Inter-Society Color Council *News*

# Issue 418

# Nov/Dec 2005

## Contents



**Happy Holidays to each and everyone!**

## President's Column

We have enjoyed a spectacular autumn with unseasonably warm temperatures and a colorful display of changing colors. However, with the shorter days and colder nights, it is evident that winter is just around the corner. In Ottawa, we have already experienced our first snowfall but rest assured that this will have long disappeared when we have our annual meeting in Ottawa in May 2006.

The plans for our annual meeting are well underway. We have selected wonderful venues for the meeting, accommodations and Symposium banquet. We have also made excellent progress on the technical programs for the ISCC-CIE Symposium and ISCC Annual Meeting. This Newsletter includes a 2nd Call for Papers from the Symposium Technical Chair, Alan Robertson, with information on some of the confirmed speakers and presentations. Those wishing to present at the Symposium, please submit your abstracts to Alan by January 15, 2006. The three ISCC Interest Groups and Education Committee are also working on their Sessions for the 2006 Annual Meeting. Students attending the meeting may be eligible for travel assistance and awards will be given to the best student papers in each Interest Group Session. The Interest Groups calls for papers, as well as for the poster session, and details of the student travel assistance can be found in this issue of the Newsletter. To find out the latest information on the week-long jubilee celebrations in Ottawa, regularly check the ISCC conference web-site, www.iscc.org. The hotel and meeting registration forms will be available soon.

We had a highly successful Special Topics Conference in Scottsdale in November on Precision and Accuracy in Color Measurements with about 60 attendees. This one and a half-day meeting featured three Sessions dealing with the problems of fluorescence, the distinction between repeatability, reproducibility and traceability, and measurements using images. Each Session featured a key-note speaker that set the stage for several contributed papers that focused discussion on the issues related to making reliable measurements of digital images. Kudos go to Conference Co-Chairs, Danny Rich and John McCann, for putting together this highly informative and interactive sessions. The ISCC Board would also like to specially acknowledge the wonderful cooperation and support that was received from

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our Member-Body, the Society for Imaging Science and Technology (IS&T), and their Executive Director, Suzanne Grinnan, in co-hosting this meeting. A report on the meeting highlights are in this issue of the Newsletter on page 6.

We are also planning a Special Topics Conference on Industrial Color Challenges for the Fall of 2006 (venue TBD). This meeting will be modeled on our highly successful 2003 Special Topics Conference on Industrial Color Solutions that was held in Philadelphia and Chaired by Ralph Stanziola. The 2006 Special Topics Conference will focus on the special challenges faced by the textile industry. The Co-Chairs of this event are Sy Commanday and Frank O'Donnell. Please stay tuned for further details in upcoming issues of the Newsletter.

Finally, I would like to wish everyone a wonderful holiday season. I look forward to welcoming you to Ottawa in May 2006.

*Joanne Zwinkels, National Research Council of Canada*

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# Student Travel Grants
# ISCC 2006 Annual Meeting

The ISCC Education Committee is providing a limited number of Student Travel Grants to assist students traveling to the ISCC Annual Meeting in Ottawa in May 2006. To be eligible for this grant, the student must submit a letter of recommendation from their supervisor including affirmation that they are a full-time student, and an estimate of their travel costs. Preference will be given to students who also include a title and abstract for a paper or poster presentation. Deadline for applying to this program is March 12, 2006. Applications should be sent to:

The ISCC Office:
c/o Cynthia J. Sturke, Office Manager
11491 Sunset Hills Road
Reston, VA 20190
tel: 703-318-0263 fax: 703-318-0514
iscc@iscc.com or csturke@aol.com

These requests will then be forwarded to the members of the ISCC Education Committee, Chaired by Professor Margaret Miele. Students will be informed of their decision by April 1, 2006. Be sure to include proof of status as a full-time student with your application.

## Request for Nickerson Service Award Nominations

The Inter-Society Color Council's Nickerson Service Award was established in 1980 to recognize outstanding long-term contributions toward the advancement of the Council and its aims and purposes. The contributions may be in the form of organizational, clerical, technical, or other services that benefit the Council and its members. Candidates for the award must be members of the Council and must have been active in the affairs of the Council. Recent past recipients include: Allan B. J. Rodrigues - 1995, Ann Campbell Laidlaw – 1997, Louis A. Graham – 1998, Danny C. Rich -1999, Hugh S. Fairman -2000, Paula J. Alessi – 2001, Ellen C. Carter -2003, Ralph Stanziola – 2004, and Gultekin Celikiz – 2005.

If you would like to nominate a person for this award please contact Ellen Carter, 1001 North Vermont St, Suite 809, Arlington, VA 22201 or by email at Ellen.Carter@alum.rpi.edu. Nominations must be received before December 31, 2005.

## New NIST Vision Science Research Program

A group of researchers from NIST's Optical Technology Division were awarded funding from the NIST Director to launch the project "Vision Science as a Basis for Optical Metrology." This project, which will begin in the 2006 fiscal year, is strongly supported by the Physics Laboratory and also received support from industrial groups and government agencies, including the National Electrical Manufacturers Association (NEMA), Department of Energy (DOE), Federal Highway Administration (FHWA), Federal Aviation Administration (FAA), and Council for Optical Radiation Measurements (CORM). This funding will support initiation of a state-of-the-art vision science program at NIST, which will be unique among national metrology institutes and national laboratories.

