Cumulative List of INFUSE Awards

INFUSE 2026 | September 1, 2026

28 abstracts, alphabetized by company

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Acceleron Fusion, Inc

SAM UEI: Y32XULXFH471

Title: Target material characterization for high-efficiency muon production in muoncatalyzed fusion

Abstract:

Acceleron Fusion is developing muon-catalyzed fusion as an abundant new source of energy and as a high-intensity neutron source for a range of industrial, scientific, and medical applications—including supporting the DOE priority to construct a U.S. Fusion Prototypic Neutron Source. In muon-catalyzed fusion, muons replace electrons in the fusion fuel, enabling fusion at lower temperatures than conventional approaches. Brookhaven National Laboratory and Acceleron Fusion will collaborate on ion-beam experiments to measure pion production yields and pion absorption lengths in Acceleron's novel muonproduction target materials and AI-optimized target geometries. The experiments will be conducted at beam energies where state-of-the-art hadronic simulation codes predict highly efficient pion (and therefore muon) production in these materials. These tests are a vital step toward developing compact fusion power plants that can provide reliable, domestically produced energy. This work supports the goals of energy security and domestic energy innovation, reinforcing U.S. leadership in advanced energy technologies.

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Advanced hCMOS Systems

SAM UEI: VXG9BG2NEA11

Title: GaAs hCMOS

Abstract:

The imaging of “hard” X-rays (energies of 10keV to 50keV) is a critical diagnostic for fusion research, yet it remains one of the most technically challenging diagnostic systems to deploy in a experimental testbed or reactor relevant environment. This INFUSE project aims to leverage the work performed at Sandia National Laboratories with GaAs to integrate a pixelated GaAs photodiode array onto an hCMOS Readout Integrated Circuit (ROIC). The resulting sensor would offer a compelling solution to the hard X-ray imaging challenges in fusion research by combining a GaAs photodiode array that provide superior stopping power and quantum efficiency for hard X-rays with radiation-tolerant, multi-frame, high-speed, and high-dynamic-range ROIC.

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Blue Laser Fusion

SAM UEI: NQP9Y1JRFBE5

Title: Modeling and Evaluation of Magnetically-Assisted Dry-Wall Laser Inertial Fusion Energy Direct-Drive Chamber

Abstract:

Laser-based inertial fusion energy (IFE) offers a pathway to carbon-free, dispatchable electricity using abundant fuel with minimal long-lived radioactive waste. The feasibility of laser based inertial fusion energy continues to be demonstrated by the recent achievement of fusion gain of 4 at the National Ignition Facility at Lawrence Livermore National laboratory. Blue Laser Fusion (BLF) is developing a novel and enabling laser platform through the implementation of a large-scale high finesse cavity, known as an optical enhancement cavity (OEC), that coherently stacks temporally separated pulses resulting in short pulse generation with energies on the order of kilojoules, a repetition rate of up to 10Hz, and an estimated 40% wall-plug efficiency. The BLF laser-OEC platform can drive nuclear fusion reactions that generate electricity efficiently and cost effectively. Achieving reliable, high-repetition-rate electricity generation requires innovative reaction chamber concepts capable of withstanding intense, repetitive charged-particle, x-ray, and neutron loads while preserving clean optical access for laser delivery. This project proposes to develop and apply high-fidelity, multiphysics models to evaluate a novel magnetically assisted dry-wall chamber concept for direct-drive IFE. Key innovations include geometrically tailored, cone-like first wall features that increase effective surface area to reduce peak thermal loading, and the use of strategically placed magnetic fields that deflect charged particles away from laser ports and other sensitive components. Argonne National Laboratory will perform an integrated, simulation-based feasibility assessment using advanced modeling tools spanning charged-particle transport, magnetic field design, transient thermo-mechanical response of first-wall materials, chamber gas dynamics, and magnetohydrodynamic effects on coolant systems. The results will quantify heat-flux reduction, structural survivability, magnetic-field requirements, and system-level design margins, providing BLF with predictive capability and actionable guidance for chamber optimization. This work directly supports the INFUSE mission by leveraging national-laboratory expertise to reduce technical risk in a private-sector IFE design and accelerate progress toward commercially viable fusion energy systems.

