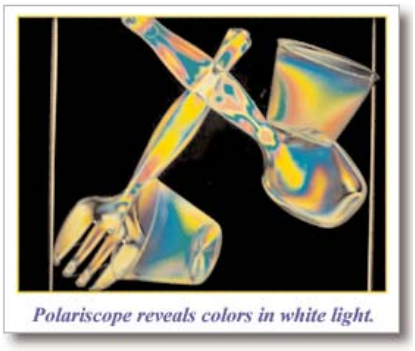


Polariscope reveals colors in white light.

Progress Report:
"Promoting Career Awareness with the *Optics Suitcase*"

Stephen D. Jacobs and Leslie L. Gregg
University of Rochester, Rochester, NY

Members of the Rochester Section of the Optical Society of America have conducted career awareness workshops for teachers and in-class presentations for middle school children since late 1999. The goal for this outreach activity is to increase the number of people beginning careers in engineering, hopefully optical engineering. Our strategy is to encourage optics professionals to go into the classroom and using the *Optics Suitcase*, demonstrate to students that engineering can be fun and exciting. We equip the presenters to explore different ways to find color in white light using a series of activities based on give-away "theme packets". This effort was described here two years ago (*OPN*, July 2000, p. 16).

With significant financial support from our local members, activity grants from the national OSA, and from the Center for Optics Manufacturing (COM) at the University of Rochester, we have provided our *Optics Suitcase* without charge to organizations throughout North America. The *Optics Suitcase* contains an array of reusable and give-away items that provide the presenter with an exciting means for introducing children to optical engineering as an attractive career choice. In this article, we provide some feedback in the form of a progress report. We discuss the distribution and use of the *Optics Suitcase*, observations from the professional volunteers in the classrooms, and comments from the target audience... some of the thousands of children on the receiving end of the presentations.

Optics Suitcase Locations

There was some concern that, as a result of the OPN article cited above, we would be inundated with requests for the *Optics Suitcase*. This did not occur. Through word of mouth and presentations given at various New York State, OSA and SPIE educator workshops, we received an average of two requests per month. This is commensurate with our level of funding and we manufactured and shipped 26 *Optics Suitcases* as of March 2002.

#	State/Prov	Organization	Contact
1	MA	Physics Department, Boston University,	Bennett Goldberg
2	NH	Pinkerton Academy, *Derry*	Gale Christensen
3	DC	OSA National Headquarters	Jason Briggs
4	FL	Coastal Optical Systems, Inc., *W. Palm Beach*	Jay Kumler
5	NY	Oneida BOCES, *New Hartford*	Pauline Rogers
6	NY	Mohawk Valley Community College, *Utica*	Celia Domser
7	NY	Boynton Middle School, *Ithaca*	Marcie Wyant
8	NY	Optimax, Inc., *Ontario*	James Vankouwenberg
9	NY	Fisba Optik LLC, *Rochester*	John Nemechek
10	NY	Gates-Chili Central School District, *Rochester*	Christine Fenton
11	NY	OSA Student Chapter, University of Rochester	Mi-Young Park
12	NY	Ceramic Association of NY/Alfred University	Anne Baldwin
13	PA	Electro-Optics Center Penn State Univ., *Kittanning*	Wendy Gilpin
14	ONT	Southwest Ontario Local section of the OSA, *Waterloo,CAN*	Donna Strickland
15	OH	American Ceramic Society, *Westerville*	Mark Glasper
16	AL	U.S. Army Aviation & Missile Command, Redstone Arsenal	Jim Kirsch
17	IN	Crane Div., Naval Surface Warfare Center, Dept. of the Navy	John Smith
18	TX	Zebra Imaging, *Austin*	Deanna McMillen
19	NM	Ctr. High Tech. Matls., Univ. of New Mexico, *Albuquerque*	Arthur Guenther
20	CO	Colorado Photonics Industry Assoc., *Northglenn*	Brian Hooker
21	CA	Physics Department, San Diego State University	Matt Anderson
22	CA	Optical Society of Northern California, *Los Altos*	Paul Griffiths
23	CA	Coherent, Inc., *Auburn*	Bob Basor
24	OR	OSA Columbia Local Chapter, *Seattle*	Jeannie Williams
25	WA	Mount Tahoma High School, *Tacoma*	John Currie
26	WA	SPIE, *Bellingham*	Patty Sweaney

Table 1. Optics Suitcase recipient organizations in the USA and Canada.

