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STAFF FELLOWS
AT ORNL

Jake Nichols

Alvin M. Weinberg Fellow

Where and when did you earn your PhD?

I earned my PhD in Plasma Physics from Princeton University in 2018.

What was the subject of your dissertation?

My doctoral research focused on modeling the erosion, transport, and redeposition of wall materials in magnetic fusion devices that utilize multiple materials for plasma-facing components, and how these materials temporally evolve into mixed-material surfaces.

What was your dissertation's major contribution to your field?

My dissertation clarified the mechanisms that limit the lifetime of thin-film conditioning techniques that are frequently applied to the walls of magnetic fusion devices to control impurities. This knowledge allows for more targeted conditioning of the wall surfaces, which will enable present fusion devices to operate at higher performance for longer periods of time between maintenance cycles.

Who is your ORNL mentor?

My mentor is Zeke Unterberg, Power Exhaust and Particle Control Group leader.

Which Lab organization are you part of?

I work in the Fusion Energy Division in the Fusion and Fission Energy and Science Directorate.

What will your fellowship research focus on?

My fellowship project will focus on developing novel models for filamentary plasma transport in the edge of magnetic fusion devices that take into account advanced divertor regimes and realistic 3D wall geometries, helping to constrain estimates of the heat and particle fluxes that will strike different parts of the vessel wall in a pilot plant–scale fusion device.

What is your project's expected contribution to your field?

This project should allow us to further optimize the main wall of a fusion reactor by specially shaping the wall geometry such that the strongest fluxes are concentrated on components designed for the task. This approach will help to improve component reliability while reducing overall reactor cost.

What are your research interests?

My research interests include Plasma–material interactions, tokamak edge and divertor plasma physics, and integrated modeling of fusion systems.

What led you to science and your specific discipline?

I know it's silly, but I was introduced to fusion by the video game Sim City 2000. You spend most of that game carefully balancing the energy needs of your city with the environmental effects of your power plants, but that gets exponentially easier once you research the fusion power plant. That got me thinking about how I could get involved in science, and how I could help bring the benefits of fusion energy to bear in the real world.

What did you do before coming to ORNL?

I was a DOE Fusion Energy Sciences Postdoctoral Research Fellow at UT–Knoxville. My work focused on identifying the controlling mechanisms behind the transport of heavy impurities like tungsten in the edge plasma of magnetic fusion devices.

What nonscience topic or activity is important to you and why?

I think that tackling climate change and providing affordable energy to a growing and developing world are critical challenges that stretch far beyond the laboratory, and that will have significant societal ramifications in the coming century. That's why I'm excited to be in a position where I can hopefully help come up with a solution!

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