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Canary Instruments LLC

SAM UEI: Z3H9KL2CEJR5

Title: Assessment of Direct Continuous Tritium Monitoring for Fusion Fuel Cycle and Facility Safety

Abstract:

Prompt and accurate monitoring of tritium is essential for the safe operation of nuclear fusion systems. Common tritium measurement methods rely on offline sampling and laboratory analysis, limiting real-time awareness of tritium behavior in aqueous and process systems. This project will to benchmark and validate a continuous, real-time tritium monitoring technology under fusion relevant aqueous conditions by leveraging the tritium expertise and reference measurement capabilities of Savannah River National Laboratory. Through side-by-side comparison with established methods and extended operational testing, this work will quantify accuracy, stability, and operational performance, advancing development of a sensor that could meaningfully benefit the fusion industry through improved facility safety and more robust fuel-cycle management.

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Commonwealth Fusion Systems

SAM UEI: FLSJGUF7BGS1

Title: High-fidelity, critical measurement of vanadium alloy swelling under fusion relevant conditions

Abstract:

Commonwealth Fusion Systems (CFS) and the University of Michigan will collaborate to understand fusion materials performance. The partners will use the state-of-the-art triple-ion-beam irradiation capability at the Michigan Ion Beam Laboratory (MIBL) to explore the swelling behavior of vanadium alloys that are leading structural material candidates in fusion power plants. The characterization will be done across a temperature range of 600-800°C and a range of He/H transmutation ratios. Utilizing MIBL's unique gas-gradient technology, the project will generate high-throughput data on swelling as a function of temperature and gas content, which will be quantified using an accelerated post-irradiation examination (PIE) protocol employing machine learning. This data will be used to develop a mathematical model to inform fusion power plant structural design, and serve as a baseline for future advanced vanadium alloy development.

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Electric Power Research Institute, Inc

SAM UEI: JBV2SMLRBK29

Title: Catalog of HFIR Irradiated Materials for Fusion Applications

Abstract:

The Electric Power Research Institute, in partnership with Oak Ridge National Laboratory, would create a comprehensive catalog of irradiated materials produced in the High Flux Isotope Reactor. This effort would organize decades of valuable data on how advanced materials behave under extreme conditions relevant to fusion energy. By consolidating this information into an accessible and standardized resource, the project can help researchers and developers avoid duplicative testing and accelerate progress toward fusion pilot plant designs. The resulting catalog can strengthen collaboration across the fusion community and support the advancement of commercially viable fusion energy systems.

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Helion Energy

SAM UEI: HS69YQMCJKF5

Title: Study of field reversed configuration relevant transport, stability, and lifetime via reconnection experiments at FLARE

Abstract:

Axisymmetric, high-field, pulsed magnets form the basis of the fusion platform being developed at Helion Energy. The geometrically simple, compact, and high β (~1) Field Reversed Configuration (FRC) is an excellent target for compression with such magnetic fields. Helion's 6th Prototype, Trenta, was a double ended machine, where each end formed an FRC plasmoid and accelerated it to high velocity, while simultaneously compressing it. The two plasmoids collided and merged in a compression chamber in the center of the machine, where the kinetic energy of the FRCs was rapidly converted to ion

thermal energy. The magnetic field in the compression section then ramps up to trap and adiabatically heat the newly merged FRC. In Trenta, FRCs were formed and compressed to thermonuclear plasma temperatures at peak magnetic fields of 8 T. The fusion performance demonstrated in Trenta still needs improvement for Helion's fusion technology to be a viable source of clean energy for the grid. Helion is building an increased scale fusion prototype with the goal of demonstrating electricity from fusion. Increasing the machine scale and compression field strength imposes limitations on how quickly fields can be ramped in compression and require global stability and good confinement to be optimized to improve FRC plasmoid lifetimes. FRC machines can be difficult to diagnose as plasma temperatures can quickly reach many 100's of eV and the pulsed nature of the machine limits diagnostic access. The experimental and simulation work proposed herein is to analyze reconnection experiments at the FLARE facility that are scaled to be relevant to FRC merging and standard transport near an X-point to develop and validate computational models of micro-instabilities that may arise in these systems and lead to anomalous transport of energy and particles.

