Asking "why?" leads undergraduate to nanocrystal research

Most undergraduates wait until their junior or even senior year to get involved in scientific research projects, but not John Jumper. The sophomore, a double major in physics and math, has already begun his second semester working in a Vanderbilt physics lab.

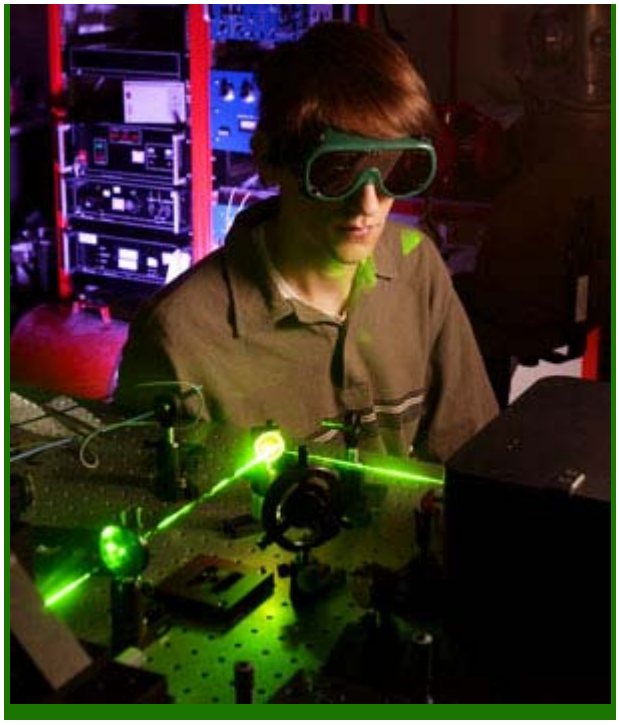

Photo by Daniel Dubois

John Jumper working in the Haglund lab

In fall 2004, Jumper got some first hand experience about what "big science" is like by working with three Vanderbilt physicists: associate professor Paul Sheldon, assistant professor Will Johns and professor Medford Webster. They are part of an international high-energy research project at the Fermi National Accelerator Laboratory that involves dozens of scientists from 18 different universities. They put him to work analyzing data from the experiment.

This spring, the budding scientist shifted his attention to the field of condensed matter physics, which focuses on the nature of different kinds of materials. He has begun studying laser interactions with vanadium dioxide nanocrystals under the supervision of physics professor Richard Haglund.

The research done in the high energy lab, which "involved searching for specific decay sequences in large data sets…was very different than what I am doing in professor Haglund's lab," says Jumper. The two labs "are not really comparable."

The switch is part of a deliberate strategy. "I have a very strong interest in math and that goes very well with physics…[which] uses all the math you didn't know had a purpose," he says. So he is using opportunities to become involved in different types of research as a way to figure out "what areas of physics suit me best."

Jumper decided to work with Haglund after he took an introductory class in quantum physics from him: "I was really impressed with the way he taught and looked at physics."

Haglund has assigned Jumper to work with a graduate student to construct a special kind of laser that generates white light, a combination of all wavelengths of light in the visual spectrum. They will be working from a description of the instrument published in a scientific paper. However, the assignment is not just to duplicate the published design, but to improve upon it by using mirrors that are more reflective. When it is completed, the laser will give the laboratory a new way to study the characteristics of the vanadium dioxide nanocrystals being developed by Haglund and his collaborators.

According to Jumper, the laser project is attractive because it allows him to develop and utilize his skills in both physics and mathematics. He also likes the fact that it has both experimental and theoretical elements. He hopes to continue working in the Haglund lab next fall, but wants to expand his activities beyond instrument building into the development and fabrication of nanocrystals.

Nature’s quickest change artist

His drive to better understand physics through research, and his excellent academic qualifications recently earned Jumper one of the highly competitive Barry M, Goldwater scholarships given in 2005 to highly qualified students pursuing careers in the fields of the natural sciences, mathematics or engineering. The scholarship provides up to $7,500 each year for one to two years of undergraduate study to help encourage students to become professional researchers.

Jumper has been able to work on various physics projects because “getting involved in undergraduate research is extremely easy” in the Vanderbilt physics department, he says, and the opportunity “is definitely a high point” of his educational experience thus far.

Both of Jumper’s parents are engineers. Because of his “need to understand on a fundamental level how things work” and constantly asking the question “why?” he realized at an early age that academia suited him. Though he will technically finish his physics major at the end of this semester, thanks to 36 advanced placement credit hours, he plans on continuing to take higher-level physics courses to prepare for a career in research and to help him tackle the many questions still waiting for an answer.

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