Vision science underlies all photometric and colorimetric measurements and metrics. Vision research capabilities are critical to advance photometry and colorimetry. This program will allow NIST to perform the vision science experiments necessary to develop fundamental metrics optimized for lighting technologies of the 21st century. Burgeoning technologies, such as solid-state lighting, are strongly dependent on available metrics. In some cases the current metrics are inappropriate to new technologies or the necessary metrics do not exist. Product designers and developers optimize products to the standards available. Metrics that accurately take into account human perception are required for new solid-state lighting products to be accepted in the marketplace.

A full-time permanent vision scientist will be hired and a visual testing facility will be created to perform fundamental vision science experiments, initially to support the development and commercialization of solid-state lighting for general illumination and safety lighting. The crux of the new facility will be illumination sources capable of producing nearly any spectral power distribution within the visible range. These spectrally-tunable light sources will be constructed of a large number of high power LED clusters at many different peak wavelengths. The sources will be able to simulate spectra of practically any light source, such as traditional lamps, daylight, blackbody radiation, solid-state sources, and some theoretical spectra such as equal energy, with precise control of chromaticity. This facility will allow NIST to perform vision research related to lighting in a most systematic and well-controlled manner.

At the outset, the focus of the research performed will be to develop a new metric for color rendering of light sources (due to inadequacies of the CIE Color Rendering Index, particularly when applied to solid-state lighting) and to establish an international standard of effective intensity of flashing lights, both of which are urgent for guiding the development of these technologies. NIST will work closely with the industry and international standardizing bodies, such as the CIE. Future work will include studies of mesopic vision, photometric and colorimetric dependencies on illumination level (suprathreshold) and other issues related to fundamental photometric and colorimetric metrology.

*Cameron Miller*
*Optical Technology Division, NIST*

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## Final Call for Nominations Macbeth Award

The 2006 Macbeth Award will be awarded at next year's 75th Anniversary Annual Meeting. The Macbeth Award was established by Mr. Norman Macbeth, Jr. in honor of the memory of his father, Mr. Norman Macbeth. It is presented to a member or former member of the Inter-Society Color Council for one or more recent outstanding contributions in the field of color. The contributions shall be ones that have advanced the field of color, interpreted broadly as in the aims of the Council; see www.iscc.org/PastMacbeth.php. The contribution to color may be direct, it may be in the active practical stimulation of the application of color, or it may be an outstanding dissemination of knowledge of color by writing or lecturing. The recipient of the 2004 Macbeth Award was Dr. Louis D. Silverstein.

If you would like to nominate a person for the Macbeth Award, would you contact Dr. Robert Buckley by email at rbuckley@xeroxlabs.com or by phone at 585-422-1282. Nominations are due December 15, 2005.

# Report: 13th SID/IS&T Color Imaging Conference

## November7-11, 2005, Scottsdale, AZ USA

The 13th Color Imaging Conference (CIC-13), jointly sponsored by the Society for Imaging Science and Technology (IS&T) and the Society for Information Display (SID), drew 256 color scientists and engineers. The high quality of the 60 refereed papers maintains the CIC's reputation as the premier forum for color imaging. This year, the CIC was preceded by the International Color Consortium (ICC) Developers' Conference (Nov. 7) and followed by the ISCC's Special Topics meeting, *Precision and Accuracy in the Determination of Color in Imaging* (summarized elsewhere in the ISCC News).

The CIC tutorials included R. W. G. Hunt's successful two-day class, "Basic Color Science & Imaging," and 12 others: Color Appearance Modeling using CIECAM02 (Nathan Moroney, HP); Spatio-chromatic Vision Models for Imaging (Jan Allebach, Purdue U.); Image Quality Framework and Quantification (Peter Engeldrum, Imcotek); System Interactions in Digital Color Imaging (Raja Bala, Xerox and Gaurav Sharma, U. Rochester); Color Management Concepts for Digital Imaging Systems (Kevin Spaulding, Kodak); Implementing, Testing, and Using ICC v4 Color Management (Ingeborg Tastl and Jack Holm, HP); Device Simulation for Image Quality Evaluation (Joyce Farrell, Stanford); Color in Electronic Displays (Gabriel Marcu, Apple Computer); Color Science for HDTV and Digital Cinema (Charles Poynton, consultant); Color in High Dynamic Range Imaging (Greg Ward, consultant), Color in Medical Imaging (Mostafa Analoui, Pfizer Global Research & Development), and Spectral Imaging (Roy Berns, RIT).

Many sessions at CIC-13 followed the general format of earlier CICs: Spotlight/poster sessions, a late-breaking-news session, and topical sessions on High-Dynamic-Range (HDR) Imaging, Spectral Imaging, Color in Medical Imaging, Color Image Processing, Input Device Characterization, Printing, and Displays. The complete program with abstracts is available at http://www.imaging.org/conferences/cic13/program.cfm. I will describe some brief impressions here.

**Keynotes:** Hiroaki Kotera (Chiba U., JP) began the conference with a keynote presentation, "Intelligent Image Processing," which summarized vision-based approaches to image processing. Such approaches begin with sharpening through center-surround processing, extend through multiple resolution levels in multi-scale Retinex processing, and include local-contrast range transformations to convey the impression of a high-dynamic-range image through a lower-dynamic-range rendering device. Of course, Kotera also included nuances of color management. His dynamic and colorful slide presentation was impressive.

