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Update on the NSAC Nuclear Data Charge Subcommittee

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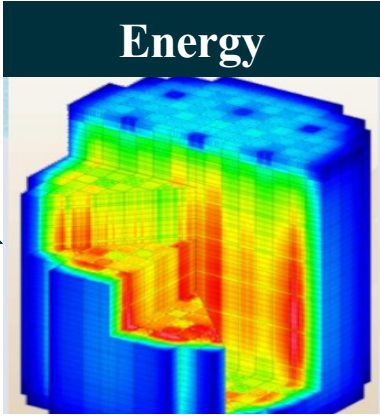
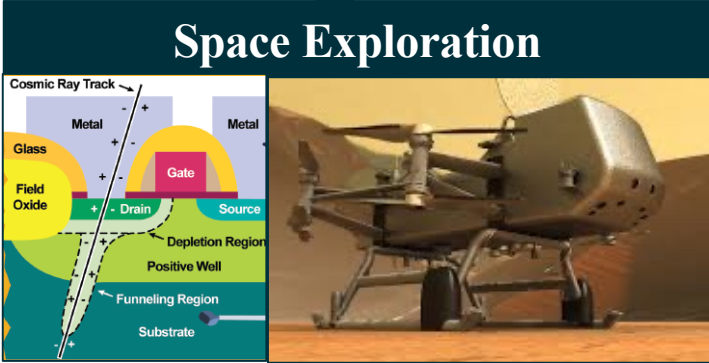


Update to the Nuclear Science Advisory Committee
July 13, 2022

Nuclear Data is a primary pipeline for the important work of the Nuclear Science Community to impact many applications



Nuclear Data



The First Part of the Charge (due 9/15/22)

1. Assess USNDP Status, which would include the following actions:
 - a) Assess and document recent achievements in nuclear data and their impact.
 - b) Survey current and future federal and non-federal needs for reliable, accurate, secure, accessible nuclear data.
 - c) Assess the role, competitiveness, and importance of the USNDP in an international context.

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Input from USNDP staff

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- b) Survey current and future federal and non-federal needs for reliable, accurate, secure, accessible nuclear data.

Input from Workshop Whitepapers & Subcommittee Members

- c) Assess the role, competitiveness, and importance of the USNDP in an international context.

Input from USNDP staff & Subcommittee Members

Workshop Whitepapers, Review Articles and External Input from USNDP speakers were assembled to aid the committee in its work

1. Whitepapers from seven nuclear data conferences:

- Nuclear Data Needs and Capabilities for Applications (2015)
- Nuclear Data Needs and Capabilities for Basic Science (2016)
- Nuclear Data Roadmapping Enhancement Workshop (2018) – focused on Nonproliferation
- Workshop for Applied Nuclear Data (2019)
 - Focus on Energy, Isotopes, Safeguards, Atomic Data, (n,x) reactions...
- Workshop for Applied Nuclear Data (2020)
 - Focus on AI/ML, Detectors, Covariance, (n,xn and (n,x γ), Isotopes
- Workshop for Applied Nuclear Data (2021)
 - Focus on Isotopes, Computing/AI/ML, Energy, Human Pipeline
- Some session reports from the Workshop for Applied Nuclear Data (2022)
 - Space Applications subgroups

2. Intro material (Annual Review Article, “Nuclear Data 101” Lecture)

3. Material from Presenters (talks and reports/summaries)

The NSAC Nuclear Data (NSAC-ND) Charge Subcommittee

<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
Friederike Bostelmann	ORNL	Arjan Koning	IAEA/Petten
Mike Carpenter	ANL/Atlas	Ken LaBel & Tom Turflinger	NASA & Aerospace
Mark Chadwick	LANL	Caroline Nesaraja	ORNL
Max Fratoni	UCB	Syed Qaim	Jülich
Ayman Hawari	NC State	Catherine Romano	Aerospace
Lawrence Heilbronn	UTK	Sunniva Siem	Univ. of Oslo
Calvin Howell	TUNL	Artemis Spyrou	MSU
Jo Ressler	LLNL	Etienne Vermeulen	LANL
Thia Keppel	J-lab	Ramona Vogt	LLNL