As shown in Table 1 (numbered East Coast to West Coast), recipients are evenly distributed among community colleges and universities (4), OSA local chapters (4), middle and high schools (4), companies (5), and government or not-for-profit groups (9). To receive an *Optics Suitcase* we require a letter describing the types of activities planned from the person responsible for its storage and/or use, and a good faith commitment to provide feedback from in-school visits.

Each *Optics Suitcase* contains an illustrated copy of our "Educational Outreach Presentation Guide". This 14-page guide lists the equipment and supplies included in the *Optics Suitcase* (see Figure 1) and it provides detailed suggestions on how to set up and give a ~40 minute lecture /demonstration. Reusable items include a portable heat therapy pad and "Happy /Unhappy" balls (attention grabbers), a silicon wafer, a lens, a slinky, two high quality sheet polarizers, a sheet of temperature sensitive liquid crystal film and a set of six presentation transparencies. Give-away supplies include 75 copies of the periodic table of the elements (compliments of Mark Glasper and the American Ceramic Society) and 225 "theme packets" that explore color in white light through "Magic Trick" experiments: *The Rainbow Peephole® - color by diffraction* (75 ea.), *Magic Stripes - color by polarization* (75 ea.), and *Magic Patch - color by selective reflection* (75 ea.).

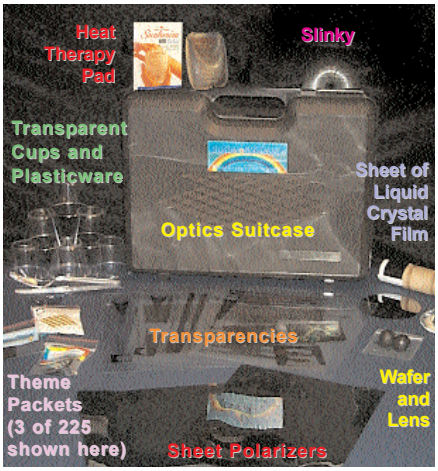


Figure 1. Contents of the *Optics Suitcase*.

*To find out more about the *Optics Suitcase* Outreach Program visit: www.OpticsExcellence.org. Information is available on the development and production of the "take-home" theme packets discussed in this article.

Replacement "theme packets" are supplied when requested, provided we receive written feedback. The manufacture and distribution of these packets is a major effort. Fortunately, as a result of a series of outreach presentations in Kittanning, PA, we were able to enlist the aid of Dr. Wendy Gilpin (Electro-Optics Center, Penn State University) and Roy Cigola (Progressive Workshop) in this endeavor.

Take Home "Theme Packets" get kids of all ages excited about careers in sciences, even optical engineering.

Celia Domser, Professor and Department Head, Engineering, Computer & Physical Sciences Department, Mohawk Valley Community College, Utica, NY, was the first *Optics Suitcase* recipient to request refills. Celia compiled the following record of presentations between February 12, 2001 and May 19, 2001: Proctor High School, 30 juniors and seniors; Children's Museum in Utica, 28 elementary students (up to 3rd grade); SUNY Oneonta, 22 student teachers; Rome Catholic High School, 30 juniors; Annisville Elementary, 46 students (3rd & 4th graders) and 10 kindergartners; Saquoit Elementary School, 76 4th graders; Mohawk Valley Community College, mother-daughter breakfast, 20 high school girls.