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Intensity Energy Inc

SAM UEI: G3KPFMTA9YT2

Title: Modern modeling of heavy ion fusion targets

Abstract:

Heavy-ion accelerators can deliver energy to fusion targets with high electrical efficiency and long component lifetimes, which may enable inertial fusion energy systems that operate repeatedly for power production. This project will use modern, high-fidelity radiation-hydrodynamics simulations to re-create several landmark heavy-ion indirect-drive target designs and establish a transparent, reproducible performance baseline. Using the HYDRA radiationhydrodynamics simulation code at Lawrence Livermore National Laboratory, the work will rebuild published target geometries, materials, and ion-beam energy-deposition descriptions, then re-simulate the sequence from ion energy deposition to x-ray drive and capsule implosion. The study will also quantify how robust these targets are to realistic driver and chamber conditions by testing sensitivity to beam spot size, pointing and timing offsets, power imbalance, and uncertainty in ion stopping depth. The outcome will be a modern benchmark set and a compact set of design tolerances that reduce technical risk and translate target performance into practical requirements for efficient, scalable heavy-ion fusion energy systems.

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Kyoto Fusioneering America Ltd

SAM UEI: 118966752

Title: Advanced Magnetohydrodynamic Modelling of Flow Non-Uniformity and Heat Transfer in Fusion Blanket Systems

Abstract:

Liquid-metal breeding blankets are essential to future fusion power plants: they extract heat, breed tritium fuel, and protect reactor structures. Yet their behavior in the strong magnetic fields of a fusion device is extremely complex. Magnetic forces can distort liquid-metal flow, reduce heat removal, trap tritium, hinder emergency drainage, and increase pumping power, challenges that current modelling tools cannot reliably predict.

This INFUSE proposal brings together Kyoto Fusioneering America and the Princeton Plasma Physics Laboratory to close these critical gaps. The project builds on breakthroughs at PPPL that allow commercial simulation tools to accurately capture Magnetohydrodynamic (MHD) effects at fusion-relevant conditions. Using these advances, we develop and validate a new generation of modelling workflows tailored for liquid-metal blankets

The work addresses five major challenges that currently slow blanket

development:

1) how induced electrical currents create uneven flow and stagnation zones;

2) how manifold geometry determines whether channels receive too much

or too little coolant;

3) how blankets drain during normal operations or emergencies;

4) how magnetic fields reshape heat-transfer performance; and

5) how surface roughness increases pressure drop and affects long-term

reliability.

The outcome will be design-ready correlations, simulation frameworks, and engineering rules that can be used immediately by industry and national laboratories. These tools will directly support upcoming experiments at facilities such as UNITY, reduce technical risk for blanket developers, and accelerate the path toward commercially deployable fusion systems that rely on liquid-metal technologies.

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Los Alamos Plasma Technologies LLC

SAM UEI: G76WSM7KM7S1

Title: Advanced Sensor Development for Multi-Color Infrared Imaging Bolometers

Abstract:

A bolometer is a diagnostic used to measure the radiation emitted by a plasma. In this project we will develop new sensors for imaging bolometers. Imaging bolometers read out the heat on a thin foil that views the plasma through a pinhole. The infrared optical readout with a sensitive infrared camera enables hundreds or thousands of lines of sight at a time without corresponding wire connections of traditional electrically connected bolometers. Rather than using the traditional large thin foil (which is delicate, hard to make uniformly, and suffers heat diffusion across the sensor), we will be making and testing new designs built with individually isolated multilayer pixels fabricated on a silicon wafer in a clean room using chipmaking microfabrication tools. The new and novel multicolor imaging bolometer sensor will enable pictures of the plasma radiation in different energy bands, e.g. from the edge and the core, simultaneously in one instrument. A multi-energy band imaging bolometer has the potential to enable real-time control of the plasma position in future magnetic fusion devices, by observing the edge radiation boundaries. Los Alamos Plasma Technologies LLC is a plasma diagnostic company with concepts. U of Wisconsin-Madison is our partner with the plasma test facilities (HSX stellarator and MST reversed field pinch), and the National Institute of Standards and Technology (Boulder) has the cleanroom fabrication capabilities and expertise.

