Harold Agnew National Security Postdoctoral Fellow
Research Areas

Matter in Extreme Environments: *Understanding the dynamic evolution of matter and its properties at high density, high temperature, and other extremes.* Key research areas include dynamic materials science (with emphases on the manufacturing and aging of polymers, high explosives, actinides, and other metals), fluid dynamics, high energy density physics (with emphases on radiation transport plasmas, and thermonuclear burn), nuclear physics, inertial confinement fusion, and advanced manufacturing. The study of stellar astrophysics from star formation through stellar end states provides a natural laboratory for extreme environments some of which are also accessible through laboratory experimental facilities.
This area also includes advances of accelerator methods, technologies that enable new diagnostics (including x-ray and proton radiography and neutron diagnostics), and data analysis of matter in extreme environments for current and future facilities such as DARHT, LANSCE, U1a, NIF, Z, APS, and LCLS.

Data Analytics: *Techniques and tools to analyze and understand data sets so large and/or complex that traditional data processing applications are inadequate*. Advances in this area include methods to extract knowledge from multiple and diverse data sources, including physical sensor output, streaming data, social media, and other data sources. Tools that could be applied include signal processing, image processing, uncertainty quantification, machine learning, anomaly recognition, and data fusion. It also extends to security of cyber-physical networked systems, including threat detection and mitigation, especially prevention of surreptitious process modification and information transfer.

Advanced Engineering Analysis — Exploration of finite element analysis, with an emphasis on the development of techniques that incorporate plasticity, creep, and damage of materials and participation in experimental activities to characterize relevant mechanisms and validate constitutive models. Practice of multi-disciplinary engineering methods, including High Explosive Engineering, Complex Systems Engineering, Nuclear Safety and Surety Engineering, Modeling and Simulation of Complex Systems, and their application to issues in Stockpile Stewardship. This area also includes extreme engineering for deployment of autonomous measurement systems to remote, harsh environments such as space.

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