

Report from the SPS

From Outgoing SPS President Joseph Eimer:

In the past year, the UMR chapter of the Society of Physics Students has been very active. In the spirit of encouraging educational diversity, meetings have often been augmented by guest speakers from a variety of departments ranging from Ceramics Engineering to The Explosives Research Center. The traditional SPS/faculty picnic took place on a beautiful Saturday. These picnics are always great opportunities for the new students to get to know the professors on a more personal level and this year was no exception. Of course the event that everyone shows up for is the annual SPS vs. Dr. Greg Story volleyball game. Once again Dr. Story defended his undefeated title admirably.

Perhaps the newest and most exciting SPS endeavor is the new student lecture series. The aim of the series is to have SPS members present lectures that are of general interest



and are given at a level such that all undergraduates can understand them. **Travis Yates** has already inaugurated the series with a presentation on the double slit experiment and some of its quantum mechanical implications. **Deepak Vaid** is scheduled to do the next presentation.

In the upcoming semester, SPS looks forward to participating in the Girl Scouts' Bridging the Gap program. We plan to have the scouts build bottle rockets and make liquid nitrogen ice cream. Also SPS is hoping to have enough funds to do some modest renovations to the SPS room to provide a more comfortable and study-friendly environment. Finally we say goodbye to the old officers: **Kurt Koch** (Vice President), **Bernard Fendler** (Treasurer), and myself, **Joseph Eimer** (President), and say hello to the new officers **Kurt Koch** (President), **Deepak Vaid** (Vice President), **Ryan Kinney** (Treasurer), and **Toby Case** (Secretary).

Heatherly Receives Professional Degree in Physics



Douglas Heatherly

The Physics Department was pleased to honor alumnus **Douglas A. Heatherly** (BS '73) with a **Professional Degree in Physics** during the December 2002 Commencement. Doug is director of manufacturing for the North American division of DuPont Sabanci International, a joint venture between DuPont and Sabanci Holdings formed in December 2000. DUSA is currently the largest producer in the world of heavy denier nylon for use in the tire and rubber industry and operates nine manufacturing plants globally, with over 2300 full-time and 1000 contract employees. Doug started with DuPont as a manufacturing supervisor in the Waynesboro Textile Fibers Plant in 1973, following his graduation from UMR with a Bachelor's degree in Physics. Subsequent assignments included process engineer in Kinston, North Carolina, and industrial relations manager in Moberly, Missouri. In 1986, he was a member of the acquisition and transition teams that acquired Ford Motor Company's North American Paint Operations and was promoted to Plant Manager of the Michigan Automotive Coatings plant in 1989.

While at UMR, Doug led the effort to create the astronomy club and was instrumental in securing the grant that founded the observatory still utilized by many UMR undergraduate students today. Doug, who was joined at Winter Commencement

by a large number of family members, had the opportunity while he was here to visit the department with his wife **Barbara** and daughter **Carrie**. While here, he toured the department's research labs, as well as the observatory that he helped get off the ground. On Friday before commencement he participated in an informal discussion with departmental graduate and undergraduate students, and talked about his many activities since leaving UMR, as well as his experiences to get the observatory built, which grew out of a month long trip that he took to Capchat, Quebec with other UMR physics undergraduates to perform radio astronomy measurements during the solar eclipse that occurred in the summer of 1972. Part of that trip, supervised by UMR professor **Don Sparlin**, led them to Washington, where they had the opportunity to visit Senator Stuart Symington, then the senior Senator from Missouri. In the photo at right, a seated Sparlin, in white, addresses the Senator, while Heatherly watches with other UMR Physics students.



UMR's Max Bertino: Sweating the Small Stuff

In the quickly growing field of "nanotechnology," a key role is played by objects that a few years ago would have been referred to as "really short wires," or "really thin wires," but are today glorified by the term "nanowires." For example, a number of electronic devices including diodes and transistors have been recently built out of silicon nanowires and carbon nanotubes having diameters as small as 20 nanometers, about ten-thousand times thinner than a human hair. A great deal of current research is focused on the development of conducting or metal nanowires, which could be used to fabricate electrical connections between other nanodevices, or function as novel chemical sensors and catalysts.



Max Bertino

In the high-tech materials research laboratory of **Max Bertino**, UMR's newest Assistant Professor in experimental physics, new techniques are being developed to fabricate conducting metal nanowires that could be used for these applications. One technique developed recently by Bertino and graduate students **Carmen Doudna** (BS '00, MS '02) and **Jared Hund** (MS '02) is based upon the chemical reduction of metal ions into metal atoms in aqueous solution using a reducing agent that any physicist would love: gamma

rays emitted from the core of the UMR nuclear reactor.

According to Bertino, the gamma radiation interacts with water molecules and produces, among other things, free electrons not bound to any of the molecules in solution. These free electrons are then able to reduce metal ions in solution to their neutral charge state, in which they undergo aggregation and form clusters. By adding capping polymers to the



solution, clusters can aggregate even further to form particles with a very high *aspect ratio* (the ratio of a particle's length to its width) as shown in the figure.

While refining their synthetic procedures, Bertino and collaborators realized that the nanowires that they were producing, while promising candidates for microelectronic devices, have another very interesting property: they absorb visible and infrared light with extremely high efficiency. The high absorption of the nanowires is obvious from their appearance, as seen in the figure on the right. Both vials in the figure contain suspensions of Silver-Platinum (Ag-Pt) nanoparticles. Because the metal concentration is the same

in both vials, the different appearance is due only to the aspect ratio of the dissolved particles. The vial on the right, which contains a colloidal suspension of *spherical* Ag-Pt nanoparticles, is nearly transparent: one can see the fold in the paper in the background through the solution (the fold is distorted into a dark curve due to refraction). The vial on the left, on the other hand, contains a solution of narrow *nanowires*, and is nearly opaque: almost no light is transmitted through the vial.



This property has also excited the Army, which wants to develop obscurants that are effective in the infrared part of the spectrum, presumably to thwart infrared imaging devices that are a common feature on the modern battlefield. Based on their initial studies, Max and his research group have received a \$250K grant to study the optical properties of the high aspect ratio nanoparticles that he and his research group are producing. We wish them well in their endeavors and look forward to even smaller things from Max in the future.

Congratulations to UMR's 2002 Physics Department Dean's List Recipients

Winter Semester 2002

Joseph Eimer, Elizabeth Farrand, Bernard Fendler, Charlie Glaus, Timothy Ivancic, Kurt Koch, Christopher Lloyd, Brett Maune, Ryan Mallery, John Quebbeman, Christopher Schwartze, Joao Sosa, Charles Williams, Travis Yates.

Fall Semester 2002

Nathaniel Bates, Mark Dickison, Joseph Eimer, Sarah Eyermann, Bernard Fendler, Timothy Ivancic, Kevin Johnson, Ryan Kinney, Christopher Lloyd, Ryan Mallery, Charles Williams, Samuel Woods, Travis Yates, Kevin Zimmerschied.