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Maritime Fusion

SAM UEI: PWNAJ9EWMJA6

Title: Characterizing Current Sharing, Stability, and Quench Behavior in Soldered REBCO Stacked-Tape HTS Cables for Fusion Magnets

Abstract:

Maritime Fusion and Lawrence Berkeley National Laboratory (LBNL) will collaborate to advance high-temperature superconducting (HTS) magnet technology needed for compact, long-duration fusion systems designed for ships and off-grid applications. The project will experimentally validate Maritime Fusion's high-current REBCO stacked-tape HTS cable architecture through high-current electrical characterization, ramp-rate-dependent testing,

and controlled thermal runaway experiments using LBNL's specialized superconducting testing infrastructure. LBNL will also measure inter-tape contact resistance to quantify current sharing and stability, and will develop and test radio-frequency (RF) sensor approaches for early detection of localized heating ("hotspots") before conventional voltage-based quench signals appear. Finally, the team will optimize and qualify soldering and fabrication parameters using advanced diagnostics, including CT imaging and machine-learning-enabled defect analysis, and scale the process toward meter-length cable segments. Results will provide validated performance limits, manufacturing quality metrics, and improved protection strategies that reduce risk for deploying reliable HTS magnet systems in long-pulse or steady state fusion devices.

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Marvel Fusion Inc

SAM UEI: XYB5EX29WF87

Title: Development of Laser Beam Dumps for Simultaneously High Peak and Average Power Fusion Drivers

Abstract:

Marvel Fusion's (MF) concept for an economically viable Inertial Fusion Energy (IFE) is based on the emerging technology of high-efficiency diode-pumped short-pulse lasers capable of operation at 10 Hz repetition rate, leading to simultaneously high peak and average power levels. MF and its partners are developing two cutting-edge laser systems to demonstrate this technology, which will be capable of delivering 200 J pulses of ~100 fs duration at 10 Hz repetition rate and will be installed at the Colorado State University (CSU) Advanced Technology Lasers for Science and Applications (ATLAS) facility. Controlled operation of these laser drivers will require large-aperture, in-vacuum beam dumps capable of absorbing high intensity pulse trains with both multiple kilowatts of average power and multiple petawatts of peak power. To meet this engineering challenge, MF is developing a novel concept for a beam dump based on plates of absorbing optical glass

coupled to a water-cooled heat sink. This research project is a collaboration between MF and CSU to develop MFs beam dump concept and test the thermal and optical performance using the laser technology and material science infrastructure at CSU, which includes both high peak power and high average power lasers, coating deposition systems, vacuum test hardware, material development equipment, high-performance computing, and advanced manufacturing capabilities. Thermal simulations of heat absorption and dissipation coupled to nonlinear optical simulations of high-intensity propagation in the beam dump glass will first be performed to optimize the engineering design. Subaperture prototypes will then be fabricated and independently tested at high average and peak optical power to benchmark the simulations and validate the designs for future full-aperture components. In this way, the project will provide critical quantitative engineering data and de-risk a key component for future IFE laser drivers.

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OpenStar USA

SAM UEI: TCJRB5MM83P4

Title: Divertor and Edge Modeling for a Levitated Dipole Reactor

Abstract:

OpenStar Technologies and Columbia University are applying existing plasma simulation tools – TokaMaker for equilibrium reconstruction, and Hermes-3 for 2D edge transport and 3D edge turbulence simulations – to design divertor systems for OpenStar's levitated dipole reactors (LDRs). The project validates these established codes against experimental data from OpenStar's operational Junior device, then employs them to optimize divertor geometry and predict power and particle exhaust for Tahi, OpenStar's next-generation machine targeting fusion-relevant plasma conditions. Levitated dipole configurations present unique modeling challenges with their high mirror ratios and true magnetic null X-points, requiring 2D transport treatment that differs from conventional tokamak approaches. This collaboration directly informs Tahi's engineering design and establishes validated predictive capabilities supporting OpenStar's rapid iteration development path toward commercial fusion energy.

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OpenStar USA

SAM UEI: TCJRB5MM83P4

Title: Phase Contrast Imaging of a Levitated Dipole Plasma

Abstract:

OpenStar Technologies is requesting assistance from the Department of Energy to engage with experts at the University of California, San Diego to develop and deploy a Phase Contrast Imaging (PCI) diagnostic system on the "Junior" levitated dipole. This partnership leverages UCSD's world-leading expertise in PCI to perform high-resolution measurements of plasma turbulence and fluctuation-induced transport in a levitated dipole configuration.

The levitated dipole offers a potentially simpler and faster pathway to commercial fusion by utilizing a single levitated magnetic coil to confine plasma. However, to advance this technology toward a commercial power plant, we must accurately measure the turbulence in the plasma to quantify the rate at which energy is lost from the system. Currently, there is limited experimental data to confirm how this turbulence behaves in a dipole system.