All of these people were chosen based on their experience in nuclear data and some of the applications that rely on it

We had our kick-off meeting on June 15 to get introduced and to gather information from USNDP staff



1. Introductions (10 min);
2. Opening talk and charge review (10 min);
3. Sorting into topical sub-groups (10 min);
4. Talks from USNDP Personnel (90 min total);
 1. Dave Brown (BNL/NNDC): Nuclear Database & Pipeline Overview - (15+10 min)
 2. Elizabeth McCutchan (BNL/NNDC): ENSDF modernization; Pre-publication discrete structure review process. (10+5 min)
 3. Keith Jankowski (DOE/NP): The Nuclear Data Interagency Working Group FOA process. (15 min+5)
 4. Filip Kondev (ANL): Atomic Mass Evaluation, Major accomplishments from ANL (10+5 min)
 5. Michael Smith (ORNL): Nuclear Data for Astrophysics (10+5 min)
5. Closeout (5 min)

During the next week the subcommittee sorted itself into topical subgroups



Energy Applications Topical Group (6/30)



<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
<i>Friederike Bostelmann*</i>	<i>ORNL</i>	Arjan Koning	IAEA/Petten
Mike Carpenter	ANL/Atlas	Ken LaBel & Tom Turflinger	NASA & Aerospace
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Calvin Howell	TUNL	Artemis Spyrou	MSU
Jo Ressler	LLNL	Etienne Vermeulen	LANL
Thia Keppel	J-lab	Ramona Vogt	LLNL

**Writing assignment leads*

Medical Applications Topical Group (7/1)

<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
Friederike Bostelmann	ORNL	<i>Arjan Koning</i>	<i>IAEA/Petten</i>
<i>Mike Carpenter</i>	<i>ANL/Atlas</i>	Ken LaBel & Tom Turflinger	NASA & Aerospace
Mark Chadwick	LANL	<i>Caroline Nesaraja</i>	<i>ORNL</i>
Max Fratoni	UCB	<i>Syed Qaim*</i>	<i>Jülich</i>
Ayman Hawari	NC State	<i>Catherine Romano</i>	<i>Aerospace</i>
Lawrence Heilbronn	UTK	<i>Sunniva Siem</i>	<i>Univ. of Oslo</i>
<i>Calvin Howell</i>	<i>TUNL</i>	<i>Artemis Spyrou</i>	<i>MSU</i>
Jo Ressler	LLNL	<i>Etienne Vermeulen*</i>	<i>LANL</i>
<i>Thia Keppel*</i>	<i>J-lab</i>	Ramona Vogt	LLNL

**Writing assignment leads*



National Security Topical Subgroup (7/1)



<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
Friederike Bostelmann	ORNL	Arjan Koning	IAEA/Petten
<i>Mike Carpenter*</i>	<i>ANL/Atlas</i>	<i>Ken LaBel & Tom Turflinger</i>	<i>NASA & Aerospace</i>
<i>Mark Chadwick</i>	<i>LANL</i>	Caroline Nesaraja	ORNL
Max Fratoni	UCB	Syed Qaim	Jülich
Ayman Hawari	NC State	<i>Catherine Romano</i>	<i>Aerospace</i>
Lawrence Heilbronn	UTK	<i>Sunniva Siem</i>	<i>Univ. of Oslo</i>
<i>Calvin Howell</i>	<i>TUNL</i>	Artemis Spyrou	MSU
<i>Jo Ressler*</i>	<i>LLNL</i>	Etienne Vermeulen	LANL
Thia Keppel	J-lab	<i>Ramona Vogt</i>	<i>LLNL</i>

