

New Opportunities for Fundamental Physics Research with Radioactive Molecules

Virtual Meeting
June 28 - July 2, 2021

*These molecules are “dying”
to reveal new physics!*



U.S. DEPARTMENT OF
ENERGY



New Opportunities for Fundamental Physics Research with Radioactive Molecules

Virtual Meeting
June 28 - July 2, 2021

*These molecules are “dying”
to reveal new physics!*



U.S. DEPARTMENT OF
ENERGY



NEW OPPORTUNITIES FOR FUNDAMENTAL PHYSICS RESEARCH WITH RADIOACTIVE MOLECULES WORKSHOP

June 28 – July 2, 2021



Cambridge, Massachusetts

Massachusetts Institute of Technology

Organizing Committee

Ronald Fernando Garcia Ruiz, (MIT, US)
Jens Dilling (TRIUMF, Canada)
Nicholas Hutzler (Caltech, US)
Robert Berger (Marburg, Germany)

International Advisory Committee

Vincenzo Cirigliano (LANL)
David DeMille (Yale)
Matt Dietrich (ANL)
John Doyle (Harvard)
Kieran Flanagan (Manchester)
Wick Haxton (Berkeley)
Andrew Jayich (Santa Barbara)
Stephan Malbrunot-Ettenauer (CERN)
Gerda Neyens (CERN & KULeuven)
Matt Reece (Harvard)
Marianna Safronova (U. Delaware)
Jaideep Singh (FRIB)
Amar Vutha (Toronto)

Supported by:



<http://web.mit.edu/RadioMolecules/>

Thanks to:



Lauren Saragosa



Elsye Luc

Radioactive Molecules

Nuclear EM
structure

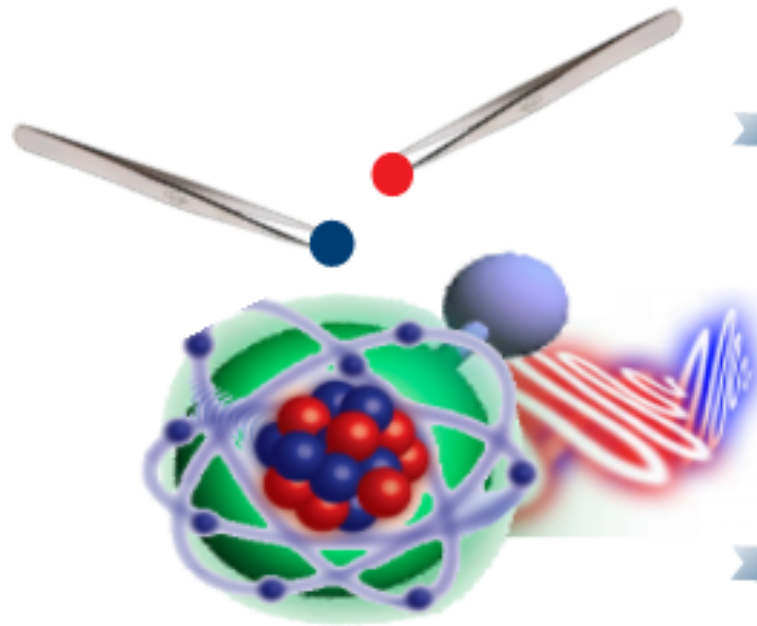
Astrophysics

Nuclear EW
structure

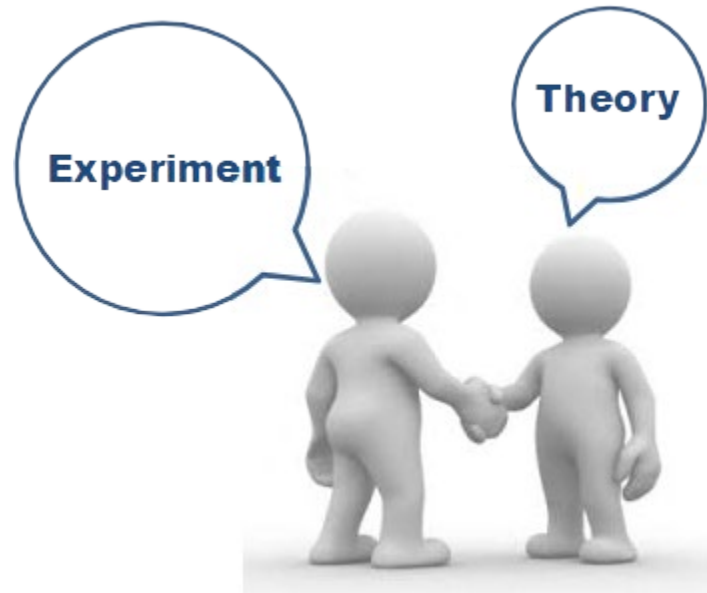
Nuclear
chemistry

Fundamental
symmetries

Quantum
chemistry



Particle & Nuclear & Atomic & Molecular



Topics:

- Particle Physics
- Production of molecules at radioactive beam facilities
- Current/new techniques
- Molecular theory
- Nuclear theory
- Other opportunities

Program Schedule

All times are in Eastern Daylight time (EDT)

Time	Monday (28)	Tuesday	Wednesday	Thursday	Friday
9:00	Intro	Ramsey-Musolf	Discussion	Skripnikov	Prasanna
9:35	Flambaum	Dobaczewski	Isaev	Gaul	Karthein
10:10	Vincenzo	Engel	Borschevsky	Kotochigova	Inouye
10:45	Jordy	Butler	Fleig	Field	Stadnik
11:20	Break				
11:35	Reece	Nazarewicz	Demille	Krems	Vutha
12:10	Jaideep	Budker	Breier	Safronova	Gabrielse
	Lunch				
2:00	Jayich	Haxton	Rothe	Arvanitaki	Panel discussion
2:35	Caldwell	Holt	Wilkins	Hamilton	Panel discussion
3:10	Break				
3:25	Tarbutt	Navratil	Udrescu	Von der Wense	Panel discussion
4:00	Doyle	Miyagi	Gottberg	Zhang	Panel discussion
4:35	Hutzler/Augenbraun	Discussions	Severin	Discussions	Summary talk

Topics:

- **Particle Physics**
- **Production of molecules at radioactive beam facilities**
- **Current/new techniques**
- **Molecular theory**
- **Nuclear theory**
- **Other opportunities**

Talks:

- **25 + 10 minutes**
- **Recorded for one week only (if speaker agrees)**
- **Slides will be uploaded on the webpage.**

Program Schedule

All times are in Eastern Daylight time (EDT)

Time	Monday (28)	Tuesday	Wednesday	Thursday	Friday
9:00	Intro	Ramsey-Musolf	Discussion	Skripnikov	Prasanna
9:35	Flambaum	Dobaczewski	Isaev	Gaul	Karthein
10:10	Vincenzo	Engel	Borschevsky	Kotochigova	Inouye
10:45	Jordy	Butler	Fleig	Field	Stadnik
11:20	Break				
11:35	Reece	Nazarewicz	Demille	Krems	Vutha
12:10	Jaideep	Budker	Breier	Safronova	Gabrielse
	Lunch				
2:00	Jayich	Haxton	Rothe	Arvanitaki	Panel discussion
2:35	Caldwell	Holt	Wilkins	Hamilton	Panel discussion
3:10	Break				
3:25	Tarbutt	Navratil	Udrescu	Von der Wense	Panel discussion
4:00	Doyle	Miyagi	Gottberg	Zhang	Panel discussion
4:35	Hutzler/Augenbraun	Discussions	Severin	Discussions	Summary talk

Topics:

- **Particle Physics**
- **Production of molecules at radioactive beam facilities**
- **Current/new techniques**
- **Molecular theory**
- **Nuclear theory**
- **Other opportunities**

Discussions:

- Challenges for AMO precision experiments at accelerator facilities.
- Strategy to identify physics cases to be pursued first.
- Required lab infrastructure, especially plans for a precision laboratories at FRIB, TRIUMF, CERN, .
- Key instrumentation, challenges and required developments. Molecular formation at RIB facilities.
- Required theoretical developments in AMO, nuclear and particle physics.
- 'Bridging the gaps': how to efficiently exchange ideas between the many different fields involved in the projects of radioactive molecules.

