Nuclear Science User Facilities Access Only

Melissa Bates, Federal Program Manager
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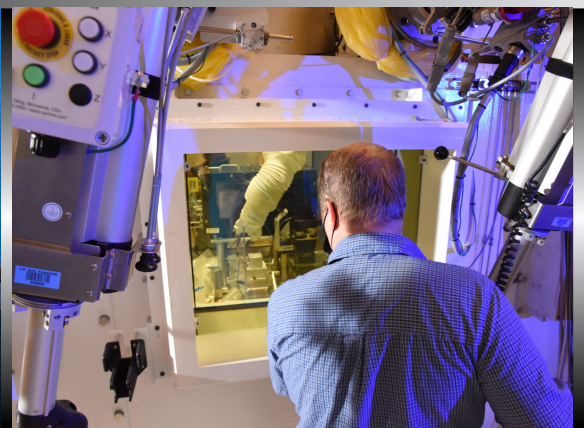

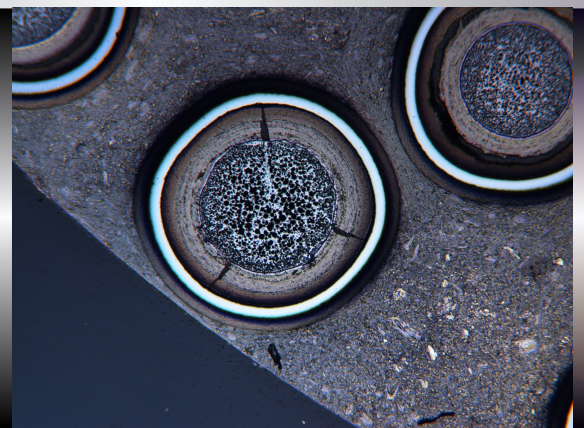

NSUF Nuclear Science User Facilities

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Nuclear Science User Facilities

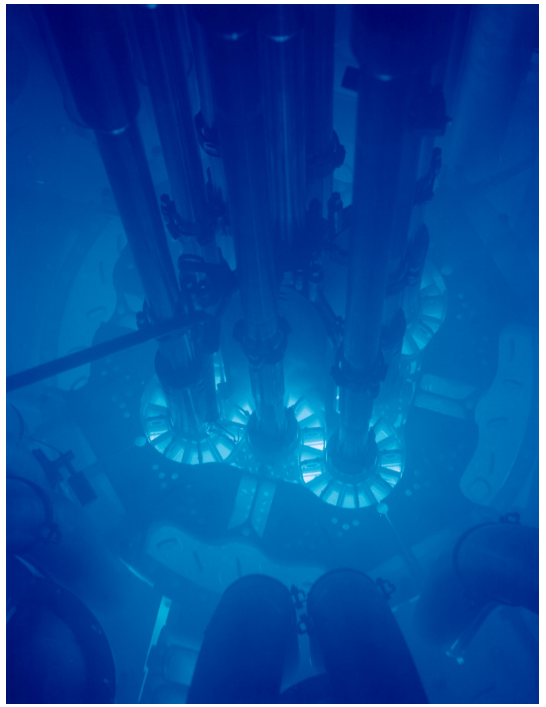
Established in 2007 as DOE Office of Nuclear Energy's user facility

- Focus: Irradiation effects in nuclear fuels and materials
- Provides access to capabilities and to expertise at no cost to the user
- Supports experiment design, fabrication, transport, irradiation, PIE, disposition

Projects are selected through open, competitive proposal processes

- Consolidated Innovative Nuclear Research (CINR) FOA
  - Neutron Irradiation and Post Irradiation Examination (PIE) ($500K - $4.0M, up to 7 years)
  - Synchrotron or Neutron Beamline or PIE only ($50K to $750K, up to 3 years)
  - Neutron irradiation only ($500K - $3.5M, up to 3 years)
  - Ion or Gamma Irradiation only ($20K - $100K, up to 3 years)
  - Ion or Gamma Irradiation and PIE ($50K - $250K, up to 3 years)

- Rapid Turnaround Experiments (RTE)
  - Not part of the CINR FOA
  - Limited scope ($50K) and completed within 9 months
  - Open to university, national laboratory, and industry applicants

