ICANS25 Tutorial and Workshop Program

An excellent set of tutorials for students and young investigators will be given at the start of the ICANS25 conference, on Sunday, August 18, covering a wide range of fundamental and applied topics in amorphous and nanocrystalline semiconductors. There will be two plenary sessions in the morning on charge transport in disordered materials and photovoltaics, and three parallel sessions in the afternoon specializing in thin film silicon and oxides, chalcogenides, and organic semiconductors. Refreshments and lunch will be provided to participants as part of the tutorial registration fee.

Tutorials will be held on the St. George campus of the University of Toronto, located in the center of downtown Toronto. All sessions will take place in the Bahen Center for Information Technology conveniently located in the south-east section of the campus (Bahen Center for Information Technology, 40 St George St, Toronto, ON M5S 2E4, Canada).

Plenary Tutorial 1

Generation, Transport, and Recombination of Charge Carriers in Amorphous Semiconductors

8:30 AM – 10:00 AM
Sunday August 18th, 2013

Lecturer: Sergei Baranovski,
Philipps Universität Marburg, Germany

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1130

Abstract

Interest in the optoelectronic properties of amorphous organic and inorganic semiconductors has been steeply growing in the last decades. This is caused by successful current applications of such materials in various devices and by their promise for future applications, particularly for large-area devices. Amorphous semiconductors dominate already the electrophotographic image recording on the industrial scale and they are becoming more and more important for applications in light-emitting diodes, in field-effect transistors, and in solar cells. The processes of charge carrier generation and recombination play the decisive role for device applications of amorphous materials. The current state of research related to these processes will be reviewed in the talk. Particular attention will be devoted to charge generation in organic semiconductors, where the high binding energy of electron-hole pairs hinders charge generation, and to recombination of carriers in inorganic amorphous materials, which in some cases does not fit into the general Onsager model.

Plenary Tutorial 2

Thin-film Photovoltaics

10:30 AM – 12:00 AM
Sunday August 18th, 2013

Lecturer: Sigurd Wagner,
Princeton University, USA

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1130

Abstract

Thin-film solar cells are attractive for their potentially low cost of materials and fabrication processes. When these advantages combine, developing a competitive thin-film photovoltaic technology requires substantially less investment than bulk silicon PV has needed. All solar cells function by photon-driven charge separation in energy and in space; these translate to voltage and current. Thin films of semiconductors deposited over large surface areas contain many defects, which hurt charge collection. I will examine thin-film silicon, CdTe, Cu(In,Ga)Se_2, and organic cells for their ability to generate photocurrent, and also to identify cell-specific challenges. Then I will conclude with a personal outlook.

Tutorial Session A

Chalcogenides

Tutorial A1

Chalcogenide Semiconductors: Fundamental Physics

1:00 PM – 2:30 PM
Sunday August 18th, 2013

Lecturer: Koichi Shimakawa
Gifu University, Japan

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1200

Abstract

Chalcogenide glassy semiconductors (g-CGs) have unique electronic and optical properties among other disordered matter. After the introduction of well-established issues, e.g. electronic transport, optical properties, and the nature of defects, the following will be discussed: 1) unique features found in g-CGs, photoinduced effects, e.g. photodarkening, photoexpansion, and photoinduced defect creation, 2) the

Meyer-Neldel (compensation) rule found in the carrier transport, and 3) recent topics of on electronic properties (0–THz–IR frequency range) in phase change materials. Overall physical properties on g-CGs can be well understood through studying the above issues.

Tutorial A2

Chalcogenide-Based Phase-Change Memory Devices

2:45 PM – 4:15 PM
Sunday August 18th, 2013

Lecture: John Robertson
University of Cambridge, UK

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1200

Abstract

Phase change materials are generally GeSbTe alloys. They have a crystalline phase and an amorphous phase with almost the same energy, and they can change rapidly (<10 ns) between these phases on thermal activation. They were developed for rewritable DVDs by Panasonic, and are now being developed for phase change non-volatile electrical memories (PCRAM). They are poor glass formers. They are unusual because, unlike a-Si, they have very different bonding in their crystal and amorphous phases, although the nearest neighbor coordinations are no so different. This leads to a significant difference in refractive index, called optical contrast. The second difference is that they have vey different electrical resistivities, as used for PCRAM. I will review their atomic structures, models of bonding, electronic structures, phase change mechanism, and electrical properties. A further unusual feature is that these materials are 'fragile glass formers', in which the viscosity and diffusion deviate from the Einstein relation near the glass transition, similar to poor glasses like metallic glasses or organic molecular glasses, and unlike a-SiO2 or a-Si.

