
**Jong-Soo Choi** / *Chung-Ang University, Seoul, South Korea*
**Caterina Ciminelli** / *Politecnico di Bari, Bari, Italy*
**Thomas L. Clarke** / *University of Central Florida, Orlando, Florida, U.S.A.*
**William B. Clodius** / *Los Alamos National Laboratory, Los Alamos, New Mexico, U.S.A.*
**J. J. Coleman** / *University of Illinois, Urbana, Illinois, U.S.A.*
**John G. Daly** / *Vector Engineering Inc., Sorrento, Florida, U.S.A.*
**Arnold Daniels** / *Keren-Or Engineering, Rocklin, California, U.S.A.*
**Panos G. Datskos** / *Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A.*
**E. R. Davies** / *University of London, Engham, Surrey, United Kingdom*
**Nazif Demoli** / *Institute of Physics, Zagreb, Croatia*
**Cornelia Denz** / *Westfälische Wilhelms-Universität, Münster, Germany*
**Sandor Z. Der** / *U.S. Army Research Laboratory, Adelphi, Maryland, U.S.A.*
**Craig M. Deyerle** / *MacAulay-Brown, Inc., Shalimar, Florida, U.S.A.*
**Vikram Dhar** / *Solid State Physics Laboratory, Delhi, India*
**David Dickensheets** / *Montana State University, Bozeman, Montana, U.S.A.*
**Ariela Donval** / *Institut d'Alembert, Cachan, France*
**Kyoung-Soo Doo** / *Chung-Ang University, Seoul, South Korea*
**Thomas H. Drayer** / *Virginia Polytechnic Institute and State University, Falls Church, Virginia, U.S.A.*
**N. K. Dutta** / *University of Connecticut, Storrs, Connecticut, U.S.A.*
**Louay Eldada** / *DuPont Photonics, Wilmington, Massachusetts, U.S.A.*
**Martin Elvis** / *Harvard–Smithsonian Center for Astrophysics, Cambridge, Massachusetts, U.S.A.*
**Patrick Fay** / *University of Notre Dame, Notre Dame, Indiana, U.S.A.*
**Robert D. Fiete** / *Eastman Kodak Company, Rochester, New York, U.S.A.*
**J. Fitzsimmons** / *University of Florida, Gainesville, Florida, U.S.A.*
**Nicklaus F. Fogt** / *The Ohio State University, Columbus, Ohio, U.S.A.*
**Michael Friedmann** / *KLA-Tencor Corporation, Migdal Ha'Emek, Israel*
**James G. Fujimoto** / *Massachusetts Institute of Technology, Cambridge, Massachusetts, U.S.A.*
**Madalina Furis** / *University at Buffalo, The State University of New York, Buffalo, New York, U.S.A.*
**Nikolas P. Galatsanos** / *Illinois Institute of Technology, Chicago, Illinois, U.S.A.*
**Angel García Cabañes** / *Universidad Autónoma de Madrid, Madrid, Spain*
**Kurt W. Getreuer** / *Plasmon Inc., Colorado Springs, Colorado, U.S.A.*
**Dennis H. Goldstein** / *U.S. Air Force Research Laboratory, Eglin Air Force Base, Florida, U.S.A.*
**Leon Golub** / *Harvard–Smithsonian Center for Astrophysics, Cambridge, Massachusetts, U.S.A.*
**Francisco González** / *Universidad de Cantabria, Santander, Spain*
**Milton Gottlieb** / *Carnegie Mellon University, Pittsburgh, Pennsylvania, U.S.A.*
**John Gowar** / *University of Bristol, Bristol, United Kingdom*
**Arnaud Grisard** / *Thales Research and Technology, Orsay, France*
**Gilbert Grynberg** / *Laboratoire Kastler–Brossel, Paris, France*
**Claire Gu** / *University of California, Santa Cruz, California, U.S.A.*
**Minzhi Gu** / *Zhejiang University, Hangzhou, Zhejiang, People's Republic of China*
**Chun Guan** / *University of Kentucky, Lexington, Kentucky, U.S.A.*
**Philippe Guyot-Sionnest** / *University of Chicago, Chicago, Illinois, U.S.A.*
**David J. Hagan** / *University of Central Florida, Orlando, Florida, U.S.A.*

