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Dear Hiring Manager,

I am writing to express my strong interest in the Scientist - Scenarios and Integrated Modeling position at Commonwealth Fusion Systems. As a Postdoctoral Researcher currently working on the NSTX-U, I have closely followed the development of SPARC. My background uniquely combines the development of high-fidelity kinetic simulation codes with years of direct experimental execution on major tokamaks like EAST and DIII-D. I am eager to apply this "experiment-model-validation" loop to help CFS achieve net fusion energy.

Your role requires a scientist who can not only use existing tools but also refine and develop comprehensive predictive tool chains. During my Ph.D. and current postdoctoral work, I developed a novel hybrid kinetic solver that synergizes the spectral method with modular, object-oriented architecture to compute electron distribution functions in 0D2P phase space. This code self-consistently incorporates electric field acceleration, collisions, and synchrotron radiation to model runaway electron avalanches. My experience architecting this extensible framework directly aligns with your need for a candidate who can develop robust simulation tool chains and integrate complex physics modules using Python and advanced numerical methods.

Furthermore, effective scenario development requires rigorous validation against experimental data. My experience is deeply rooted in this intersection. I have spent over seven years leading experimental campaigns and operating diagnostics on the EAST tokamak, and more recently on NSTX-U and DIII-D. My work has not been limited to running codes; I have spearheaded the analysis of Micro-tearing mode (MTM) instabilities and non-thermal electron dynamics to understand their impact on plasma confinement. This hands-on experience in control rooms and data analysis ensures that the scenarios I model are grounded in experimental reality, a critical requirement for planning pulses on SPARC.

In addition to core plasma physics, I possess strong expertise in synthetic diagnostics. I recently created a 2D beam tracing simulation using FDTD methods to model wave propagation and developed synthetic platforms for microwave imaging.

This experience allows me to effectively bridge the gap between the integrated modeling team and the diagnostics team, ensuring that predicted scenarios are observable and verifiable.

I thrive in collaborative, multi-institutional environments, having worked extensively with teams from General Atomics, PPPL, UC Davis, and international partners. I am excited about the opportunity to bring my expertise in kinetic modeling, synthetic diagnostics, and experimental validation to the world-class team at CFS.

Thank you for your time and consideration. I look forward to discussing how my technical background can contribute to the success of SPARC and ARC.

Sincerely,

Xinhang Xu