**Writing assignment leads*

Nonproliferation Topical Subgroup (7/5)

<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
<i>Friederike Bostelmann</i>	<i>ORNL</i>	Arjan Koning	IAEA/Petten
<i>Mike Carpenter</i>	<i>ANL/Atlas</i>	Ken LaBel & Tom Turflinger	NASA & Aerospace
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Thia Keppel	J-lab	<i>Ramona Vogt</i>	<i>LLNL</i>

**Writing assignment leads*

Additional input provided by Dr. David Matters (NA-22 Nuclear Data PM)

Basic Science Topical Subgroup (7/6)

<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
Friederike Bostelmann	ORNL	<i>Arjan Koning*</i>	<i>IAEA/Petten</i>
<i>Mike Carpenter*</i>	<i>ANL/Atlas</i>	Ken LaBel & Tom Turflinger	NASA & Aerospace
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Jo Ressler	LLNL	Etienne Vermeulen	LANL
Thia Keppel	J-lab	<i>Ramona Vogt</i>	<i>LLNL</i>

**Writing assignment contributions*

Database Topical Subgroup (7/6)

<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
<i>Friederike Bostelmann</i>	<i>ORNL</i>	<i>Arjan Koning</i>	<i>IAEA/Petten</i>
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Thia Keppel	J-lab	<i>Ramona Vogt</i>	<i>LLNL</i>

Caroline Nesaraja (with help from Michael Smith) provided input gathered from the nuclear structure evaluation community



Space Applications Topical Subgroup (7/7)



<u>Person</u>	<u>Org</u>	<u>Person</u>	<u>Org</u>
Friederike Bostelmann	ORNL	Arjan Koning	IAEA/Petten
Mike Carpenter	ANL/Atlas	<i>Ken LaBel & Tom Turflinger*</i>	<i>NASA & Aerospace</i>
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Thia Keppel	J-lab	<i>Ramona Vogt</i>	<i>LLNL</i>

**Writing assignment leads*

Some common themes are emerging

1. Integral Benchmarks are needed for many areas
 - Energy (criticality), isotope production (thick target yields)
 - The National Criticality Safety Program could be a model for this
2. Nuclear reaction networks for 6,000-8,000 reactions (mostly neutrons & γ s)
 - Both recommended values and uncertainties (including covariances)
 - A USNDP-led effort is needed to provide the correct input including discrete structure (ENSDF \rightarrow RIPL), $\rho(E)$, $\Gamma(E_\gamma)$, Optical Model parameters etc.
3. ≤ 10 GeV \cdot A reaction data are needed for space, isotopes, beam therapy
4. Suggestions from USNDP:
 - Consistency between databases, faster publication (associate editors?), Strengthen the satellite sensors, ML evaluation tools to improve Sisyphean tasks, engineering study to streamline the nuclear data pipeline process.

Next Steps

- Over the next 3 weeks the topical subgroups will provide written input to the chair
- This information, together with the input from the USNDP staff, will be compiled into a draft report organized by *crosscutting nuclear data type* (see next slides)
- This report will be distributed to the subcommittee and USNDP leadership to allow for feedback.
- The report will be edited until 9/15/22 and then distributed to the committee for use in the second part of the charge.