The data collected through this project will be used to validate advanced physics models and establish scaling laws that predict how larger, future reactors will perform. By confirming predictions that the levitated dipole can maintain stable, high-pressure plasmas in steady-state, this project directly supports the U.S. goal of accelerating the commercialization of fusion energy. Successful results will de-risk the development of OpenStar's next-generation fusion devices, moving the industry closer to providing a near-limitless supply of economical baseload electricity.

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Pacific Fusion

SAM UEI: XFQBNJZ8YDE7

Title: Composite Liners For Self-Magnetizing High Gain Fusion Targets

Abstract:

Pacific Fusion is building a pulser fusion demonstration system in Albuquerque, NM, with the goal of achieving net facility gain in the early 2030s. This is a critical step on the path to developing a commercial fusion energy system. A key feature of a commercial IFE system is that the targets must be inexpensive. MagLIF, the most highly developed pulser fusion concept to date, uses a large external magnetic field coil to pre-magnetize the target, allowing the subsequent compression to efficiently achieve high temperatures. However, this coil gets destroyed on every experiment, which is infeasible for a high repetition rate IFE system. This project aims to study a novel class of target that allows a portion of the drive magnetic field to leak into the target during the implosion, eliminating the need for the external coils. Recent experiments on the Z machine at Sandia National Laboratories proved that this was possible without perturbing the implosion. This project will study the flux leakage on a small scale, using the COBRA driver at Cornell University, to understand the details of the process and develop the tools needed to control the timing and magnitude of this effect.

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Pacific Fusion Corporation

SAM UEI: XFQBNJZ8YDE7

Title: Activated Praseodymium as a multi-feature diagnostic material for ICF

Abstract:

Pacific Fusion is developing a robust suite of nuclear diagnostics to support the company's mission of developing ICF concepts for fusion energy. Praseodymium is a novel material for activation-based diagnostics and could provide significant advantages for our diagnostic designs and their data quality, however the nuclear data available for Praseodymium is highly uncertain and insufficiently validated. We propose using a recently developed technique at UC Berkeley to efficiently measure the (n,2n) and (n,3n) cross sections of Praseodymium. This cross-section data will ensure accurate results from our activation diagnostics for measurements of total neutron yield and fuel magnetization.

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Realta Fusion Inc

SAM UEI: MVSHELKP1GZ1

Title: Simulation of open field line systems with a new Fokker-Planck equation solver based on COGENT

Abstract:

Realta Fusion requires advanced plasma simulation capabilities to design and understand experiments performed using axisymmetric mirrors, a potentially disruptive path to fusion energy. Fokker-Planck (FP) equation solvers are used to calculate transport in magnetic mirrors. These transport simulations provide the plasma temperature and density profiles set by collisional transport (and potentially anomalous diffusion due to microturbulence) given a magnetic equilibrium and a set of particle and energy sources and sinks. Fast and

effective transport solvers are critical to understanding experiments at the Wisconsin HTS Axisymmetric Mirror (WHAM) and designing next generation devices. However, while FP solver codes for magnetic mirror geometries such as CQL3D-m exist, they rely on the bounce average approximation. The bounce average approximation reduces the dimensionality of the FP equation, making it easier to solve quickly, but this comes at the cost of not being able to accurately account for particle populations which are trapped away from the magnetic midplane (the low field point at the axial center of the magnetic mirror) and the inability to calculate the ambipolar potential which balances the ion and

electron density in the mirror from base principles. These limitations prevent base principles simulation of tandem mirrors for which standard operation is dependent on locally trapped particles that do not transit the midplane and complicated ambipolar potentials. In addition, bounce average models lack the ability to efficiently simulate the mirror expanders as well as the coupling between the mirror confinement and the plasma surface interaction processes. Therefore, first-principles kinetic simulations are also required for integrated modeling.