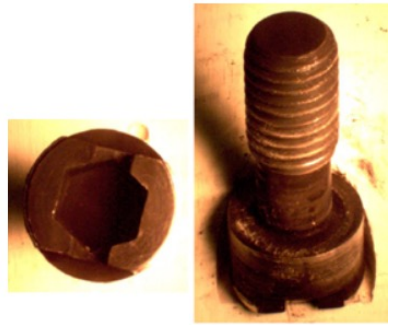


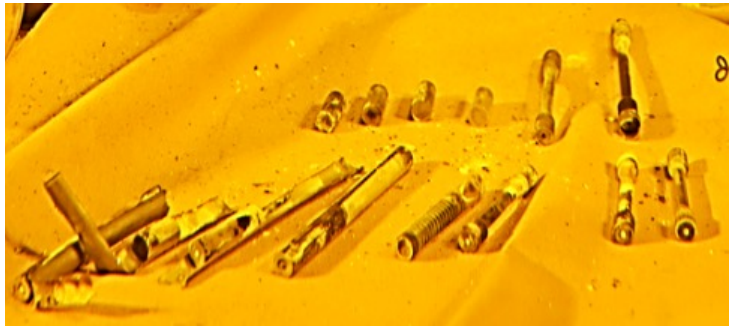
Consortium Offering Research Opportunities

Neutron Irradiations	Ion Irradiations	Gamma Irradiations	Post Irradiation Examination	Characterization Beamlines	High Performance Computing
INL Idaho National Laboratory	University of Wisconsin-Madison	INL Idaho National Laboratory	INL Idaho National Laboratory	CAES Center for Advanced Energy Studies	Brookhaven National Laboratory
Oak Ridge National Laboratory	University of Michigan	Oak Ridge National Laboratory	Oak Ridge National Laboratory	Cal	NC State University
Massachusetts Institute of Technology	Argonne National Laboratory	Sandia National Laboratories	PNNL	NC State University	Los Alamos National Laboratory
NC State University	Sandia National Laboratories		University of Michigan	Purdue University	
Ohio State	Texas A&M University		Westinghouse	University of Florida	
SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire	Lawrence Livermore National Laboratory		Los Alamos National Laboratory	University of Wisconsin-Madison	
			SCK•CEN Studiecentrum voor Kernenergie Centre d'Etude de l'Energie Nucleaire		

Nuclear Fuels and Materials Library (NFML)

- The library includes over 6000 specimens from NSUF projects, legacy research projects, commercial reactors, and research reactors
- Most specimens are neutron irradiated with a small number of ion irradiated materials
- Web-based searchable database through nsuf.inl.gov
  - Material or fuel composition
  - Specimen configuration
  - Irradiation conditions
  - Publications
- Specimens include:
  - Steels – conventional and advanced
  - Nickel and uranium alloys
  - Ceramics
  - High purity elemental materials
  - Actinides
  - Various fuel forms and constituents (Please contact NSUF)





NSUF Workscopes

NSUF-1: NUCLEAR SCIENCE USER FACILITIES ACCESS ONLY

Eligible to lead: University, National Laboratory & Industry Applicants

- NSUF-1.1: CORE AND STRUCTURAL MATERIALS AND NUCLEAR FUEL BEHAVIOR AND ADVANCED NUCLEAR FUEL DEVELOPMENT
  - UP TO 7 YEARS
  - NSUF READINESS REQUIREMENTS APPLY

  (Federal POC – Melissa Bates, Technical POC – Simon M. Pimblott)

- NSUF-1.2: HIGH PERFORMANCE COMPUTING AT IDAHO NATIONAL LABORATORY
  - LIMITED TO 3 YEARS

  (Federal POC – Melissa Bates, Technical POC – Eric Whiting)

NSUF-1 Access Only Workscopes

Objective

- Provide access to the capabilities of the NSUF for research projects supporting the DOE Office of Nuclear Energy mission

Types of Projects

- Neutron Irradiation and Post Irradiation Examination (PIE)
- Synchrotron or Neutron Beamline or PIE only
- Ion or Gamma Irradiation only
- Ion or Gamma Irradiation and PIE
- Computational projects requiring INL High Performance Computing

Restrictions

- R&D support funding for applicant not provided.
- Source, scope and duration of R&D funding must be identified.
- NSUF does not fund travel, salaries, or other user costs.