Tutorial Session B

Thin Film Silicon and TCO

Tutorial B1

Amorphous Oxide Semiconductor TFTs and Applications

1:00 PM – 2:30 PM
Sunday August 18th, 2013

Lecturer: Arokia Nathan
University of Cambridge, UK

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1210

Abstract

Amorphous oxide semiconductor thin film transistors (TFTs) exhibit high transparency as well as high electron mobility even when fabricated at room temperature. These properties make oxide semiconductors a promising candidate for a new generation of applications where speed and transparency are essential requirements. While the oxide TFT shows a better dark-stability compared to amorphous silicon TFTs, it is optically unstable due to persistent photoconductivity believed to be due to ionization of oxygen vacancies located at the sub-gap. Although performance issues related to instability still remain, the attractive feature of the oxide TFT technology lies in process simplicity and relatively high device mobility. This tutorial will discuss the development of oxide TFTs for large area electronics with specific focus on display and imaging applications.

Tutorial B2

Thin Film Silicon Electronic Devices

2:45 PM – 4:15 PM
Sunday August 18th, 2013

Lecturer: Jin Jang
Kyung Hee University, Republic of Korea

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1210

Abstract

I will talk about the fabrication, characterization of a-Si:H thin-films and their application to TFT and PIN diodes. The display application of TFTs, sensor and photovoltaic applications of PIN will be also touched on. In the 2nd part, I will discuss low temperature poly-Si (LTPS) on glass which is being used for high resolution displays such as the retina display and also for the Galaxy AMOLED. The crystallization techniques and electrical properties of LTPS TFTs will be discussed together with hot carrier and bias-stress effects. Some displays developed in ADRC will be also explained. The TFTs and AMOLED on flexible substrates will be added.

Tutorial Session C

Organic Electronics

Tutorial C1

Optical and Electronic Properties of Organic Semiconductors

1:00 PM – 2:30 PM
Sunday August 18th, 2013

Lecturer: Robert A. Street
Palo Alto Research Center, USA

Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1220

Abstract

The tutorial will discuss the opto-electronic properties of organic semiconductors, primarily in the context of thin film transistors and solar cells. Topics will include carrier mobility, optical absorption and recombination mechanisms, as well as electronic structure and defects. The similarities and differences between the organic and inorganic disordered materials will be emphasized.

