

# Weekly Calendar and News

September 26-30, 2016

## Departmental Colloquium

### “Complexity of Entanglement in Quantum Computation and Macroscopic Quantum Orders”

**Akimasa Miyake**

University of New Mexico

**3:30-4:30 pm Thursday, September 29, 2016**

**Room 109 Nicholson Hall**

Quantum entanglement, which Einstein, Podolsky, and Rosen were concerned about due to its unconventional nonlocal correlation, has been realized by now to be a useful resource for quantum information processing such as quantum computation and communication. Furthermore, the concept of entanglement turns out to be helpful in several research fields of physics in order to capture the complexity of quantum many-body systems. For example, topological orders that exhibit spin liquid behaviors of frustrated quantum antiferromagnets can be well understood in terms of the interplay of entanglement and symmetry. In this talk, I will address the roles of entanglement in two seemingly distant subjects: quantum computation and symmetry-protected topological orders. An unexpected connection between them suggests that entanglement underlies a common hierarchical structure of complexity in both cases.

## New Publications

- [“CALET Upper Limits on X-Ray and Gamma-Ray Counterparts of GW 151226”](#) has been published by the CALET collaboration including Nick Cannady, Mike Cherry, Greg Guzik, Amir Javaid, John Wefel et al. in *Astrophysical Journal Letters*, 829:L20 (2016).
- [“Efficacy of the SU\(3\) scheme for ab initio large-scale calculations beyond the lightest nuclei”](#) has been published by Tomas Dytrych, Kristina Launey, and Jerry Draayer et. al. *Comp. Phys. Commun.* 207 (2016) 202.
- [“Ripples in Reality”](#) has been published by Don Lincoln and Amber Stuver. *Phys. Teach.* 54, 398 (2016).

# LSU Physics & Astronomy in the News

- Amy LeBleu and Harvey Shows Named 2016 Astronaut Scholars  
[http://www.lsu.edu/science/news\\_events/cos-news-events/LSUASF2016.php](http://www.lsu.edu/science/news_events/cos-news-events/LSUASF2016.php)
- Amber Stuver Talks Gravitational Waves and the Impact of Science Communication  
<http://lsuscienceblog.squarespace.com/blog/2016/9/16/yppqfqpkq8hzh4ao5eh1b8r51jriyd>
- Update on the Puzzling Boyajians Star  
<http://aasnova.org/2016/09/16/update-on-the-puzzling-boyajians-star/>

## Saturday Science

### “Discovering the Newest Species in the Human Lineage: *Homo naledi*”

Juliet Brophy, LSU Department of Geography and Anthropology  
Saturday, September 24, 2016, 10:00 - 11:10 AM,  
Room 130

*Homo naledi* is the newest member of our Homo species lineage. The speaker, Dr. Juliet Brophy, is a member of the international team that recently described the fossils of this species.

## Events

- LaCNS seminar: [“Molecular level engineering of block copolymer electrolytes’ structure via directed self-assembly”](#)
- Visit the 2016 Block Party Page to see the competition results and photo gallery from this year’s event. <http://www.lsu.edu/physics/graduate-programs/block-party.php>



Monday, September 26  
3:00 PM  
1008B Digital Media Center  
Louisiana State University

### **Molecular level engineering of block copolymer electrolytes' structure via directed self-assembly**

Solid-state ion conducting polymers (i.e., polymer electrolytes) are found at the heart of numerous electrochemical processes that store and convert energy, synthesize chemicals, and purify water. One key functional property of these materials is their ion conductivity – a key transport property that governs the ohmic resistance in electrochemical devices. Block copolymer electrolytes are a subset of polymer electrolytes and they are attractive materials because their micro-phase separated architecture yields greater conductivity over their random copolymer counterparts. However, there is a poor understanding between molecular level structure and bulk material properties like ion transport.

In this work, the process of directed self-assembly controlled the micro-phase separated structure in block copolymer electrolytes with astonishing fidelity. Engineering the block copolymer electrolyte structure was achieved by first directing the self-assembly of the non-ionic variant block copolymer (poly (styrene-block-2-vinyl pyridine)) using solvent vapor annealing on non-preferential layers or topographical patterned substrates. After self-assembly, an invasive, gas phase Menshutkin reaction with an alkyl halide converted the pyridine moiety to n-methyl pyridinium iodide – anion charge carriers. The reaction was benign to the self-assembled molecular structure. Complementary x-ray scattering (GI-SAXS and RSoXS) and electron microscopy (SEM and EDX mapping via STEM) substantiated the introduction of ionic groups without detriment to structural integrity. Key results from the ordered block copolymer electrolytes highlight that ion conductivity followed an exponential growth curve with respect to ion domain connectivity. Ion domain alignment to electrode surfaces with a tortuosity of 1 yielded a 4 order of magnitude improvement in ion conduction over anti-aligned ionic domains. The results of this work have far reaching implications for the rationale, molecular level design of block copolymer electrolytes.

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2016



*Guest Speaker*

**Dr.  
Christopher  
Arges**

Gordon A. and Mary  
Cain Professor of  
Chemical  
Engineering

Louisiana State  
University

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