Cross Cutting Area #1 – Decay Data

Decay Data

Nonproliferation

Astrophysics

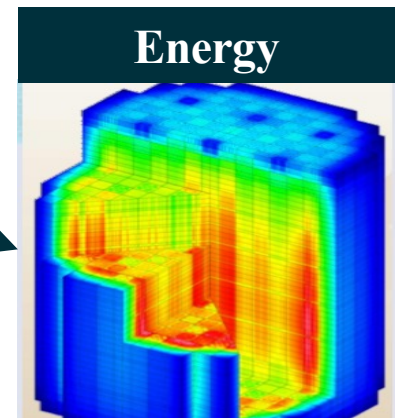
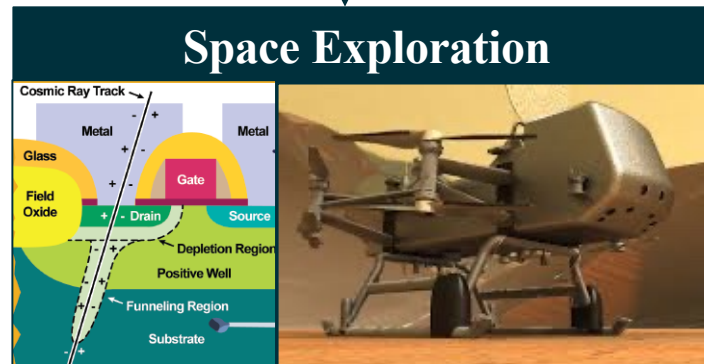
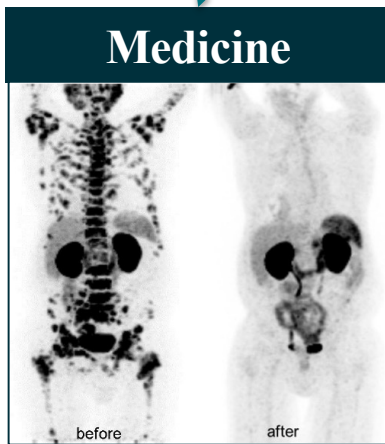
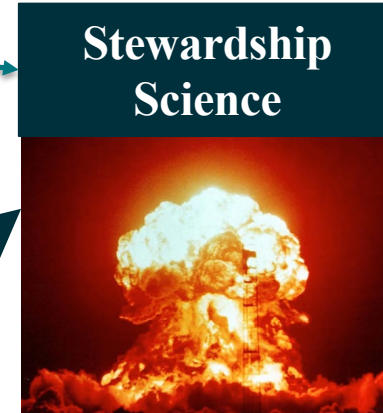
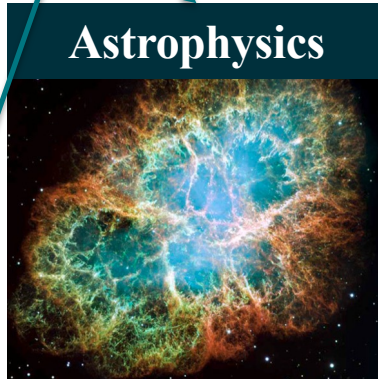
Stewardship Science