In "Color display technology: from pixels to perception," Louis D. Silverstein (VCD Sciences, Inc.) summarized a career of co-evolving his human-factors solution strategies (e.g., in displays for the Boeing 757/767 aircraft) with the maturing display technology (to which he has also contributed). After presenting an involved tree-structure for display evolution, he called active-matrix LCDs "the 800 pound gorilla" that will overpower all other display technologies. He also discussed ways to enhance the visual quality of displays, ranging from spatio-temporal sub-pixel options to multiprimary displays. Among the multiprimary displays he noted were prototypes of field-sequential-color DLP and LCoS projectors, of spatial-mosaic AMLCD direct-view displays, and of hybrid spatial/temporal configurations. Also, Lou discussed a number of three-primary displays with expanded gamuts, and pointed to a metric developed by R. W. G. Hunt wherein the three-primary solutions appear better than solutions with more than three primaries. For mobile displays, Lou pointed to a shift toward emissive rather than reflective and transflective technologies. Finally, he described some emerging technologies: OLEDs, electronic ink, and interferometric modulators.

Paul Hubel described "Foveon technology and the changing landscape of digital camera technology." Foveon X3 is a colorimeter on a chip (an expensive one) in which, for each pixel, the red, green, and blue sensors are in a vertical stack on a single piece of silicon (thereby enhancing resolution on all color planes). However, the Foveon camera is not designed to generate tristimulus values. Three years ago Paul gave a CIC paper in which he noted that a single filter over the camera makes the camera sensitivities tolerably close to color-matching functions. More startling to me was that the filter over the camera is itself even closer to a color-matching function. Why? In his talk, Paul cited my question and answered it by saying he had no idea why it worked out that way, not even with multiple generations of wisdom. (His father, David Hubel, is a Nobel-Prize-winning visual physiology researcher.) Hubel sees the future of Foveon technology in both high- and low-end cameras, especially where high dynamic range and high resolution are important.

**Special Presentation**: Michael Bourgoin (Microsoft) offered the first public disclosure of the new Windows Vista operating system. Bourgoin assured us that Microsoft's product, developed jointly with Canon, will use ICC profiles without difficulty. The main virtues of Microsoft's new system are flexibility of device profiles, XML, open source, gamut management, and 3rd party plug-ins. The algorithms are available now via NDA, and as soon as the product is released they will be freely available on the Microsoft website. One problem I saw was the reliance on CIECAM02 as the profile-connection space. That space has instabilities (regions of non-invertibility), "not-a-number" evaluations, and potential divisions by zero. Li and Luo in April 2005 pointed to such instabilities and these were explored in a poster

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(I. Tastl, N. Moroney, J. Holm, HP Labs, "ICC color management and CIECAM02," which won the conference Cactus Award) and in a late-breaking-news paper (M. Shaw and R. Guay, "Dealing with imaginary color encodings in CIECAM02 in an ICC workflow"). After his talk, Bourgoin told me that Microsoft had modified CIECAM02 for its purposes, so the problems may be ameliorated.

**Evening Address:** David Tobie (Datacolor/ ColorVision) gave an engaging talk, "Shortcuts and detours: how photographers actually manage color." The audience resonated strongly with David's experiences trying to sell color management to photographers——either in consultation or in instrument form. Color-management products have had to adapt to certain preferences of photographers, such as using RGB instead of CMYK printers. To highlight the emerging salience of RGB over CMYK, David presented a slide called "Cyanosaurus Wrecks," featuring offset cyan, magenta, yellow, and black copies of a dinosaur picture. He pointed to affordable monitor calibrators as a way to raise the consciousness of professional photographers.

**Sessions of Special Note:** A highlight of CIC-13 was Tuesday's session on color in medical imaging. Kristin Dana (Rutgers U.) gave an invited paper, "Computational skin models," in which she discussed texture analysis and polarization multiplexing. The latter, which is amenable to false-color encoding, gives a good noninvasive way to see structures in depth: light scattering from the depths is not polarized. This could be a good way to see tooth structure as well as skin lesions. After the invited paper, Wen Luo (Leeds University, UK) reported a modified CIE whiteness formula that is empirically better for dentistry than the usual one, Masahiro Yamaguchi (Tokyo Inst. of Technology) talked about multispectral color imaging for dermatology, and Pinky Bautista (Tokyo Inst. of Technology) discussed a kind of colorization called digital staining of pathological tissue specimens using PCA-based feature extraction.

The conference closed with a session on basic vision science. Jan Morovic (HP, ES) and Peter Morovic (U. East Anglia, UK) asked, "Can highly chromatic stimuli have a low color inconstancy index?" Their answer was no, at least through standard chromatic-adaptation and color-difference models. Then Boris Oicherman (at Leeds, with coauthors Ronnier Luo, Arthur Tarrant, and Alan Robertson) discussed the uncertainty of inter- and intra-observer color-matching data. Despite the low luminance level of the matches (mesopic at about 3 cd/$m^2$), Oicherman's data is fundamental and will be important to test the transformability of primaries in CIE TC1-56, "Improved Colour Matching Functions." Finally, Mark Fairchild and Garrett Johnson (RIT) measured and demonstrated visual adaptation to such image artifacts as blur and added point-noise. When one looks awhile at two images, presented side-by-side, that differ only in artifact severity, our vision adapts to the artifacts. Then, when two identical images with an intermediate artifact severity are positioned where the adapting images were, the new image in the location of the severely impacted adapting image looks better. As Fairchild emphasized, this effect is similar to chromatic adaptation in that novel stimuli are salient. Fairchild is now looking at the intriguing concept of "channel-free adaptation" to describe these effects.

In 2006, CIC-14 will be held in Scottsdale's Chaparral Suites Resort on November 5-10. I've already marked my calendar.