NSUF-1.1:
CORE AND STRUCTURAL MATERIALS AND NUCLEAR FUEL BEHAVIOR AND ADVANCED NUCLEAR FUEL STUDIES

- Focused on:
  - fundamental understanding of irradiation effects in core and structural materials and the behavior of nuclear fuels (including cladding) in reactor, and research into advanced nuclear fuels and improving the performance of current fuels

- Areas of interest include:
  - material aging and degradation mechanisms, testing alternate and/or radiation resistant materials for application in current and future fission reactors, and materials from alternate or advanced manufacturing techniques (including welding and joining)
  - physics and chemistry of nuclear fuels and other radioactive materials, irradiation and thermal effects on microstructure development and the effects on, for example, thermophysical and thermomechanical properties as well as chemical interactions.

NSUF-1.1:
CORE AND STRUCTURAL MATERIALS AND NUCLEAR FUEL BEHAVIOR AND ADVANCED NUCLEAR FUEL STUDIES

- Projects may involve research in the areas of fuels and materials irradiation performance and combined effects of irradiation and environment on fuels and materials.
- Advanced fuel types extend to fast spectrum transmutation systems, coated particle fuels for high-temperature reactor systems, robust fuels for light water reactors including accident tolerant fuels, and fuel for small modular, micro-, and other advanced reactor concepts.
- Activities can be aimed at irradiation experiments (neutron steady state or transient, ion, and gamma) and post irradiation examination that investigate fundamental aspects of fuel performance such as radiation damage, amorphization, fuel restructuring, species diffusion and migration, and fission product behavior.
- Separate effects testing focused on validation of specific modeling and simulation issues is encouraged.
- Proposals that advocate duplicating previous or on-going NSUF supported irradiation studies will not be considered. A complete list of NSUF awards made under the FY2017 to FY2022 CINR funding opportunities can be found under the R&D flag on the website NEUP.inl.gov

NSUF-1.2:
HIGH PERFORMANCE COMPUTING AT IDAHO NATIONAL LABORATORY

- Provide scientific computing capabilities to support efforts in advanced modeling and simulation (Sawtooth, Lemhi, and Hoodoo)
- Proposals in this area may address a wide range of research activities including:
  - performance of materials in harsh environments (including the effects of irradiation and high temperatures),
  - performance of existing light water and advanced nuclear reactors
  - multiscale, multi-physics analysis of nuclear fuel performance
- Support includes access to INL HPC systems, assistance with system login and running code, basic HPC training, and software support and expertise as requested.
- Available software includes an assortment of tools in the areas of: Computer Aided Engineering, Chemistry, Code Development, Data Manipulation, Math, MPI, Neutronics and Transport, Numerical Libraries, Programming, and Visualization
- Access to HPC resources through this FOA does not provide licenses to software
- Use of DOE-developed software from the NEAMS programs is encouraged

INL HPC Capabilities

- **Sawtooth**: INL's newest supercomputer operates with a LINPACK rating of 5.6 petaflops and is ranked #37 on the November 2019 TOP500 list. The HPE SGI 8600 system comprises 99,792 cores with 403 TB of memory. The system also includes dedicated GPU capability with 108 NVIDIA V100 GPUs.

- **Lemhi**: A Dell 6420-based system operating on an OmniPath fat tree network. It contains 20,160 cores and 94 total terabytes of memory. Lemhi is rated at 1 petaflop and ranked #427 on the November 2018 TOP500 list.

- **Hoodoo:** A Lambda Hyperplane deep learning distributed memory system with 44 NVIDIA A100 tensor core GPUs and 7.2 TB of total memory.

- **Storage:** 3 Petabytes of disk storage including a **WORM** (Write-once read-many) filesystem for use in multi-year archiving of data

NSUF User Agreement

- Upon award of an NSUF supported project, the NSUF User Agreement must be signed before activities will begin on the project.

- Failure to sign the non-negotiable User Agreement within 30 days of receipt of the User Agreement may result in cancellation of an awarded project.