Nuclear Data

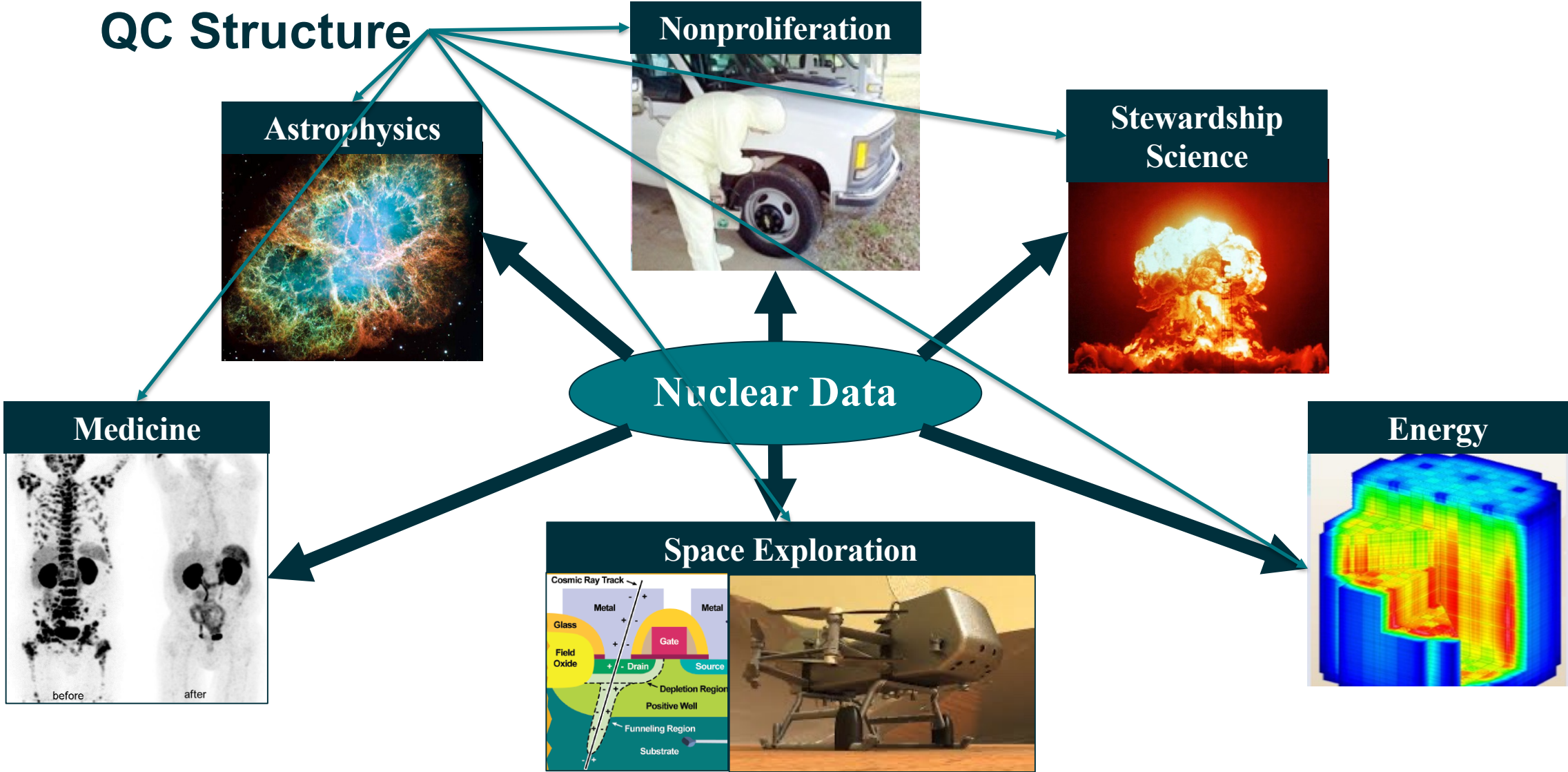
Medicine

Energy

Space Exploration

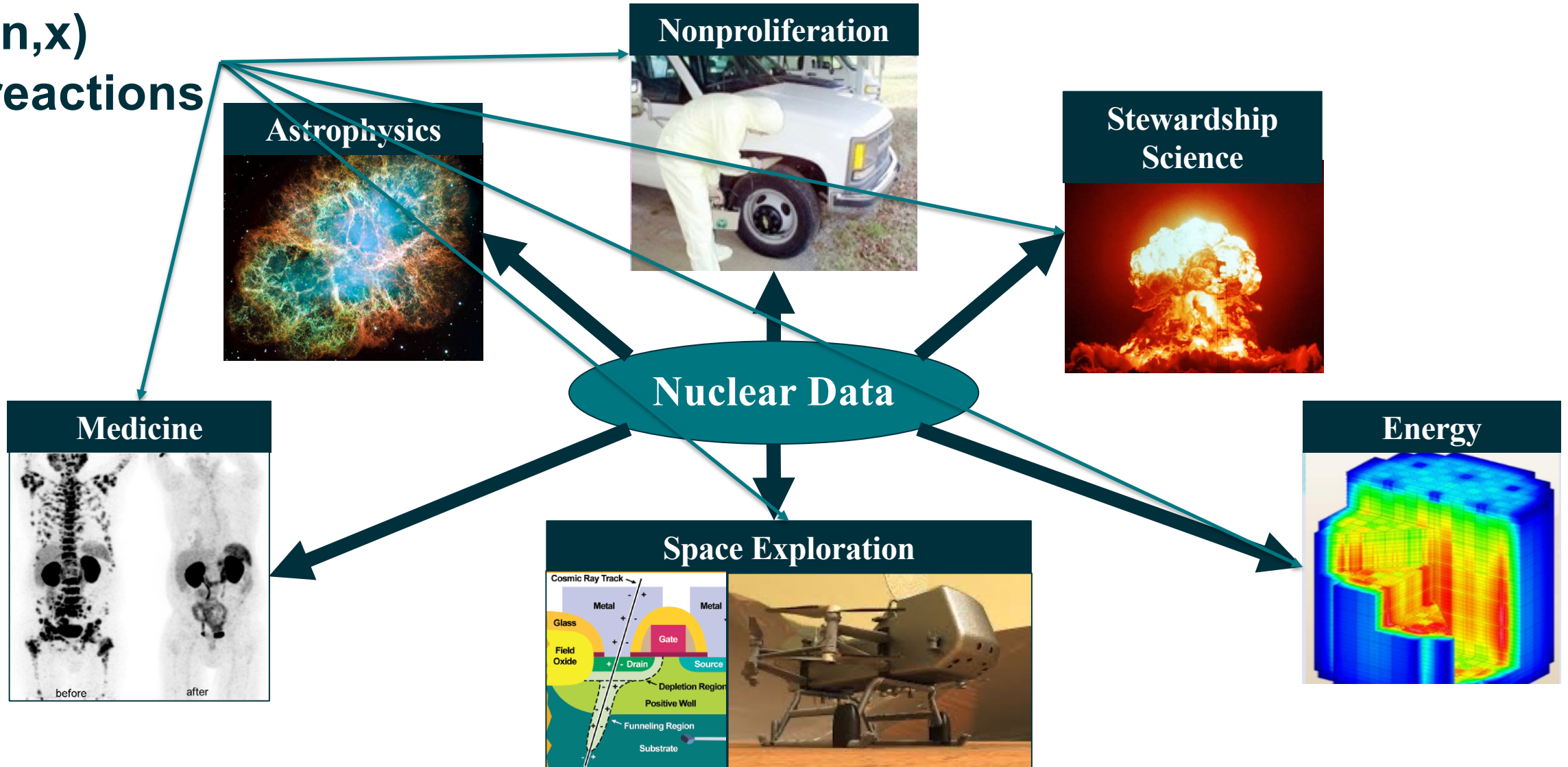


Cross Cutting Area #2: Structure Beyond ENSDF



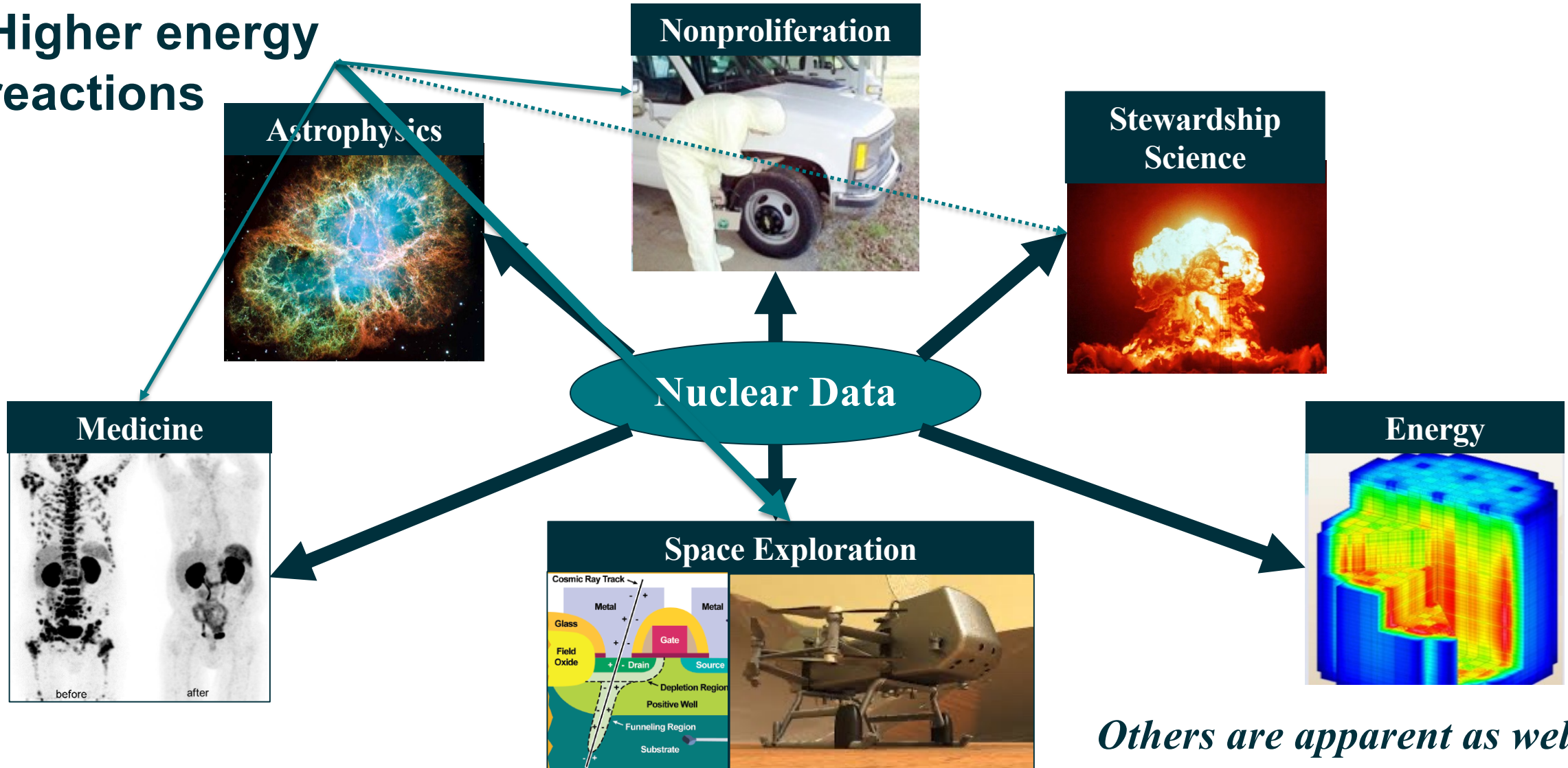
Cross Cutting Area #3: (n,x) reactions to $E_n=20$ MeV

(n,x)
reactions



Cross Cutting Area #4: Reactions beyond $E/A = 20$ MeV

Higher energy reactions



Others are apparent as well

The Second Part of the Charge (due 1/30/23)

2. Based on the USNDP Status Report (from part 1), provide recommendations for maintaining effective stewardship of nuclear data, which includes the following actions:
 - a) Identify challenges for nuclear data stewardship in the future, including identifying and prioritizing the most compelling opportunities to enhance and advance NP stewardship of nuclear data and the impact if those opportunities can be realized.
 - b) Describe possible ways the Nuclear Data (ND) community can work to train and retain a diverse, equitable, and inclusive workforce capable of sustaining the U.S. ND enterprise.
 - c) Identify access needs for facilities and instrumentation, crosscutting opportunities with other federal programs, and potentially mutually beneficial interactions with other domestic and international stakeholders.

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...and we have input from the USNDP

Thanks for your attention!