

Holography Projects for the Evil Genius®

Gavin D. J. Harper



New York Chicago San Francisco Lisbon London Madrid
Mexico City Milan New Delhi San Juan Seoul
Singapore Sydney Toronto

Copyright © 2010 by The McGraw-Hill Companies, Inc. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of the publisher.

1 2 3 4 5 6 7 8 9 0 WDQ/WDQ 1 6 5 4 3 2 1 0

ISBN 978-0-07-162400-8

MHID 0-07-162400-7

Sponsoring Editor

Judy Bass

Editing Supervisor

Stephen M. Smith

Production Supervisor

Pamela A. Pelton

Acquisitions Coordinator

Michael Mulcahy

Project Managers

Smita Rajan and Vasundhara Sawhney,
Glyph International

Copy Editor

Anne Lesser

Proofreader

Medha Joshi, Glyph International

Indexer

Robert Swanson

Art Director, Cover

Jeff Weeks

Composition

Glyph International

Printed and bound by Worldcolor/Dubuque.

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. To contact a representative, please e-mail us at bulksales@mcgraw-hill.com.

This book is printed on acid-free paper.

McGraw-Hill, the McGraw-Hill Publishing logo, Evil Genius, and related trade dress are trademarks or registered trademarks of The McGraw-Hill Companies and/or its affiliates in the United States and other countries and may not be used without written permission. All other trademarks are the property of their respective owners. The McGraw-Hill Companies is not associated with any product or vendor mentioned in this book.

Information contained in this work has been obtained by The McGraw-Hill Companies, Inc. ("McGraw-Hill") from sources believed to be reliable. However, neither McGraw-Hill nor its authors guarantee the accuracy or completeness of any information published herein, and neither McGraw-Hill nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that McGraw-Hill and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be sought.

Contents

Acknowledgments	xi	Project 14: Transmission Hologram with Soft Lighting	80
Introduction to Holography	xiii		
1 History of Holography	1	10 Advanced Holographic Projects	81
2 How We See in Three Dimensions	5	Project 15: Making a Hologram with Diffuse Illumination	81
Project 1: Make a Camera Obscura	7	Project 16: Making a Hologram with Multiple Sources of Illumination	82
3 Basic Practical Optics	11	Project 17: Making a Copy of a Hologram	82
Project 2: Cutting Mirrors	12	Project 18: Experimenting with 360° Holograms	83
4 Light and Lasers	23	Project 19: Making a Direct Beam 360° Cylindrical Hologram	84
5 How Holography Works	31	Project 20: Making a Cylindrical Hologram with a Convex Mirror	86
6 Holographic Chemistry	41	Project 21: Making a Conical Hologram	89
Project 3: Develop Holographic Plates	43	Project 22: Make a Hologram Cube	90
Project 4: Develop Holographic Film	46	Project 23: Rainbow Transfer Hologram	91
7 Your Holography Workshop	53	11 Advanced Holographic Chemistry	93
Project 5: Construct a Sandbox	53	Project 24: Changing the Color of Your Holograms	96
8 Simple Holography	61	Project 25: Chemical Blackening of Reflection Holograms	97
Project 6: Direct Beam Reflection Hologram	61	12 Computer-Generated Holography	99
Project 7: Creating a Single-Beam Transmission Hologram	70	Project 26: Make Your Own Digital Hologram	99
Project 8: Making a Single-Mirror Transmission Hologram	72	13 Useful Electronic Circuits for Holographers	105
Project 9: Creating a Multiple-Channel Hologram	73	Project 27: Darkroom Timer	105
9 Intermediate Holography	75	Project 28: Electronic Shutter	107
Project 10: Working with Film	75	Project 29: Automatic Electronic Shutter	109
Project 11: Multiple-Beam Reflection Hologram	78		
Project 12: Split-Beam Transmission Hologram (I)	78		
Project 13: Split-Beam Transmission Hologram (II)	79		

Project 30: Simple Photometer	111	Project 37: Making an Inexpensive Stereo Camera	128
Project 31: Simple LED Safelight	116	Project 38: Digital Stereo Photography	130
14 Science Fair Projects for Holographers	117	Project 39: Lenticular Imaging	132
Project 32: Michelson's Laser Interferometer	117	Project 40: Make an Anaglyph Image	137
Project 33: Laser Interferometry	119	Project 41: Exploring the Mirage 3D Instant Hologram Maker	140
Project 34: Watching Mushrooms Grow	120	16 What Next for Holography?	143
Project 35: Experiment with Diffraction Gratings	122	Glossary	147
15 Other Non-Holographic Three- Dimensional Projects	125	Suppliers' Index	151
Project 36: Making a Stereo Pair of Images	126	Index	153