Encouraging observations

Here are some comments from a sampling of science and engineering professionals who have given presentations or observed them being given:

January 26, 2000
Magic tricks were demonstrated by father (and local Eastman Kodak engineer & OSA member), John Bowen, to 40 kindergarten children at Jefferson Road Elementary School, Pittsford, NY.

"I showed the spectroscope [Rainbow Peephole®] and the temperature sensitive film [liquid crystals]. Both of these were very easy to use (I was concerned about them being able to handle the things), and generated a lot of excitement. So much so that the teacher kept saying '...tell me when you want them to quiet down...' At the end, most of the questions were variants on, 'How did you make these?' so I think it definitely sparked their curiosity."

May 30, 2001
Engineer Sarah Curet from the University of Rochester Laboratory for Laser Energetics (LLE) gave an outreach presentation to 40 children in the 4th grade at Warsaw Elementary School, Warsaw, NY. Classroom teachers Joyce Runfola and Tina Harding sent the following email:

"Dear Dr. Jacobs: Just wanted you to know that Sarah did a wonderful job when she presented her materials to our science classes last week. She was one of several presenters we've had in this year to discuss their careers-in-science, and she certainly gets the award for generating the most 'cool', 'awesome', and 'wow' comments!!! Thanks, too, to the members of your group for putting the packets together and to the Center for providing such great hands-on projects and visuals. We also appreciated the materials (posters) you sent to the teachers. The kids are sure to remember the visit and the fun they had with optics."

July 4, 2001
Xerox Scientist Keith Knox used the kits with 15 eight-year-olds:

"They were fascinated with the polarizers and were wowed by how they changed as they rotated them. The stripes were beautiful with their different colors and they loved the way the colors changed as one of the polarizers was rotated.... Many of them were very inquisitive and would jump ahead of me and try out ways of combining the individual pieces on their own. By the end, I found myself letting them experiment and answering their questions as they tried to understand what they were seeing.... The teachers thought the lesson was wonderful."

December 14, 2001
Wendy Gilpin from the Electro-Optics Center at Penn State sent a copy of an e-mail she received from teachers in PA:

"...Larry Freeman and I [Dennis Whitson] have visited 16 schools and made our electro-optics presentation. This is a total of about 1092 students with whom we have interacted. What seems to excite the students the most were the packets that they could manipulate themselves: Rainbow Peephole® and the Magic Stripes."

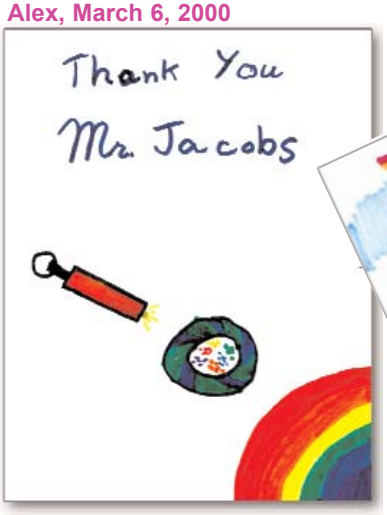
February 21, 2002
John Schoen (COM) gave his first *Optics Suitcase* presentation to Ann Esch's 4th grade class at Rogers Middle School, West Irondequiot, NY. From John:

"I must admit I was nervous at the start, but the 'oohs and aahs' came fast and often throughout the interaction. It was a fun and rewarding experience. Your advice to allow more interaction (not to provide the answers) was right on target. The kids had great ideas."

March 7, 2002
A note from Jim Kirsch (U.S. Army Aviation and Missile Command, Redstone Arsenal, Huntsville, AL):

"The presentation went very well. SciQuest is the local hands-on science museum and they bring in all the sixth grade classes every year. I was very fortunate this year to only have 30 kids with no other groups to follow so I could take more time. The polarization demo was really nice because SciQuest has an exhibit on using polarization to measure stress in bridge supports. The kids had the take-home kit but could also see a very practical application as well."