In this work we propose to apply a fully kinetic 1D-2V (one spatial dimension two velocity space dimensions) FP simulation model developed within the COGENT-code framework to the analysis of parallel collisional transport in weakly-collisional mirrors operated and designed by Realta Fusion. The main computational challenge for fully kinetic simulations is associated with handling time scale disparity between fast parallel streaming (i.e., bounce frequency) and slow ion collision processes. For an explicit time-integration approach, the

problem is further exaggerated by a strenuous Courant constraint associated with a strong magnetic mirror force, thereby making explicit simulations prohibitively costly. The COGENT code employs state-of-the-art implicit time integration capabilities that were initially designed for gyrokinetic simulations of tokamak edge plasmas but can be adapted for magnetic mirrors. Preliminary proof-of-principle results from the COGENT implicit model employing fully kinetic ions and Boltzmann electrons demonstrate speedup by a factor of >1000 compared to recently reported results from analogous explicit simulations for WHAM-like parameters. Following this initial success, we propose to apply the COGENT implicit simulation model for experimental planning and interpretation on WHAM as well as to the analysis of next step fusion devices including a tandem mirror geometry. Additionally, the simulation model will be extended to include the effects of kinetic electron unlike-species (e.g., ion-electron) collisions on the slowing down of neutral beam injected (NBI) ions and on the generation of ambipolar confining potential. Where applicable the results of fully kinetic COGENT simulations will be compared with the result of counterpart CQL3D-m simulations.

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Realta Fusion Inc

SAM UEI: MVSHELKP1GZ1

Title: Tritium Fuel Cycle Analysis for the Axisymmetric Tandem Mirror

Abstract:

Realta Fusion will work with Savannah River National Laboratory (SRNL) to apply their fusion fuel cycle design expertise to the axisymmetric tandem mirror and develop a novel conceptual fuel cycle design optimized for low tritium inventory, leveraging unique aspects and benefits of the Realta Fusion concept. Realta Fusion's axisymmetric tandem mirror has unique requirements which affect fuel cycle design and optimization. The central cell is a plasma region where the majority of fusion power will be produced. The high temperature

superconducting magnets, a dominant cost component, are located at the end plugs flanking the central cell. The two end plugs are designed to intentionally suppress fusion to more easily protect the superconducting magnets from radiation. This is accomplished by fueling the end cells with deuterium only, whereas the central cell will contain a mixture of equal parts deuterium and tritium. As such, the vacuum pump exhaust from the central cell, end plugs, and a third region, the expander cells, will have strongly differing gas mixtures. Furthermore, helium-3 is used for minority heating but is also produced by deuterium-deuterium reactions in the end plugs and it is potentially valuable to recover it. This work builds upon and extends work performed as of the Milestone-Based Fusion Development Program, enabling the next steps towards the axisymmetric tandem mirror FPP.

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Starfire Industries LLC

SAM UEI: GZ2MY2S55JW9

Title: Silicone Carbide Coatings by High Power Impulse Magnetron Discharge with Positive Kick™ for Molten Salt Corrosion Resistance of Fusion Reactor Components

Abstract:

Molten salt technologies are pivotal for advancing high-density high-power energy generation, spanning plasma-facing components, fusion blankets, heat transfer systems, and thermal energy storage. These systems leverage molten salts' high thermal stability, heat capacity, low pressure, and favorable nuclear properties for efficient, low-carbon power and industrial heat. In fusion, molten fluoride salts are well suited to use as breeding blankets due to lithium content, neutron stopping power, and thermohydraulic properties. Many fusion concepts propose FLiBe (a mixture of LiF and BeF2) blankets for tritium breeding and heat extraction, synergizing with fission fluoride-salt-cooled high-temperature reactors. Corrosion of structural elements in molten salt circulation systems

remains a primary industry challenge. While corrosion of structural materials in clean salts is not thermodynamically favored, extensive dissolution of structural elements can occur in real conditions, due to impurities, flow, temperature gradients, irradiation, and redox shifts. Silicon carbide (SiC) emerges as a promising barrier material for structural elements of molten salt breeding blankets to resist chemical attack in purified fluoride salts and have low tritium permeability and solubility to tritium making it suitable as a permeation barrier.

CVD SiC film morphology and texture are challenging to retain excellent properties due to the nucleation and thin-film growth kinetics; whereas, PVD SiC films deposited with next-generation High Power Impulse Magnetron Sputtering with impulse and ion energy control using a patented cathode reversal technology have shown superior performance.

Starfire Industries has developed and patented a thin film deposition and etching technique known as IMPULSE® + Positive Kick™ that enables "not available previously" coatings that create and enhance parameters, i.e. SiC thin-films. Starfire has recently developed a novel HiPIMS system for ID coating small-diameter tubes, pins and cladding that should have strong relevance for the fusion industry. This INFUSE proposal is aimed to develop data can be used to enable enhanced performance of fusion reactor components. We are partnering with the University of Illinois NPRE department for Advanced Blankets and Cooling under Prof. Lorenzo Vergari.