Tutorial C2

Organic Optoelectronic Devices

2:45 PM – 4:15 PM
Sunday August 18th, 2013

Lecturer: Hany Aziz
University of Waterloo, Canada

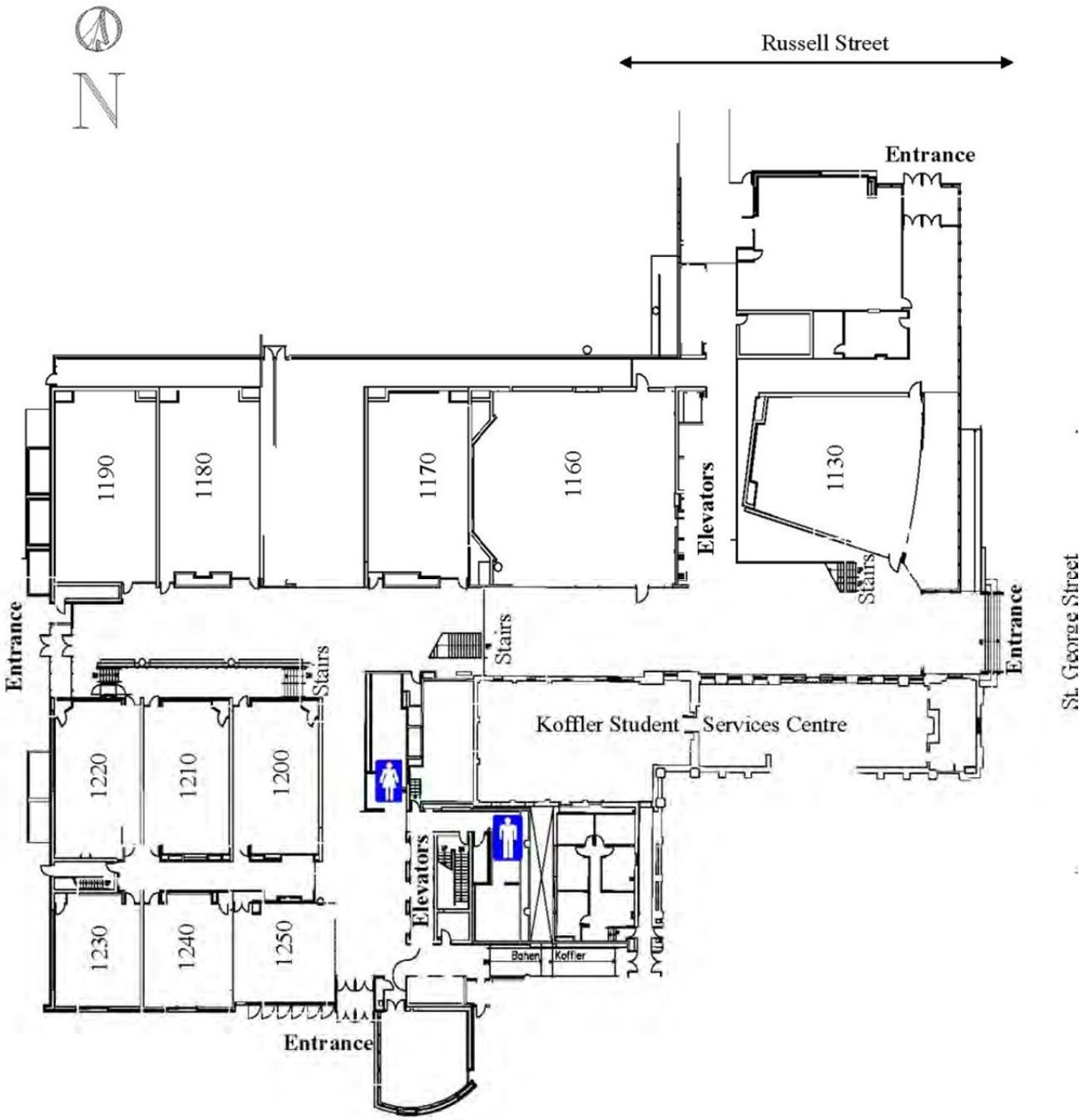
Location: University of Toronto St. George Campus
Bahen Center for Information Technology,
Room: BA1220

Abstract

The tutorial will build-up on the previous talk and discuss the principles of operation of a number of organic optoelectronic based devices, including light emitting devices (OLEDs), organic solar cells (OSCs), organic photodetectors (OPDs) and other optoelectronic devices. Topics related to charge and energy transfer processes in these devices including charge injection at interfaces, excited states in organic molecules, radiative and non-radiative transitions and exciton transfer processes in organic

semiconductors will be covered. The different influence of these processes in the context of light-emissive (e.g. OLEDs) versus light-harvesting (e.g. OSCs and OPDs) devices will be highlighted.

07.30 – 10.00	Registration. Bahen Buildin Foyer		
08.30 – 10.00	Generation, Transport, and Recombination of Charge Carriers in Amorphous Semiconductors *Sergei Baranovski*, Philipps Universität Marburg, Germany Chair: Alla Reznik Bahen: BA 1130		
10.00 – 10.30	**Cofee**		
10.30 – 12:00	Thin-film Photovoltaics *Sigurd Wagner*, Princeton University, USA Chair: Andrei Sazonov / Safa Kasap Bahen: BA 1130		
12.00 – 13:00	**Lunch (Provided)**		
	A **Chalcogenides** **BA 1200**	**B** **Thin Silicon and TCO** **BA1210**	**C** **Organic Electronics** **BA1220**
13.00 – 14:30	Chalcogenide Semiconductors: Fundamental Physics *Koichi Shimakawa*, Gifu University, Japan Chair: Gurinder K. Ahluwalia	Amorphous Oxide Semiconductor TFTs and Applications *Arokia Nathan* University of Cambridge, UK Chair: Stephen O'Leary	Optical and Electronic Properties of Organic Semiconductors *Robert A. Street* Palo Alto Research Center, USA Chair: Robert Johanson
14.30 – 14:45	**Coffee**		
14.45 – 16:15	Phase Change Memory Materials *John Robertson*, University of Cambridge, UK Chair: Alla Reznik	Thin Film Silicon Electronic Devices *Jin Jang,* Kyung Hee University Republic of Korea Chair: Stephen O'Leary	Organic Optoelectronic Devices *Hany Aziz*, University of Waterloo, Canada Chair: Peyman Servati


N
Russell Street
Entrance
1190
1180
1170
1160
Elevators
1130
Stairs
Entrance
Entrance
Stairs
Stairs
Koffler Student Services Centre
1220
1210
1200
Elevators
1230
1240
1250
Bahen
Koffler
Entrance
St. George Street