Promotion of interdisciplinary research through UNIT (1/2)

Address the "**unsolved problems**" of fusion science through "**academic formulation**" of them, by establishing the "**interdisciplinary joint research structure**."

UNIT	Axis	Theme
Meta-hierarchy dynamics	Dynamics, space-time	Reconsidering the hierarchy of fusion plasma phenomena from a bird's-eye view (meta) perspective, we reformulate contributions from micro-models and macro-models to construct a physical model that expresses multi-layered dynamics and explore the universality inherent therein. We will utilize methodologies obtained through both theoretical and experimental studies to establish academic collaborations both within and outside the field.
Structure formation and sustainability	System	Using fusion plasmas as a subject, explore universal laws behind structure formation common to various systems and contribute to establishing more efficient and sustainable confinement methods for plasmas. The knowledge from these studies will be fed back to the design and optimization method of the magnetic coils that generate the confinement field.
Phase space turbulence	Fluctuation, Turbulence, Transportation	Experimental research on phase space plasma fluctuations is carried out to provide answers to anomalous transport, which is an unsolved problem in fusion plasma research. Taking guidance from theoretical and simulation studies, we simultaneously measure the velocity distribution function at multiple points in space and observe the phase space structure. Complementary research development with other research areas where the particle nature of plasma becomes notable (e.g., laser-plasma interaction and magnetospheric plasma) will contribute to understanding non-equilibrium and nonlinear plasma physics.
Plasma Quantum Processes	Elementary process, Interaction	From the quantum processes of atoms, molecules, and light occurring in plasma and matter, we clarify how the collective properties and dynamics are determined and how they are observed as collective phenomena. Quantitative physics models of non-equilibrium and high-density plasmas in fusion reactors, celestial bodies, and the universe will be developed to elucidate universal physics for collective phenomena on a wide variety of scales.
Transports in Plasma Multi-Phase Matter System	Different-phase coupled phenomena	This research aims to understand and control heat, particles, and momentum transport phenomena due to interactions between plasmas and solids, liquids, and gases in the open magnetic field region where magnetic confinement plasma connects to walls. The knowledge and technologies obtained from such research will be applied to fields other than the fusion field to contribute to advancing those fields.

Promotion of interdisciplinary research through UNIT (2/2)

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UNIT	Axis	Theme
S&I: Sensing and Intellectualization	Measurement, data	Innovative measurement, analysis, and expression methods and a new system for understanding nature that integrate them will be realized. We will tackle unresolved problems in fusion science through unprecedented measurement with high spatial and temporal resolution, data analysis using statistical mathematics and data science methods, and advanced information conversion to visual, auditory, and tactile senses.
Plasma Apparatus	Device Science, Technology	To create new measurement and control technologies for charged particles by improving the existing measurement and control technologies in plasma and fusion science experiments. Always keep a broad perspective, collaborate and fuse with other fields, and use these technologies to explore methods to bring about qualitative changes in the deepening of natural sciences (including applied sciences) and methods to pursue new developments in natural sciences.
Complex Global Simulation	Computing Science	Global simulations that consider the interactions between hierarchies are necessary to understand the behavior of systems composed of multiple hierarchies. We will develop a coupling method between hierarchies and different physical models to realize a global simulation of the entire magnetically confined fusion plasma, including the core and boundary plasma, and establish a methodology with broad applicability.
Ultrahigh-flux concerting materials	Material science	In fusion, nuclear power, space, aerospace, chemical plants, etc., materials are used in harsh environments where ultra-high flux energy and particles are injected into the materials. We aim to investigate and systematize the fundamental laws governing the adaptation and life of materials in such harsh environments, create high-strength, high-performance, long-life materials that will revolutionize engineering systems under harsh environments, and establish life prediction theory.
Applied Superconductivity and Cryogenics	Cryogenics	We will conduct academic research to establish innovative superconducting magnet and low-temperature technology with high performance and versatility under high reliability and contribute to the long-term goal of fusion and the medium- to short-term goal of creating a carbon-neutral society. We are also researching and developing liquid hydrogen, which is attracting attention as a "clean energy."