*Michael H. Brill, Datacolor*

## CGIV 2006
## IS&T's Third European Conference on Colour in Graphics, Imaging and Vision

The Third European Conference on Colour in Graphics, Imaging, and Vision to be held at the University of Leeds, UK, June 19-22, 2006. CGIV 2006 will cover a wide range of topics related to colour and visual information. Its single-track structure will encompass technical areas that strike a balance between academia and industry. CGIV 2006 builds on the success of two previous conferences—CGIV 2002 (Poitiers, France) and CGIV 2004 (Aachen, Germany)—and will provide an excellent forum for scientists to discuss new ideas, exchange results, and establish possible future collaborations. Newcomers will discover the scope of exciting colour-related research areas and be able to discuss ideas with world-renowned experts.

Keynote speakers and the topics are Robert Hunt, "Colour Science," Roger Hersch, EPFL, "Colour Reproduction/Colour Image Processing" and Jan Koenderink, Utrecht University, The Netherlands, "Human Perception."

Technical Areas and the Session Chairs are:

Colour Science (Roy Berns, RIT, USA)

Computational Colour (Reiner Lenz, Linköping University, Sweden)

Colour in Computer Graphics (Werner Purgathofer, TU Wien, Austria)

Colour Vision/Psychophysics (Anya Hurlbert, University of Newcastle, UK)

Colour Image Quality (Christine Fernandez-Maloigne, University of Poitiers, France)

Colour Image Processing (Dietrich Paulus, University of Koblenz, Germany)

Multispectral Imaging (Yoichi Miyake, Chiba University, Japan)

For additional information, please see: www.imaging.org/conferences/cgiv2006/ or contact IS&T, 7003 Kilworth Lane, Springfield, VA 22151; Phone: 703-642-9090; Fax: 703-642-9094, and email: cgiv@imaging.org or contact IS&T Europe Phone: +32 0473 89 33 66, email: ISandTEurope@imaging.org.

# ISCC Special Topics Conference Report

A Special Topics Conference was held on *Precision and Accuracy in the Determination of Color in Imaging* in Scottsdale, AZ on November 11-12, 2005. The program chairs were Danny Rich, Sun Chemical Corporation and John McCann, McCann Imaging. The conference consisted of a day and a half of presentations on the topics of *The Problem of Fluorescence*; *Repeatability, Reproducibility, & Traceability*; and *Standardization in the Measurement of Images*.

On the first day, Patrick Emmel, Clariant gave an "Introduction to Fluorescence & Optical Brighteners" for his keynote lecture during the *Fluorescence* session. He gave an overview of fluorescence and optical brighteners, as well as a discussion of the modeling and measurement of them. Danny Rich described an experiment that he conducted on "The Effect of Brightened Substrates on Color Management." One finding was that halftone and dithered prints, as well as prints with translucent and transparent inks, were more affected by fluorescence in the paper than solid ink prints because of the paper showing through next to, and through, the dots. Claudio Puebla, Axiphos discussed "Compensating or Correcting for Brightened Substrates," where it was concluded that a fluorescent sample could never fully match a non-fluorescent sample due to metamerism. Before the close of this session, Mahnaz Mohammadi described "An Abridged Method for Multispectral Fluorescence Imaging," which was based on her proposed PhD work at RIT. Mahnaz concluded that spectral radiance of fluorescent pigments can be reconstructed using the abridged spectrophotometer; however, the accuracy depends on the excitation and emission filters that are selected.

Day Two began with a keynote by Maria Nadal, NIST. In addition to discussing "Uncertainties in the Measured Color Caused by the Measuring Instrument," she described NIST's Spectral Tri-function Automated Reference Reflectometer (STARR) instrument, which is the absolute standard for reflectance measurements in the United States.

The next two presentations were based on work by Danny Rich and Dave Wyble, RIT. They dealt with the repeatability and reproducibility of instruments and much of the research was analyzed using multivariate statistics as outlined in ASTM E2214-02. Their work showed that multivariate statistics could be useful for describing distributions in data that would not otherwise have been seen using classic color difference metrics. In addition, all of the 12 instruments tested were significantly different from the others showing that there is a complete lack of inter-instrument agreement.

The next presentation in the session on "Repeatability, Reproducibility, & Traceability" was by Charles Leete, Collaborative Testing Services. He described the methods employed by CTS to measure the inter-laboratory performance of color measurement instruments. Tuo Wu, Hewlett Packard described how HP uses CTS samples as a basis for their own "Validation of Colorimeter Performance in the Field." Since it would be extremely expensive to send every HP instrument to CTS, they send only one from each site and then use those samples to test other instruments. HP found that using this method, and their modified analysis, they could identify instruments failed by CTS at a 100% success rate. The final presentation in this session, by Jack Ladson, consisted of a discussion on Mean Plus™, a software package that can improve intra- and inter-instrument correlation, even between instruments by different manufacturers or with different geometries.

The session on the *Standardization in the Measurement of Images* began with a keynote by John McCann on the "Measurement of Radiances from Picture Elements in High Dynamic Range Images." He gave a history of radiance measurement and high dynamic range in real scenes, beginning with Ansel Adams Zone System. McCann's examples of high dynamic range images processed using Retinex were striking. Réjean Baribeau, the National Research Council of Canada discussed "Predicting Color Corrections from the Measured Spectral Response of a Colorimeter," which focused on a method for characterizing a color measurement instrument using a monochromator. Jeffrey DiCarlo, HP discussed trade-offs relating to the calibration of image capture devices and discussed ways to increase accuracy and consistency of the calibration of these devices. Finally, Mark Fairchild's presentation on "Using HDR Technology and Color Appearance Modeling to Create Display Color Gamuts That Exceed the Spectrum Locus" showed a new idea on how to display images with colors that are *perceived* to be outside the gamut of the display, and therefore appear fluorescent.

