

Department of Nuclear Science and Engineering  
Massachusetts Institute of Technology

SPOTLIGHT ON WOMEN IN NSE

## NSE research opportunities give Ledoux a perfect intersection for materials studies



**G**abrielle Ledoux came to MIT as a freshman in 2012 with a longtime interest in materials science, and a passion for research and discovery — a combination that's finding fulfillment at MIT Nuclear Science and Engineering, where her participation in a series of investigations has led to a dual major and a Summer 2013 project that Ledoux calls “a perfect intersection of all my interests.”

Any undergraduate with wide-ranging curiosity is apt to feel challenged by the need to declare a major, and Ledoux was no exception. The daughter of an MIT Physics alum and former associate professor (Bob Ledoux, '78, Ph.D. '81), Ledoux got her first taste of Institute life during the summer between her junior and senior years in high school, when she sent an email inquiry that led to an internship with NSE Senior Research Scientist Richard Lanza, in which she helped analyze orbit properties on an

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ultra-compact superconducting cyclotron and co-authored a resulting paper.

After her acceptance to the class of 2016, she spent the summer of 2012 working with NSE doctoral student Zach Hartwig on development of data acquisition software for a groundbreaking materials-diagnostic system used in MIT's tokamak fusion reactor, part of a larger project headed by Prof. Dennis Whyte. Ledoux continued her work with Whyte and Hartwig through an Undergraduate Research Opportunities Program (UROP) project during her freshman year, and then went on to another UROP with NSE Assistant Prof. Michael Short during the summer of 2013.

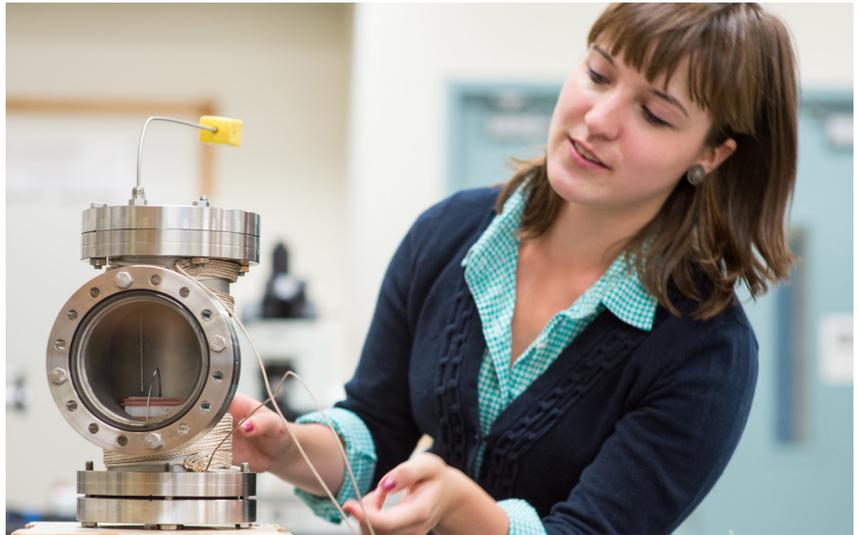
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“I had been set on declaring Course 3 [Materials Science and Engineering], but the UROPs really helped me make up my mind to declare a dual major with Course 22 [Nuclear Science and Engineering],” says Ledoux. “Like a lot of people, I was concerned about jobs and opportunities in the nuclear field, but NSE was really great about helping me build a course of study around what I was interested in. They listened to what I wanted to do, and connected me with Mike Short, who's done something very similar.”

Short's work focuses on the problem of deposits that accumulate on fuel rods and other surfaces in fission reactors. By conducting multi-physics,



multi-scale modeling, the effort is developing new fundamental understanding of the deposits (known as CRUD, for Chalk River Unidentified Deposits, after the power plant where they were first identified), which will enable better performance, efficiency, and safety in nuclear power plants.

Ledoux is using an atomic force microscope to measure bonding forces between CRUD particles and a variety of surfaces, including silicon and titanium oxide; her data will be presented at a conference in Japan this fall, which Ledoux will be attending.

“What I like about Mike's project is that he's finding a way, through materials research, to make reactors safer and more efficient. I would really enjoy continuing to find better materials and alternative materials that can help make nuclear energy more appealing, especially in the US, where we've had such a problem adopting it,” explains Ledoux.

Ledoux notes that both Short and Hartwig “have invested so much time” helping her build her fund of knowledge and her big-picture understanding of opportunities in nuclear research.

“I was particularly impressed by two qualities I saw in Gabby – the eagerness to acquire new and diverse skills, and the tenacity to solve problems for herself,” comments Hartwig. “Those are crucial for success in science, and it's great to see them in someone who is just starting to do research.”

Other highlights of Ledoux's MIT experience thus far include her Principles of Engineering Practice class (3.004), which included a trip to Japan, and 3.094, Materials In Human Experience, which merges her interest in archaeology with hands-on work in the MIT Forge. That class had the added bonus of being taught by Prof. Heather Lechtman, who knew Ledoux's father during his time on campus. Ledoux is also maintaining a ballet training schedule. ■

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*Photo by Justin Knight*