**Sven T. Lagerwall** / *Chalmers University of Technology, Göteborg, Sweden*
**Akhlesh Lakhtakia** / *Pennsylvania State University, University Park, Pennsylvania, U.S.A.*
**Philippe Lalanne** / *Centre National de la Recherche Scientifique, Orsay, France*
**Eric Lallier** / *Thales Research and Technology, Orsay, France*
**Nicole Langer** / *Dymax Corporation, Torrington, Connecticut, U.S.A.*
**Nickolay V. Lavrik** / *Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A.*
**Jon C. Leachtenauer** / *J/M Leachtenauer Associates, Charlottesville, Virginia, U.S.A.*
**Isabelle Ledoux-Rak** / *Institut d'Alembert, Cachan, France*
**C. Leonard** / *University of Florida, Gainesville, Florida, U.S.A.*
**A. Levenson** / *Centre National de la Recherche Scientifique (CNRS), Marcoussis, France*
**Uriel Levy** / *Tel-Aviv University, Tel-Aviv, Israel*
**Cheng-Chung Li** / *Corning, Inc., Corning, New York, U.S.A.*
**Adam Liebert** / *Polish Academy of Sciences, Warsaw, Poland*
**William Livingston** / *National Solar Observatory, Tucson, Arizona, U.S.A.*
**José Manuel López-Alonso** / *University Complutense of Madrid, Madrid, Spain*
**K. Lu** / *Multiplex Inc., South Plainfield, New Jersey, U.S.A.*
**A. G. Luchinin** / *Russian Academy of Science, Nizhny Novgorod, Russia*
**Robert P. Madding** / *FLIR Systems, Inc., North Billerica, Massachusetts, U.S.A.*
**Virendra N. Mahajan** / *The Aerospace Corporation, El Segundo, California, U.S.A.*
**Joseph N. Mait** / *U.S. Army Research Laboratory, Adelphi, Maryland, U.S.A.*
**Walter Makous** / *University of Rochester, Rochester, New York, U.S.A.*
**Daniel Malacara-Hernández** / *Centro de Investigaciones en Optica, A.C., León Gto., Mexico*
**Eliot Malumuth** / *Science Systems and Applications, Inc., Greenbelt, Maryland, U.S.A.*
**Roman Maniewski** / *Polish Academy of Sciences, Warsaw, Poland*
**Robert L. Marcialis** / *University of Arizona, Tucson, Arizona, U.S.A.*
**Guillermo Martin-Fuchs** / *Institut d'Alembert, Cachan, France*
**Martin W. McCall** / *Imperial College of Science, London, United Kingdom*
**Ross McCluney** / *University of Central Florida, Cocoa, Florida, U.S.A.*
**Robert S. McCuskey** / *University of Arizona, Tucson, Arizona, U.S.A.*
**Mark McDowell** / *National Aeronautics and Space Administration (NASA), Cleveland, Ohio, U.S.A.*
**Matthew J. McGill** / *National Aeronautics and Space Administration (NASA), Greenbelt, Michigan, U.S.A.*
**Donald M. McKeown** / *Rochester Institute of Technology, Rochester, New York, U.S.A.*
**David Mendlovic** / *Tel-Aviv University, Tel-Aviv, Israel*
**Hongxiang Meng** / *Zhejiang University, Hangzhou, Zhejiang, People's Republic of China*
**François G. Meyer** / *University of Colorado at Boulder, Boulder, Colorado, U.S.A.*
**Alan Michette** / *King's College London, London, United Kingdom*
**Leonard R. Migliore** / *Laser Kinetics, Inc., Mountain View, California, U.S.A.*
**Jean Montagu** / *Brookline, Massachusetts, U.S.A.*
**Mark T. Montgomery** / *Noah Industries, Inc., Melbourne, Florida, U.S.A.*
**Fernando Moreno** / *Universidad de Cantabria, Santander, Spain*
**Geert Morthier** / *Ghent University, Ghent, Belgium*
**Judith R. Mourant** / *Los Alamos National Laboratory, Los Alamos, New Mexico, U.S.A.*
**Pantazis Z. Mouroulis** / *California Institute of Technology, Pasadena, California, U.S.A.*
**W. J. Munro** / *Hewlett-Packard Laboratories, Bristol, United Kingdom*
**Allen L. Nagy** / *Wright State University, Dayton, Ohio, U.S.A.*
**Nasser M. Nasrabadi** / *U.S. Army Research Laboratory, Adelphi, Maryland, U.S.A.*