This conference, while small, seemed to be stimulating to its audience. The presentations often inspired questions before the presentations were complete which gave the conference a more casual and interactive feel. This was my first attendance at an ISCC conference. I look forward to attending more conferences of this type in the future.

*Ellen A. Day, Pantone, Inc.*

# ISCC 2006 Annual Meeting Calls for Papers

All three interest groups are soliciting papers for the ISCC 2006 Annual Meeting, Ottawa, Ontario, Canada, May 14-15, 2006. The meeting is co-located with the ISCC-CIE Expert Symposium and celebration of 75th anniversary of the Standard Observer. The emphasis will be on the standardization of color measurement, but contributions in all areas of color are encouraged.

**Interest Group I: Basic and Applied Research**

Interest Group I centers on research in all fields of color, such as color vision, color order systems, standardization of color measurements, and color instrumentation. Join Dr. Michael H. Brill of Datacolor, Dr. Joanne Zwinkels of National Research Council of Canada, and Dr. Maria E. Nadal of NIST and make your own 30 minute presentation. Mike will start the program with a talk titled "Ten Commandments for Standardized Model Making."

**Interest Group II: Industrial Application of Color**

Interest Group II focuses on the technical challenges and possible solutions that face industries in the commercial application of color. Abstracts are currently being sought for papers with topics that may include but are not necessarily limited to: color reproduction, color management, quality control practices, color tolerancing, color and appearance measurement issues, best formulation practices or other related industrial color application challenges.

**Interest Group III: Art, Design and Psychology**

Interest Group III probes the use of color in areas for which affect is key, ranging from advertising to artistic expression.

**Poster Session**

The Poster Session encompasses the topics of all three Interest Groups and provides a forum to demonstrate research results in a more intimate setting. Poster presenters are encouraged to incorporate visual aides such as instrumentation, laptops, and samples. Student submissions are encouraged; a $100 prize will be awarded to the best student poster. (Proof of full-time student status is required.)

**Abstract Submission**

Please send your one-page abstract to the appropriate session chair, listed below. Abstracts are due January 31, 2006. Also, please include a brief author biography.

Interest Group I: Milt Hardt, Chair IG-I
milhar@ccicolor.com, (773) 475-2576

Interest Group II: Jerry Dimas, Chair IG-II
jerdim@ccicolor.com, (773) 638-1400

Interest Group III: Marcia Cohen, Chair IG-III,
marcia.cohen@woodruffcenter.org

Poster Session: Karen Braun, Poster Chair,
karen.braun@xerox.com, (585) 422-6380

# 2nd Call for Papers for the ISCC-CIE Expert Symposium on the Standard Colorimetric Observer

To celebrate the 75th Anniversary of the CIE Standard Colorimetric Observer, the ISCC and the Canadian National Committee of the CIE are hosting an Expert Symposium on May 16-17, 2006 at the National Research Council in Ottawa, Canada. The Symposium will anchor a week of events starting with the Annual Meeting of the ISCC and ending with meetings of CIE Division 1, "Vision and Colour."

The goals of the Symposium are to recall the many advances that have been made since the introduction of the Standard Colorimetric Observer, to understand the current state of colorimetry and colour appearance, and to provide guidance on directions for future work. Several prominent speakers have already committed to speak. These include Robert Hunt on the past and future of CIE colour appearance models, Michael Brill on the validity of Grassmann's Laws, Jay Enoch on studies on colorimetry in Stiles' laboratory at NPL, Mark Fairchild on colour appearance in image displays, Ronnier Luo on colour difference formulae: past, present and future, Janos Schanda on possible future CIE recommendations on colorimetry, and Todd Newman on colour management.

Authors are invited to submit two-page extended abstracts of their proposed contributions in English according to the submission instructions. Word versions of the submission form and a template for the extended abstract are also available. Extended abstracts should be sent by e-mail or post to the Chair of the Technical Program of the Symposium no later than 15 January 2006.

Dr. Alan Robertson
National Research Council
1200 Montreal Road
Ottawa, Ontario K1A 0R6
CANADA
Email: alan.robertson@nrc-cnrc.gc.ca

For more information, visit the Symposium website at http://www.jubilee2006.org.

**Tulip Time on the Rideau Canal**
**Ottawa, Canada**

## Color Research and Application In This Issue, December 2005 (Vol. 31, Issue #6)

Color is often used to communicate danger or caution regardless of language. Therefore safety colors should be easily detectable under almost any possible circumstance. We need to find the information in what can be a very complex visual environment. The first article in this issue is concerned with the safety colors of red, orange, and yellow. In "Effects of Surrounding Brightness on Visual Search for Safety Colors," Nobuhisa Ochiai and Masako Sato report on research about visual search for safety colors in complex fields at various luminance levels. The orange target becomes the focus of the results because the search efficiency for the orange target changed the most with changes in the surrounding conditions.

Besides seeking to understand more about the human visual system, researchers also look for new experimental techniques and improved instruments. The advent of computer displays for color presentation has increased the speed and efficiency of preparing and presenting visual stimuli to observers in experiments. Réjean Baribeau and Alan R. Robertson use a high resolution CRT with feedback from a spectroradiometer to measure the color discrimination thresholds of human observers. In "Estimation of hue discrimination thresholds using a computer interactive method," besides reporting a hue dependence in the blue to purple region of color space that is not corrected by the weighting function of the CIEDE2000 formula, the authors contend that there is an additional benefit of the technique that they use. Their method measures color discrimination at the sub-threshold level. Thus, this supplements the threshold and supra-threshold data reported by other authors.