Application Timeline

• Letter of Intent (Mandatory)	14 September 2022 @ 7.00 pm ET
• NSUF Preapplication (Mandatory)	28 September 2022 @ 7.00 pm ET
• NSUF Preliminary SOW (Mandatory)	30 November 2022 @ 7.00 pm ET
• NSUF Final SOW (Mandatory)	25 January 2023 @ 7.00 pm ET
• Full NSUF Application	8 February 2023 @ 7.00 pm ET

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NSUF Website, https://nsuf.inl.gov/


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Nuclear Science
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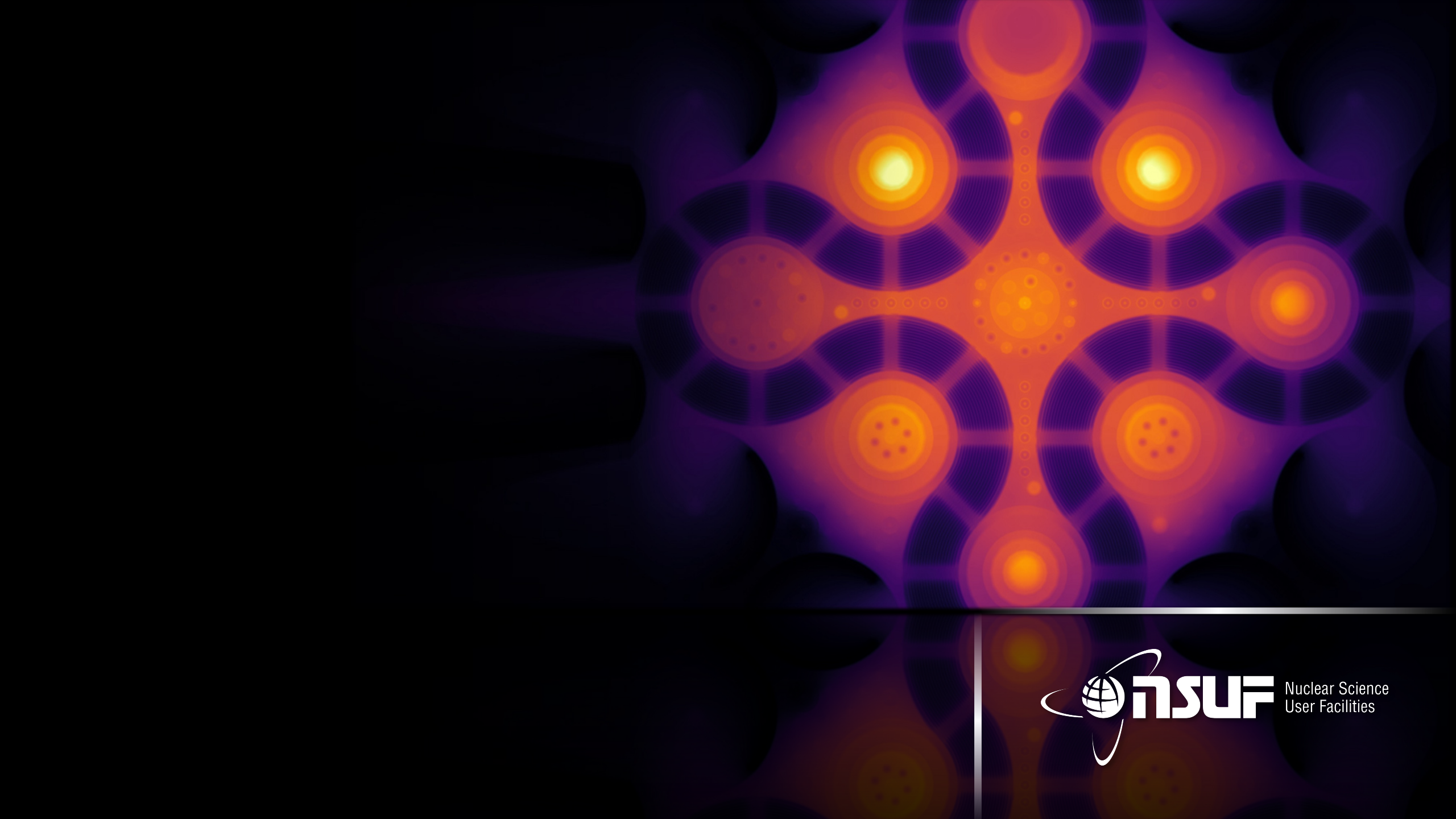
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