**Paul Norton** / *U.S. Army Night Vision and Electronic Sensor Directorate, Fort Belvoir, Virginia, U.S.A.*
**Gary O'Brien** / *Science Applications International Corporation, Arlington, Virginia, U.S.A.*
**John D. O'Connor** / *U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, Virginia, U.S.A.*
**Barbara L. O'Kane** / *U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, Virginia, U.S.A.*
**Takeo Ohta** / *Energy Conversion Devices, Inc., Rochester Hills, Michigan, U.S.A.*
**Gustaf Olsson** / *Swedish Defence Research Agency, Linköping, Sweden*
**Stanford R. Ovshinsky** / *Energy Conversion Devices, Inc., Rochester Hills, Michigan, U.S.A.*
**Saravanan M. Peelamedu** / *The University of Toledo, Toledo, Ohio, U.S.A.*
**Ronald L. Phillips** / *Florida Space Institute, University of Central Florida, Kennedy Space Center, Florida, U.S.A.*
**Jean-Paul Pocholle** / *Thales Research and Technology, Orsay, France*
**Alois K. Popp** / *Harvard University, Cambridge, Massachusetts, U.S.A.*
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**Mihaela D. Quirk** / *Los Alamos National Laboratory, Los Alamos, New Mexico, U.S.A.*
**James A. Ratches** / *U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, Virginia, U.S.A.*
**Deqing Ren** / *The Pennsylvania State University, University Park, Pennsylvania, U.S.A.*
**William R. Reynolds** / *Signature Research, Inc., Calumet, Michigan, U.S.A.*
**John A. Richards** / *Sandia National Laboratories, Albuquerque, New Mexico, U.S.A.*
**Giancarlo C. Righini** / *Nello Carrara Institute of Applied Physics, Firenze, Italy*
**Francesc Rocadenbosch** / *Universitat Politècnica de Catalunya, Barcelona, Spain*
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**Hendrik Rothe** / *University of the Federal Armed Forces, Hamburg, Germany*
**Per G. Rudquist** / *Chalmers University of Technology, Göteborg, Sweden*
**S. Sahni** / *University of Florida, Gainesville, Florida, U.S.A.*
**Jose M. Saiz** / *Universidad de Cantabria, Santander, Spain*
**Alan C. Samuels** / *Department of the Army, Aberdeen Proving Ground, Maryland, U.S.A.*
**José M. Sasián** / *University of Arizona, Tucson, Arizona, U.S.A.*
**Andreas Schilling** / *OVD Kinegram Corp., Zug, Switzerland*
**Bradley W. Schilling** / *U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, Virginia, U.S.A.*
**Jean Schleipen** / *Philips Research Laboratories, Eindhoven, The Netherlands*
**Mark S. Schmalz** / *University of Florida, Gainesville, Florida, U.S.A.*
**John R. Schott** / *Rochester Institute of Technology, Rochester, New York, U.S.A.*
**Jonathon M. Schuler** / *Naval Research Laboratory, Washington, District of Columbia, U.S.A.*
**Steven M. Scott** / *Reflexite, West Henrietta, New York, U.S.A.*
**Dean Scribner** / *Naval Research Laboratory, Washington, District of Columbia, U.S.A.*
**Richard Sears** / *University of Michigan, Ann Arbor, Michigan, U.S.A.*
**C. Andrew Segall** / *Northwestern University, Evanston, Illinois, U.S.A.*
**J. Anthony Seibert** / *University of California, Davis Medical Center, Sacramento, California, U.S.A.*
**Gal Shabtay** / *Tel-Aviv University, Tel-Aviv, Israel*
**Joseph Shamir** / *Technion-Israel Institute of Technology, Haifa, Israel*
**Mansoor Sheik-Bahae** / *University of New Mexico, Albuquerque, New Mexico, U.S.A.*
**Colin J. R. Sheppard** / *University of Sydney, Sydney, New South Wales, Australia*
**Bhimsen K. Shivamoggi** / *University of Central Florida, Orlando, Florida, U.S.A.*
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**Jan Sijbers** / *University of Antwerp, Antwerp, Belgium*
**Paulo E. X. Silveira** / *Network Photonics, Inc., Boulder, Colorado, U.S.A.*

# Preface

Optical engineers have made contributions to society to make our lives easier, safer, and more interesting. Many great technological advances in the twentieth century arose because of optical engineering.

- In 1927 Philo T. Farnsworth transmitted the first electronic television picture and Bell Telephone demonstrated the first wireless television transmission between Washington, D.C., and New York. In 1960, it is widely believed that John F. Kennedy won the U.S. presidential election based primarily on his televised performance in the Nixon–Kennedy debates. Today, there are over 1 billion television sets in operation worldwide.
- In the early 1950s, Charles Townes and Arthur Shawlow demonstrated the maser and subsequently described the possibility of the laser. In 1960, Theodore Maiman demonstrated the first laser. Today, lasers are used in surgery, welding, communications, and weapon systems. Diode lasers alone provided for a $1.2 billion market in the year 2000.
- In the 1960s, the area of fiber optics emerged with the development of glass-clad fibers for guiding light. Today a fiber can carry 200 television channels or more than 200,000 telephone channels.
- In 1990, the Hubble Space Telescope (HST) was launched allowing researchers to investigate far-off galaxies with images previously unobtainable. To date, the HST has taken more than 330,000 separate observations and allows fundamental research on universe expansion.
- In the past few decades, optical systems for precision targeting, intelligence, surveillance, reconnaissance, and night vision have provided huge advantages on the battlefield. Infrared and electro-optical systems have been key instruments in the success of wartime operations such as Desert Storm and Enduring Freedom. Today, these systems are used to protect countries and project military power.

