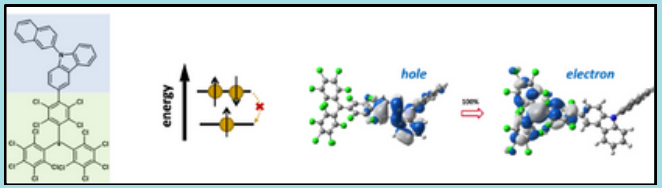
LECTURE ABSTRACT

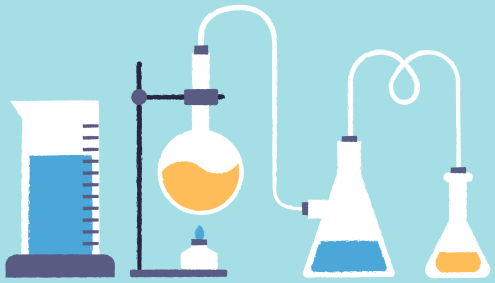
After an introduction to organic light-emitting diodes, we will discuss our recent computational work dealing with three strategies to design efficient, purely organic emitters:

The first strategy was introduced in 2012 by Chihaya Adachi and co-workers at Kyushu University, who proposed to harvest the triplet excitons in purely organic molecular materials via thermally activated delayed fluorescence (TADF). These materials now represent the third generation of OLED emitters. Impressive photo-physical properties and device performances have been reported, with internal quantum efficiencies reaching 100% (which means that, for each injected electron, one photon is emitted). In the most efficient materials, the TADF process has been shown to involve several singlet and triplet excited states.



A second strategy, which has been applied more recently, was proposed by Feng Li and co-workers at Jilin University in 2015 and is based on the exploitation of stable organic radicals. In these materials, where the lowest excited state and the ground state usually belong both to the doublet manifold, we will describe how high efficiencies and photo-stability can be obtained.

Finally, we will briefly discuss our very recent work on so-called multi-resonance (MR) TADF materials, initially developed by Takuji Hatakeyama and co-workers at Kwansei Gakuin University.



Questions and comments about the Dawson Lecture can be directed to *chemistry@uky.edu*

Established in memory of Lyle Ramsay Dawson Distinguished Professor and Former Head of the Department of Chemistry

chem.as.uky.edu

College of Arts and Sciences
Department of Chemistry

27TH ANNUAL LYLE RAMSAY DAWSON

LECTURE

"Purely Organic Emitters for Organic Light-Emitting Diodes (OLEDs): A Journey through Organic Electronics"

Dr. Jean-Luc Brédas

Department of Chemistry and Biochemistry
The University of Arizona
Tucson, Arizona

October 25, 2024
4:00pm
Chemistry/Physics Building, 155

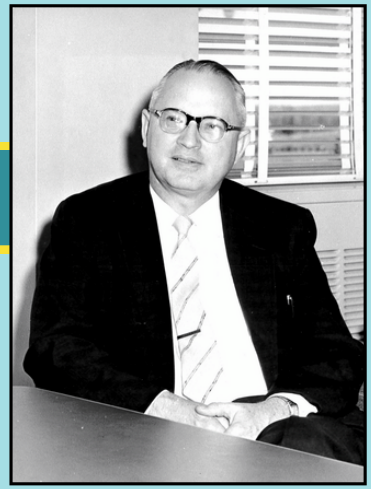
College of Arts and Sciences
Department of Chemistry

Dr. Jean-Luc Brédas

Jean-Luc Brédas received his B.Sc. (1976) and Ph.D. (1979) degrees from the University of Namur, Belgium. In 1988, he was appointed Professor at the University of Mons, Belgium, where he established the Laboratory for Chemistry of Novel Materials. While keeping an “Extraordinary Professorship” appointment in Mons, he joined the University of Arizona in 1999. In 2003, he moved to the Georgia Institute of Technology where he became Regents’ Professor of Chemistry and Biochemistry and held the Vasser-Woolley and Georgia Research Alliance Chair in Molecular Design. Between 2014 and 2016, he joined King Abdullah University of Science and Technology (KAUST) as a Distinguished Professor and served as Director of the KAUST Solar & Photovoltaics Engineering Research Center. He returned to Georgia Tech in 2017 before moving back to the University of Arizona in 2020.