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SuperPower Inc

SAM UEI: CNYTNV4JEDL4

Title: Development of PLD targets for manufacturing high in-field performance REBCO wires for compact fusion

Abstract:

The aim of this project is to develop state-of-the-art PLD targets that are optimized to deliver high performance REBCO-based 2G HTS wires for compact fusion systems. The initial focus of this work is the development of a robust PLD target fabrication method that can be utilized to support PLD REBCO wire manufacturing. This method will then be used, in combination with extensive REBCO development experience, and raw material handling and fabrication knowledge, to produce targets optimized for PLD systems. These optimized PLD targets will be targeting the high performance fusion requirements at 20K in high magnetic fields up to and exceeding 20T. This project will provide the capability needed to support the rapid expansions currently underway by REBCO wire suppliers to fill the compact fusion development demands.

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Terra Fusion Energy Corp

SAM UEI: GNHKB7CFYD17

Title: Towards integrated modeling of rotating mirror plasmas

Abstract:

Terra Fusion and Lawrence Livermore National Laboratory are partnering to develop a computational framework that will be used to refine the design of Terra Fusion's next fusion prototype. The framework will assess the stability and transport of a centrifugal mirror fusion energy machine with time dependent, fully nonlinear extended MHD simulations that include finite Larmor radius (FLR) effects. Additionally, stability of the equilibrium profiles will be studied using an independent global eigenvalue solver of the linearized equations. The extended MHD simulations will be done with the COGENT

code. A Grad-Shafranov equilibrium solver will be set up to obtain ideal MHD equilibrium profiles, which will be used as initial profiles for time-dependent extended MHD simulations, including verification with experimental results from the Centrifugal Mirror Fusion Experiment (CMFX). The results from this project will be integrated into an engineering iterative design loop that will optimize the design and accelerate the completion of the next generation machine under development by Terra Fusion, the TFEC-1 demonstration. These results will directly accelerate development of this technology, and bring commercial fusion to market.

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Thea Energy

SAM UEI: C6RDDSQK1KS8

Title: Recovery Mode via Thermal Cycling of Neutron Irradiated HTS

Abstract:

Thea Energy, Inc. in partnership with the MIT Plasma Science and Fusion Center (PSFC), will utilize the MIT Research Reactor (MITR) to address a critical bottleneck for commercial fusion: the long-term survivability of high temperature superconducting (HTS) magnets under simultaneous cryogenic temperatures, high magnetic fields, and fast neutron flux. This project seeks to close the knowledge gap between room temperature and cryogenic irradiation effects by analyzing the performance degradation of HTS tapes from multiple

manufacturers and a proprietary composite material designed for Thea Energy's planar stellarator coils. By evaluating thermal cycling as an active rejuvenation mode to recover radiation-induced performance degradation in HTS magnets, the study aims to shift the industry from a passive-failure model to a management maintenance paradigm. This research directly supports the 2025 DOE Fusion Science and Technology Roadmap, de-risking the path to a steady-state fusion power plant and significantly reducing the levelized cost of electricity (LCOE) through optimized magnet shielding and extended

operational lifespans.

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Thea Energy, Inc

SAM UEI: C6RDDSQK1KS8

Title: Adaptive Coil Current Optimization for Magnetic Island Suppression

Abstract:

This project will improve the reliability of advanced fusion devices by developing active control strategies to suppress magnetic islands – unwanted features in the magnetic field that degrade confinement - in quasi-axisymmetric (“QA”) stellarators. While QA designs are highly efficient, the evolution of pressure-driven effects, like the bootstrap currents, during system start-up can distort the magnetic fields required for plasma confinement, creating islands that can leak heat and particles. To address this, the project will employ a multifidelity simulation workflow that combines rapid computer modeling with detailed physics simulations to resolve complex plasma behaviors from vacuum to full-pressure operation. These models will inform an optimization routine that automatically tunes the electrical currents in the stellarator's planar shaping coils to "heal" magnetic islands as they emerge. By shifting the burden of precision from static hardware manufacturing to dynamic software control, this work will enable safe trajectories to high-performance plasma conditions and support the deployment of flexible, commercially viable fusion energy systems.

