

# **Nanoclusters, Nanomaterials, and Nanotechnologies**

Phys 581 (WSU, 3 credits); UW MSE 498/599 (3 credits)

Spring 2007 (May 14-25), Richland, Washington

## **Tentative schedule**

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### **Day 1 May 14 (Monday)**

9:00 – 9:30 am Badging and get acquainted  
9:30 – 10:00 am General introduction (Lai-Sheng Wang & Don baer)  
10:00 – 10:50 am Introduction to nanoscience (Don Baer)  
11:00 – 11:50 am Introduction to clusters (Lai-Sheng Wang)

Lunch

1:30 – 2:20 pm Cluster formation and generation (Lai-Sheng Wang)  
2:30 – 3:00 pm Cluster lab tour (Lai-Sheng Wang)  
3:00 – 5:00 pm Small project description and assignments  
Discussion of term papers

### **Day 2 May 15 (Tuesday)**

9:00 – 9:30 am Quiz 1  
9:30 – 10:20 am Mass spectrometry and the discovery of Buckyball C<sub>60</sub> (Lai-Sheng Wang)  
10:30 – 11:20 am Electron-shell model of clusters and magic numbers (Lai-Sheng Wang)  
11:30 – 12:20 pm Size-dependent electronic structure of clusters (Lai-Sheng Wang)

Lunch

2:00 – 2:50 pm Boron clusters – small is different (Lai-Sheng Wang)  
3:00 – 3:50 pm Gold clusters and nanoparticles (Lai-Sheng Wang)  
4:00 pm Lab projects

### **Day 3 May 16 (Wednesday)**

9:00 – 9:30 am Quiz 2  
9:40 – 10:30 am Fullerenes and Carbon Nanotubes (Lai-Sheng Wang)  
10:40 – 11:30 am Clusters as new building blocks for nanomaterials (Lai-Sheng Wang)  
11:40 – 12:30 am Stannaspherene and plumbaspherene: inorganic fullerenes? (Lai-Sheng Wang)

Lunch

1:30 – 5:00 pm Lab projects  
8:00 – 8:50 pm Race to Catch a Buckyball: NOVA TV program on the discovery of C<sub>60</sub>

### **Day 4 May 17 (Thursday)**

9:00 – 9:30 am Quiz 3  
9:30 – 10:20 am Laser surface interactions (Wayne Hess)  
10:30 – 11:20 am Photoelectron imaging (Wayne Hess)  
11:30 – 12:00 am Laser/surface lab tour

Lunch  
1:30 – 4:00 pm      Lab project  
4:00 – 5:00 pm      Informal discussion about lab projects

**Day 5 May 18 (Friday)**

9:00 – 9:30 am      Quiz 4  
9:30 – 10:20 am     X-ray photoelectron spectroscopy (Don Baer)  
10:30 – 11:20 am     X-ray photoelectron spectroscopy (Don Baer)  
11:30 – 12:10 pm     XPS Lab tour

Lunch  
1:30 – 5:00 pm      Lab projects

**Day 6 May 21 (Monday)**

9:00 – 9:50 am      Scanning probe microscopy I (Scott Lea)  
10:00 – 10:50 am     Scanning probe microscopy II (Scott Lea)  
11:00 – 11:50 am     SPM lab tour

Lunch  
1:30 – 5:00 pm      Lab projects

**Day 7 May 22 (Tuesday)**

9:00 – 9:30 am      Quiz 5  
9:30 – 10:20 am     Scanning electron microscopy (Bruce Avery)  
10:30 – 11:20 am     Transmission electron microscopy (Chongmin Wang)  
11:30 – 12:20 am     SEM/TEM lab tour

Lunch  
1:30 – 5:00 pm      Lab projects

**Day 8 May 23 (Wednesday)**

9:00 – 9:50 am      Molecular beam epitaxy I (Scott Chambers)  
10:00 – 10:50 am     Molecular beam epitaxy II (Scott Chambers)  
11:00 – 11:50 am     MBE lab tour

Lunch  
1:00 – 4:00 pm      Lab projects  
4:00 pm              Informal discussions on lab projects

**Day 9 May 24 (Thursday)**

9:00 – 9:30 am      Quiz 6  
9:40 – 10:40 am     Synthesis and Properties of Nanowires (David McIlroy)  
10:50 – 11:50 am     Synthesis and Properties of Nanowires (David McIlroy)

Lunch

1:00 – 5:00 pm      Lab projects

**Day 10 May 25 (Friday)**

9:00 – 10:00 am      Preparation for presentation

10:00 – 11:00 am      Nanolithography and charge transport in nano-scale devices (Chris Berven)

11:10 – 12:00 am      Nanolithography and charge transport in nano-scale devices (Chris Berven)

Lunch

1:00 – 4:00 pm      Presentation of projects and discussions of term papers

4:00 pm              Class adjourns

**Grading:**

1. Assigned reading materials

2. Selected quizzes

3. Small lab projects, project presentation, and term papers. During the course, there will be various lab projects for students to participate at the W. R. Wiley Environmental Molecular Sciences Laboratory of PNNL. Each project will involve 2-3 students working as a team with a research group at EMSL. The afternoon of **May 25** is reserved for discussion and presentation of the lab projects. Each student is expected to turn in a paper based on the lab project at the end of August. The term paper should describe the goals of the experiment and relevant background information, then the experimental procedures, results, and conclusions and/or proposals. Total length: no more than 15 pages (12 point font, double space, 1" margin) for text, tables, figures/illustrations, and references.