Moving to a study of chromatic vision, our next author, María L. F. de Mattiello, wanted to study: 1) the lack of additivity of brightness, 2) shifts in the maximum color-matching-function peaks, 3) variations in luminance, 4) strong metamerism of mixtures, and 5) the chromatic opponence with new data from her laboratory. This was done by the "Comparison of Different Monoptic and Dichoptic Color Matching Functions." The results reflect two important facts: the stability of the visual system and the plasticity based on the balance of the retinal illumination.

In the last issue Nobuhito Matsushiro and Noboru Ohta provided Part III of an article on "Theoretical Analysis of Subtractive Color Mixture Characteristics." In this issue, in "Part IV – Theorems on Ideal Color and Tristimulus Dimension" one of the authors, Dr. Matsushiro, reports on the continued theoretical developments toward a comprehensive modeling of subtractive color mixture. The one-dimensional theory discussed in Part III is extended to three dimensions and the theorems are used to establish the absolute lower and upper bounds for tristimulus values of subtractive color mixtures of ideal colors.

For our fifth article, we turn to Behnam Bastani, Bill Cressman, and Brian Funt of Simon Fraser University in Vancouver, Canada. Because different users, or even the same user using more than one display, would like to have consistent color across displays, accurate color management is important. In "Calibrated Color Mapping between LCD and CRT Displays: A Case Study," the authors study two CRT monitors, three LCD monitors and two LCD projectors to evaluate characterization models. This article reviews the implementation, benefits and pitfalls of each method, the characteristics of each type of device, the implementation details, and finally the results of this study.

The next article reports on a technique that uses diffuse reflectance to analyze murals in situ and to identify the pigment used in them. José Antonio Fernández Fernández and José María Fernández Rodríguez use the data to describe the color, then use Kubelka-Munk analysis and its derivatives to get semi-quantitative analysis of the pigments, which then is supported by X-ray diffraction analysis. For this research they used murals in two rooms of a villa at El Ruedo located in Almedinilla in Córdoba, Spain. In their article "Application of the Second Derivative of the Function Kubelka-Munk to the Semiquantitative Analysis of Roman Paintings," they report that generally each color was produced by a single pigment. They could also usually discriminate mixtures as long as the peak intensities in the derivatives were significant and the peak overlap was limited.

For our Industrial Application in this issue, we move to the area of food where color is used both as a basis for evaluation of food quality as well as an indicator of several biochemical processes, including oxidation, browning, ripening, or as a predictor of good quality stability. A team of researchers including F. J. García, Pérez, Y. Lario, J. Fernández-López, E. Sayas Barberá, J. A. Pérez-Alvarez, and E. Sendra Nadal from the University of Miguel Hernández in Alicante, Spain, report on their studies of the "Effect of Orange Fiber Addition on Yogurt Color during Fermentation and Cold Storage."

In the Communications and Comments Section, Jack A. Ladson and Hugh Fairman review the color matching computers developed by Davidson and Hemmendinger. They then describe the COMIC III, which is an outgrowth of the original analog color matching computer, but extended and modified for modern computers as an educational training tool.

Next we look to the new literature with reviews of two books: *Color Appearance Models, 2nd Edition* by Mark Fairchild and reviewed by Michael H. Brill, and Hunt's 6th Edition of *Color Reproduction* reviewed by Jack A. Ladson. Publications that are briefly mentioned are *CIE*

*Continued on page 9*

*Continued from page 8*

*Publication 165 CIE 10 Photometric Observer* and the Comic III.

Allan B. J. Rodrigues reports on the AIC 2004 Interim Conference that was held in Porto Alegre Brazil, and the upcoming technical meetings relating to the 75th Anniversary of the Inter-Society Color Council and CIE Standard Observer 75th Birthday Celebrations are announced including a call for papers. Finally, we close with our Annual Index.

*Ellen Carter*
*Editor, Color Research and Application*

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## GIA's Fall *Gems & Gemology* Issue

The Gemological Institute of America (GIA) has released the Fall 2005 edition of its award-winning quarterly journal, *Gems & Gemology*. This issue features a must-read review of recent developments in the diamond industry, a look at experimental CVD synthetic diamonds recently grown in a French research laboratory, and a study of inclusions in transparent rhodonite from Broken Hill, Australia.

The world diamond industry has seen a number of dramatic changes since the end of the 1980s. Dealers and retailers alike are facing challenges as never before including the shift to a multi-channel rough pipeline, the advent of commercially viable synthetics, the Kimberley Process, the popularity of large "bling-bling" jewelry, new manufacturing techniques, and the explosion of diamond branding. In the lead article, "A Review of the Political and Economic Forces Shaping Today's Diamond Industry," GIA Senior Industry Analyst Russell Shor examines these and other key developments that have transformed the diamond industry in the past 15 years.

The second feature article, "Experimental CVD Synthetic Diamonds from LIMHP-CNRS, France," addresses one of gemology's hottest topics: synthetic diamonds grown by the chemical vapor deposition (CVD) method. In it, GIA researcher Dr. Wuyi Wang and colleagues analyze six synthetic diamonds grown for research purposes at the French Laboratoire d'Ingénierie des Matériaux et des Hautes Pressions.

Also in this issue is an article by Paul W. Millsteed and co-authors on inclusions in transparent gem rhodonite from the famous mining area of Broken Hill, New South Wales, Australia. In this report, inclusions in Broken Hill rhodonite are identified for the first time using Raman spectroscopy and gemological/petrographic techniques.