Classical engineering disciplines include electrical, mechanical, civil, and some areas of chemical engineering. Computer engineering, although not "classical," all but exploded in the last quarter century and is now a well-established discipline. I consider an engineering discipline to be an area in which an individual can spend a lifetime of work; it is supported by academia, industry, government, and professional societies. Optical engineering is an engineering discipline but has yet to have individual academic departments devoted to it. It may be that the physics community holds dearly the interaction of light and matter, and, as a result, provides supporting academic programs in the fields of optical sciences and photonics. The graduates of these programs frequently find themselves working in optical engineering.

Before I continue, let me explain why I consider myself an optical engineer. While my formal training is that of an electrical engineer, I have not seen a wire or a transistor for at least 10 years. Both my undergraduate and graduate programs had a number of courses in electro-optics. Many electrical engineering programs around the country have courses in electro-optics, and a couple of schools have created a specialization or concentration in electro-optics. Graduate courses in electro-optics (and laser systems) are usually attended by both electrical

engineering students and physics students. However, the physics programs that include these courses are typically called optical sciences or photonics programs. Before it sounds as though I am biased, let me state that both engineers and physicists make excellent optical engineers.

*Optical engineering* is concerned with the engineering of a device or system in which light is involved, while *Photonics* is concerned primarily with the basic interaction of light and matter. But there is a large overlap between the two. Episodes from television's classic "Star Trek" series show that Scotty the engineer could not get the ship's systems running until Mr. Spock provided some basic science that converted a fundamental problem to a practical solution. Such is the case with optical engineering and photonics.

The purpose of this encyclopedia is to provide an optical engineering reference that can be used by engineers, physicists, and other scientists. The target length for each entry was set at around 6000 words, but many of the entries exceed this length. Authors were asked to review fundamentals of each topic. No derivations were requested. Around 50 areas were identified as important for the first issue and Topical Editors were recruited to solicit and edit articles related to these areas, ranging from adaptive optics to x-ray optics.

This encyclopedia provides dual products: digital encyclopedia via the Internet and a print encyclopedia. The online version is a living document that grows with quarterly updates, and timely content is continually added to make the work dynamic. Suggestions for new content will be welcomed; they should be directed to me at the e-mail address listed below. The printed version will be updated through new editors.

I want to thank three groups of people for my participation in this worthy project. First are the people who had a hand in making me an optical engineer: Carl Halford, Glenn Boreman, the late John Nestler, Luc Biberman, Eddie Burroughs, Ray Deep, Gerry Holst, Rich Vollmerhausen, Tim Edwards, Jim Ratches, Dean Scribner, and Jon Leachtenauer. These people have my admiration, respect, and loyalty. They are truly the cream of the crop in the area of optical engineering, and I am very grateful for the opportunities that I have had to learn from them.

Second, I would like to thank the people who worked hard to initiate the project and make the encyclopedia a success. Thanks goes to Marcel Dekker, Inc., for getting the project off the ground. I appreciate the confidence of Glenn Boreman, Barry Johnson, and Russell Dekker in my ability to accomplish this mammoth project. This encyclopedia would not have been possible without their efforts. Although I did not share my appreciation with her enough, Ellen Lichtenstein (Encyclopedia Editor) was helpful and caring throughout the project. The work of Alison Cohen was also appreciated more than she knows. The work of all the Topical Editors and authors is very much appreciated. Our Topical Editors have been superb mentors in identifying encyclopedia content; their participation improved the resulting product significantly. Many of the entries are amazing in that they provide the fundamental concepts, give technical applications, and are a joy to read.

Third and most important, I would like to thank my family for the time and support to accomplish this project. My beautiful and inspirational wife, Rita, a famous OB/GYN doctor at Johns Hopkins, supports everything that I pursue. My eldest son, Ryan, and the Drigglets (Megan, Madison, and Buddy) gave me a chaos-management experience that served me well in managing encyclopedia tasks. Their lives are far more interesting than my own and I have been blessed to be a part of them. My closest brother, Keith Krapels, is not of blood, but of the experience of sharing a majority of our lives together. It is because of these people that I do not mind growing older since the process means spending time with them.

Ronald G. Driggers
ron.driggers@nvl.army.mil

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