Alex, March 6, 2000



Krystal, March 6, 2000

Feedback from the children

We conclude this article with a selection of comments from the thank you notes written primarily by sixth graders in Ms. Jerrilyn Boynton's Home and Careers classes at Martha Brown Middle School, Fairport, NY. We encourage the readership to judge the reception this presentation has received.

Tricia: I thought the kits were really cool. Like the rainbow peephole was cool how you could see all the different color shapes. When I took it home my family loved it.

David: My whole family is amazed by what you could do with the kits. I liked when you put the paper over the cups and it showed up tie-die. [He was referring to the placement of two polarizers on an overhead projector, separated by plastic cups.]

Briana: I think you have a really cool job. I'll keep it in mind till I'm older.

Amber: I showed my family the kits you gave me and my brothers liked them so much they begged me to let them play with them.

Rachel: Thank you for coming and teaching us about where colors come from. When I went home, I showed a couple people in my family the things you gave us. They thought they were really cool. I liked it when you put the plastic cups and forks between the two sheets of black paper [polariscope]. The lesson was very cool.

"Neatorific, cool, awesome!"

Jess: I liked that you gave out kits because it makes it easier to understand when it's hands on. Science optics is confusing but you made it much easier to understand.

Alex: I learned that light can bend and change colors, and how to make optics work. I learned what an engineer does in their work. You should go to more and more schools telling them about the same topic.

J. D.: All of the stuff you showed was so neat because we could do all of the demonstrations by ourselves.

Kaitlin: Thank you for coming and telling my class and I about optics and engineering. My dad is an engineer and it pushed me to learn a little more about his job.

Laura: I never knew there were so many ways to break up light or that engineering could be so fun. It was easier to learn because we could see what you were teaching to us up close and in a way we could understand.

Hanna: I liked the Magic Patch. I'm trying to get it to turn red. But I still can't figure it out yet.

Pierson: Thank you for coming to our home and career class to talk about your job. You make me want to be an optical physicist. It was very interesting. You're the man!!

Jordan: I thought it was cool how you gave us the packets. I also really liked the magic tricks. My favorite trick is the rainbow peephole. I think it would be interesting to be an optical physicist.

Brent: Before you came I had no idea what an optical physicist was, but when you left I wanted to be one. I never realized how colorful it was. I really enjoyed the rainbow peephole. It was neat to see all the colors that are in white light.

Chelsea: I especially liked the polarizers. It was cool the way you could see all the strain in it.

Ashleigh: I learned more about what light does and how cool it looks when it reflects off something.

Dennis: I really enjoyed the rainbow peephole. I think that seeing the fireworks thru one of those would be cool!

Peter: My family and I were amazed at all the things you gave us, and they thought the way they all worked was very interesting. The way I knew how they worked was because you taught us so good.

Lisa: When you teach at other classes you should hand out things that people can touch by themselves (like you did with us!) Please write back so I can learn more about optics (and if you can, please send more optical stuff!)

Acknowledgements

We thank Dr. James L. Fergason, Redwood City, CA, for supplying thousands of square feet of liquid crystal film. Our thanks to the following students and staff at COM for supporting this outreach effort: Christine Andrews-Angelo, Jessica DeGroote, Jennifer Hayes, Jacob Hesterman, Anne Marino, Carolyn Pollicove, Harvey Pollicove, Henry Romanofsky, Jennifer Sternal, and Rupal Varshneya.

Shelly, November 8, 2000

*Dr. Stephen D. Jacobs is a senior scientist at the Laboratory for Laser Energetics (LLE), University of Rochester (NY). He is involved in education outreach and, together with Ms. Gregg, has created and developed the *Optics Suitcase* Outreach Program. Ms. Leslie L. Gregg is a chemical technician at the Center for Optics Manufacturing, University of Rochester (NY). They can be reached by email at lgre@LLE.rochester.edu