To order the new issue or to subscribe, visit www.gia.edu/gemsandgemology, or email Circulation Coordinator Debbie Ortiz at dortiz@gia.edu. Call toll-free 800-421-7250, ext. 7142. Outside the U.S. and Canada, call 760-603-4000, ext. 7142.

## Printing Technology SPb06 Abstract Deadline Extended

The abstract deadline for Printing Technology SPb06, an international conference organized by the St. Petersburg (Russia) State University of Technology and Design and cosponsored by IS&T, has been extended. The updated Call for Papers has been issued and can be accessed via http://www.imaging.org/conferences/SPb06.

Conference topics include:

a. Traditional approaches to and new methods of prepress, press, and post-press production

b. Developments in Printing Consumables and Equipment

c. Color in Printing; and

d. Print quality and process control instrumentation

We encourage all interested parties to submit abstracts to the conference committee following the guidelines in the call and to participate in this exciting international conference. For futher information, contact

St Petersburg State University of Technology and Design (SUTD), 18, Bolshaya Morskaya Str., St Petersburg, 191186, Russia. Tel./ fax: +7(812)3151474, additional fax: +7(812)3157470, email: printspb@sutd.ru, or http://www.imaging.org/conferences/SPb06/.

## A "Perfect Lens?"

In the Journal *Nature* (Vol. 438, pp 335-338, Nov. 17 2005) Grigorenko, Geim, Gleeson, Zhang, Firsov, Khrushchev and Petrovic report that they have made nanofabricated media with negative permeability at visible frequencies. The media consists of electromagnetically coupled pairs of gold dots with geometry carefully designed at a 10-nm level. They state their results demonstrate the feasibility of engineering magnetism at visible frequencies and pave the way towards magnetic and left-handed components for visible optics. These materials may make possible subwavelength imaging as Smith, Pendry, and Wiltshire point out in *Science*, Vol. 305, pp 788-92, 2004, in an article titled "Metamaterials and Negative Refractive Index." Smith et al, write that for a slab of negative index material under idealized conditions, an image plane exists that contains a perfect copy of an object placed on the opposite side of the slab.

**NOTICE: New ISCC Office Email Address: iscc@iscc.org**

The email for the ISCC office, and particularly Cynthia Sturke, Office Manager, has been changed to iscc@iscc.org. This email address is effective now. Although the old address, iscc@compuserv.com, will still be received by the office for a short period of time, please note the new email in your email address book to ensure delivery of your email.

## CALENDAR

Please send any information on Member-Body and other organization meetings involving color and appearance functions to:

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**703-318-0263 tel 703-318-0514 fax**
iscc@iscc.org **website:** http://www.iscc.org

### 2006

**Jan 8–10** **IESNA Annual Conference**, Marriott Marquis Hotel, New York City, NY, 212-248-5000, www.iesna.org/programs/meetings_calendar.cfm

**Jan 11-12** **Introduction to Textile Testing Workshop, AATCC,** Research Triangle Park, NC, 919-549-8141, www.aatcc.org

**Jan 22-25** **ASTM E12, Color and Appearance,** Embassy Suites Hotel, Ft. Lauderdale, FL, 610-832-9585, www.astm.org

**Mar 18-22** **NAPIM Convention**, La Costa Resort & Spa, Carlsbad, CA, 732-855-1525 www.napim.org

**Mar 19-21** **TAGA 2006**, Vancouver, Four Seasons Hotel, Vancouver, British Columbia, Canada, 585-475-7470, www.taga.org

**April 4-6** **Color Technology and Design,** Detroit Colour Council/Coatings Research Institute, Eastern Michigan University, www.detroitcc.org

**Apr 7-11** **CMG's Spring International Conference,** Color Marketing Group, Denver, Colorado**,** 703-329-8500, www.colormarketing.org

**Apr 18-20** **Color Pigments 2006 - A Global Perspective,** Color Pigments Manufacturers Association, Inc., 703-684-4044, Hotel InterContinental, Chicago, Illinois, cpma@cpma.com, www.pigments.org/index.php?id=61

**Apr 25-27** **Coating and Graphic Arts Conference and Exhibit - 2006 TAPPI**, Atlanta Marriott Marquis Atlanta, Georgia , www.tappi.org

**May 1-5** **Prospecting for Geospatial Information Integration**, **asprs,** The Imaging and Geospatial Information Society, Reno Hilton Hotel, Reno Nevada, 301-493-0290, www.ASPRS.org

**May 2-4** **AATCC Spring Committee Meetings,** Research Triangle Park, NC, 919-549-8141, www.aatcc.org/AATCCinfo/committees/committees.cfm

**May 9-11** **CORM 2006 Annual Conference, Industry and National Metrology Institutes: Partners in Light Measurement Problem Solving**, National Institute of Standards and Technology Gaithersburg, MD, 440-542-8042, www.corm.org, CORM2006_information.shtml

**May 7-12** **2006 International Congress of Imaging Science (ICIS 2006),** Hyatt Regency Hotel, Rochester, New York, 703-642-9090, www.imaging.org/conferences/icis2006

**May 14-15** **ISCC 2006 Annual Meeting,** Ottawa, Canada, 703-318-0263, www.ISCC.org, iscc@iscc.org

**May 16-17** **CIE Expert Symposium on the Standard Observer**, National Research Council, Ottawa, Canada, www.iscc.org/jubilee2006, iscc@iscc.org