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Thea Energy, Inc

SAM UEI: C6RDDSQK1KS8

Title: Chemistry and radiance of boron ablation plumes relevant to deuterium edge fusion plasmas

Abstract:

This project characterizes the atomic, chemical, and radiative properties of boron-based vapor shields designed to protect the plasma facing components (“PFCs”) of stellarator fusion power plants. This collaboration between Thea Energy, Inc. and the Princeton Plasma Physics Laboratory applies the laboratory’s expertise in plasma chemistry and plasma-surface interactions to the engineering challenge of PFC survivability in a fusion power plant. To generate the necessary experimental data, the research team will use short-pulse laser ablation of boron targets into deuterium gas to generate divertor-relevant material species. High resolution spectroscopy will measure the radiative signatures and chemical evolution of the resulting boron, boron deuterides, and plasma species. These experimental data will target specific gaps in current atomic databases, such as the lack of validated reaction rates and photon emission coefficients for transient boron deuteride molecules. Incorporating these measurements into multi-physics plasma material and impurity transport models will refine the simulation of vapor shielding dynamics. This project supports the exploration of divertor materials and will inform operational strategies which leverage boron impurities for PFC heat flux mitigation. These improvements are predicted to increase component and operational lifetime and core fusion plasma performance. Additionally, the fundamental insights gained into boron plasma chemistry offer broad benefits to the fusion community, particularly for devices employing boronization or impurity powder droppers for wall conditioning.

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Type One Energy Group

SAM UEI: D26JC7VM3Q71

Title: An AI/ML Pipeline for Rapid and Automatic Spectroscopy Analysis

Abstract:

To make fusion energy a reality, power plants need to run safely 24/7 without constant human intervention. The objective of this project is to build an Artificial Intelligence (AI)/Machine Learning (ML) system that acts as a 'smart monitor' for Type One Energy's next-step fusion device, Infinity One. Signals generated by light produced by the super-heated gas (plasma) will be the inputs to the smart monitor. This automated system will instantly detect leaks, contamination, or damage to the machine's interior and alert the control systems to fix the problem. This project combines the extensive experience and existing data from the HSX (Helically Symmetric eXperiment) stellarator laboratory with cutting-edge software to help bring commercial fusion energy to the grid faster.

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Type One Energy Group

SAM UEI: D26JC7VM3Q71

Title: Fast, Distributed, Fusion Exhaust Gas Analyzers for a Stellarator-based Prototype Reactor

Abstract:

This project will provide a fusion exhaust measurement system that can potentially function in the challenging fusion power plant environment, which will greatly support the monitoring and control of a fusion power plant. The goal of this project is to improve the technical readiness level of this exhaust system by testing it at higher magnetic fields and higher neutral pressure ranges typical of Type One Energy's next-step fusion device, Infinity One with a longer vision of making it viable for the Type One Energy's Infinity Two fusion power plant.

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Westinghouse Electric Co

SAM UEI: J5M8ZBUUUGK5

Title: Testing of (n, α) neutron-conversion layers for neutron spectrum measurements in fusion breeder blankets

Abstract:

Identify and test neutron-conversion layer materials to be used for neutron flux spectrum measurements suitable for the breeder blanket environment in Fusion Power Plants (FPP). Neutron flux sensors are essential for tritium accountancy, which is critical for the efficient operation of FPPs. Tritium production is currently estimated using neutronic modeling given the harsh environment in breeder blankets. Therefore, development of miniature neutron

flux sensors capable of providing real-time, high-energy-resolved, neutron flux measurements (neutron spectrum measurements) compatible with fusion blankets is needed.

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Xcimer Energy Inc

SAM UEI: KJLGRKMA6GG6

Title: Experimental Validation of Liquid Fuel Expansion and Vapor Pressure in Wetted Foam Targets

Abstract:

This project addresses a critical, unresolved physics risk for inertial fusion energy by experimentally quantifying liquid fuel redistribution and vapor pressure evolution in wetted foam targets under controlled thermal conditions. Using state-of-the-art cryogenic platforms and high-resolution, time-resolved x-ray and optical diagnostics at SLAC, the work will provide the first direct measurements of liquid deuterium expansion, clean inner-layer formation, and liquid–vapor equilibration as functions of temperature and time. These data will benchmark multiphase physics models, test long-standing equilibrium assumptions, and define allowable thermal excursions during target handling and chamber transit. The results directly inform Xcimer Energy's Fusion Pilot Plant target injection and cryogenic requirements, reducing ignition margin uncertainty, tritium inventory risk, and licensing risk while generating broadly relevant, publishable measurements for the IFE community.

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