Prof. Brédas is an elected Member of the International Academy of Quantum Molecular Science, the Royal Academy of Belgium, and the European Academy of Sciences. He is the recipient of the 1997 Francqui Prize, the 2000 Quinquennial Prize of the Belgian National Science Foundation, the 2001 Italgas Prize, the 2003 Descartes Prize of the European Union, the 2010 ACS Charles Stone Award, the 2013 APS David Adler Award in Materials Physics, the 2016 ACS Award in the Chemistry of Materials, the 2019 Alexander von Humboldt Research Award, the 2020 MRS Materials Theory Award, and the 2021 RSC Centenary Prize. He has served as editor for Chemistry of Materials between 2008 and 2021 and scientific editor for Materials Horizons since 2022. His current Google Scholar h-index is 171.

Lyle Ramsay Dawson was a native of Illinois and received his undergraduate degree from the University of Illinois in 1932. He received his Ph.D. degree in 1935 from the University of Iowa



Dr. Dawson served in several academic positions in Illinois, Wisconsin, Nebraska and Louisiana and also worked on the Manhattan Project as a Research Chemist and Group Leader in the Metallurgical Laboratory at the University of Chicago. In 1946, he was awarded the War Department’s Certificate of Merit and a U.S. Patent for his efforts on the Manhattan Project, which led to the discovery of a fundamental process for the extraction and purification of the elements plutonium and neptunium. He was a member of the committee that organized the Oak Ridge Institute of Nuclear Studies and was a council member of the Institute.

Professor Dawson came to the University of Kentucky in 1945 as Head of the Department of Chemistry. He provided key leadership in initiating and building the doctoral program in chemistry at the university. For example, in his first decade in the department, he individually obtained the major portion of extramural research support. During his twenty-five years with the department, he held contracts for fundamental chemical research with the U.S. Army, the National Science Foundation and the Atomic Energy Commission.

He directed or co-directed seventeen Ph.D. dissertations and nine M.S. theses. He was a talented research director and had a special ability to imbue his students with a concise, clear and complete scientific writing style. He published more than fifty research papers dealing with the chemistry of nonaqueous solutions and coauthored a reference book on the subject.

LYLE RAMSAY DAWSON

Dr. Dawson was a master teacher both in the classroom and in less formal conferences and discussions. His leadership and mentoring led many graduate teaching assistants and junior faculty members to become more effective teachers. His uncompromising devotion to high achievement standards in coursework, research, education and training set the tone for our department for years to come. Another significant contribution to the department was Professor Dawson’s indefatigable advocacy for a new chemistry building. His leadership in soliciting and designing a replacement for the former chemistry building, Kastle Hall, culminated in the opening of the current Chemistry-Physics Building in 1963. He also served the campus community in other ways. Dr. Dawson was elected a Distinguished Professor in the College of Arts and Sciences in 1954—1955 and was appointed to the rank of Distinguished Professor in the field of Physical Chemistry by the University of Kentucky Board of Trustees in 1956. He served as Acting Dean of the Graduate School in 1954—1955, 1956 and 1960—1961.

Dr. Dawson’s contributions outside the university were well recognized. He was a Fellow of both the American Institute of Chemists and the American Association for the Advancement of Science. He was a member of the American Chemical Society, Electrochemical Society, Sigma Xi, Omicron Delta Kappa, Alpha Chi Sigma and Kappa Delta Pi, serving leadership roles in each of these organizations. He served several times as a Tour Lecturer and Visiting Scientist under the sponsorship of the American Chemical Society. He was also active in a variety of other nonacademic organizations.

Dr. Dawson’s twenty-five years in the department represent a truly outstanding combination and balance of administrative leadership, teaching, research and service. Although Dr. Dawson passed away in 1976, his impact on the department continues to this day. The endowment of the Lyle Ramsay Dawson Lecture Series by his beloved daughter, Venita Dawson Curry, permits us to rejoice in this legacy and to continue our tradition of world-class chemical research.