**May 18-19** **CIE Division I Meeting,** Ottawa, Canada, www.bio.im.hiroshima-cu.ac.jp/~cie1

**May 23-26** **IS&T Archiving Conference**, Ottawa, Canada, 703-642-9090, www.imaging.org/conferences/archiving2006/

**2006, Continued**

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|---|---|
| **Jun 4-9** | **SID 2006 International Symposium, Seminar, and Exhibition**, Moscone Center, San Francisco, California, USA, 212-460-8090 ext. 202, www.sid2006.org |
| **Jun 14-16** | **ASTM E12, Color and Appearance**, Sheraton Centre Toronto; Toronto, ON CAN, 610-832-9500, www.astm.org |
| **Aug 26-27** | **Gemological Research Conference,** San Diego, California, www.symposium.gia.edu |
| **Aug 27-29** | **4th International Gemological Symposium,** San Diego, California, www.symposium.gia.edu |
| **Sept 17- 22** | **NIP22: International Congress on Digital Printing Technologies**, IS&T, Hyatt Denver Convention Center Hotel, Denver, Colorado, 703-642-9090, www.imaging.org |
| **Oct 8 -12** | **Frontiers in Optics 2006, The 90th OSA Annual Meeting Laser Science XXII**, Rochester Riverside Convention Center, Rochester, New York, 202-223-8130, www.osa.org |
| **Oct 24-27** | **"Colour in Culture and Colour in Fashion," AIC 2006**, Interim Meeting, Misty Hills Country Hotel and Conference Centre, Johannesburg, South Africa, www.colourgroupsa.org.za, |
| **Nov. 1-3** | **International Coatings Expo, ICE 2006,** Federation of Societies of Coatings Technology, (FSCT), 610-940-0777 email: fsct@coatingstech.org, www.coatingstech.org |

**2007**

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| **Jan 23-25** | **ASTM E12, Color and Appearance**, Embassy Suites Hotel; Ft. Lauderdale, FL, www.astm.org |

## Publications Available from ISCC Office

**Color and Light** by Fred W. Billmeyer Jr. & Harry K. Hammond., III. Authorized reprint from: ASTM Manual 17, Copyright 1996, ASTM International, 100 Bar Harbor Dr., W. Conshohocken, PA 19428.

..... $5 ea or 20 copies/$50.00

**Demystifying Color** by Bob Chung, 11 pages. Discusses and explains ten myths about color.

..... $5 ea or 20 copies/$50.00

**Proceedings-9th Congress of the International Colour Association, AIC Color 01 Rochester,** Allan Rodrigues, Ed., papers given at technical sessions...$75*

**Guide to Material Standards and Their Use in Color Measurement (ISCC TR-2003-1)**. The Guide, developed by ISCC Project Committee 51, provides an introduction to material standards and their use for the standardization of color measuring instruments. ..... $50*

*Plus shipping and handling

## Advertising Policy

The ISCC advertising policy for the ISCC News is as follows: Pre-paid color-related advertising will be accepted 30 days in advance of the publishing date. The rates are:

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| **$ 100** | **business card-size ad** |
| **$ 250** | **1/4 page ad** |
| **$ 500** | **1/2 page ad** |
| **$ 1,000** | **full page ad** |

The editor reserves the right to determine the acceptability of the advertising. A 20% discount is available for a yearly contract.

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All submissions must be in English. Please submit materials by the first of each even numbered month. Materials submitted later may be printed in the following issue.

# ISCC Sustaining Members

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|---|---|---|
| **BYK-Gardner USA** | www.bykgardner.com | **301-483-6500** |
| **Ciba Specialty Chemicals** | www.cibasc.com | **302-633-2042** |
| **Color Communications, Inc.** | www.ccicolor.com | **773-638-1400** |
| **Datacolor** | www.datacolor.com | **609-895-7432** |
| **DuPont Performance Coatings** | www.dupont.com | **248-583-8345** |
| **Flex Products, Inc.** | www.colorshift.com | **707-525-7337** |
| **GretagMacbeth, LLC** | www.gretagmacbeth.com | **800-622-2384** |
| **Hewlett-Packard Company** | www.hp.com | **650-857-6713** |
| **Hunter Associates Laboratory, Inc.** | www.hunterlab.com | **703-471-6870** |
| **IsoColor Inc.** | www.spc-software.com | **201-935-4494** |
| **Konica Minolta** | www.konicaminolta.us | **201-574-4000** |
| **Labsphere, Inc.** | www.labsphere.com | **603-927-4266** |
| **Pantone, Inc.** | www.pantone.com | **201-935-5500** |
| **PPG Industries, Inc.** | www.ppg.com | **724-274-3532** |
| **Prime-Color, Inc.** | watprime@hotmail.com | **908-272-5759** |

# ISCC Member Bodies

**American Association of Textile Chemists and Colorists (AATCC)**
**American Society for Testing and Materials International (ASTM)**
**American Society for Photogrammetry & Remote Sensing (ASPRS)**
**The Color Association of the United States, Inc. (CAUS)**
**Color Marketing Group (CMG)**
**Color Pigments Manufacturing Association (CPMA)**
**Council on Optical Radiation Measurements (CORM)**
**Detroit Colour Council (DCC)**
**Federation of Societies for Coatings Technology (FSCT)**
**Gemological Institute of America (GIA)**
**Graphic Arts Technical Foundation (GATF)**
**Illumination Engineering Society of N. America (IESNA)**
**National Association of Printing Ink Manufacturers (NAPIM)**
**Optical Society of America (OSA)**
**Society for Information Display (SID)**
**Society of Plastics Engineers, Color & Appearance Div.(SPE)**
**Society for Imaging Science and Technology (IS&T)**
**Technical Association of the Graphic Arts (TAGA)**

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