Panel discussions:

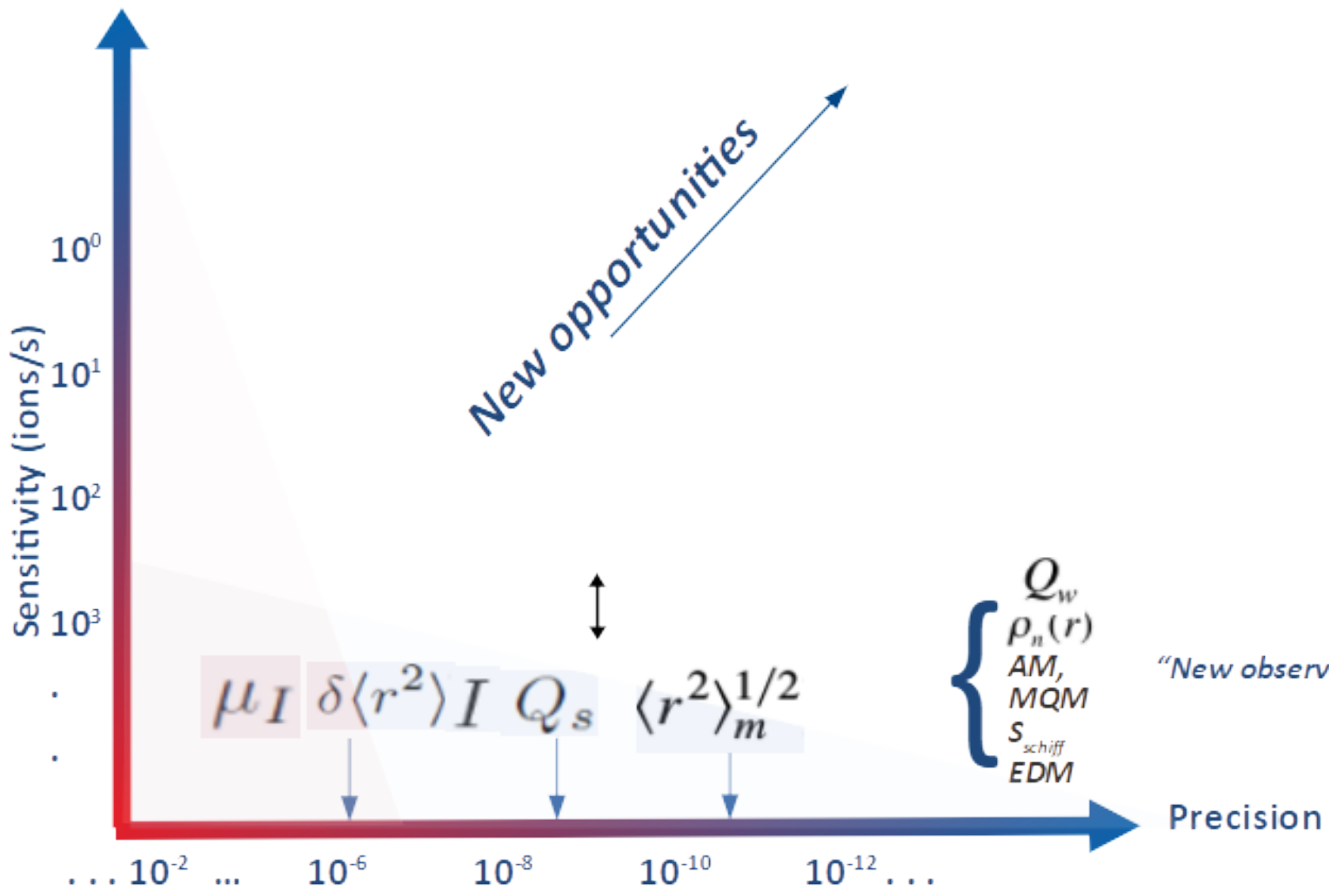
Panel 1: science impacts

Panel 2: Theoretical developments

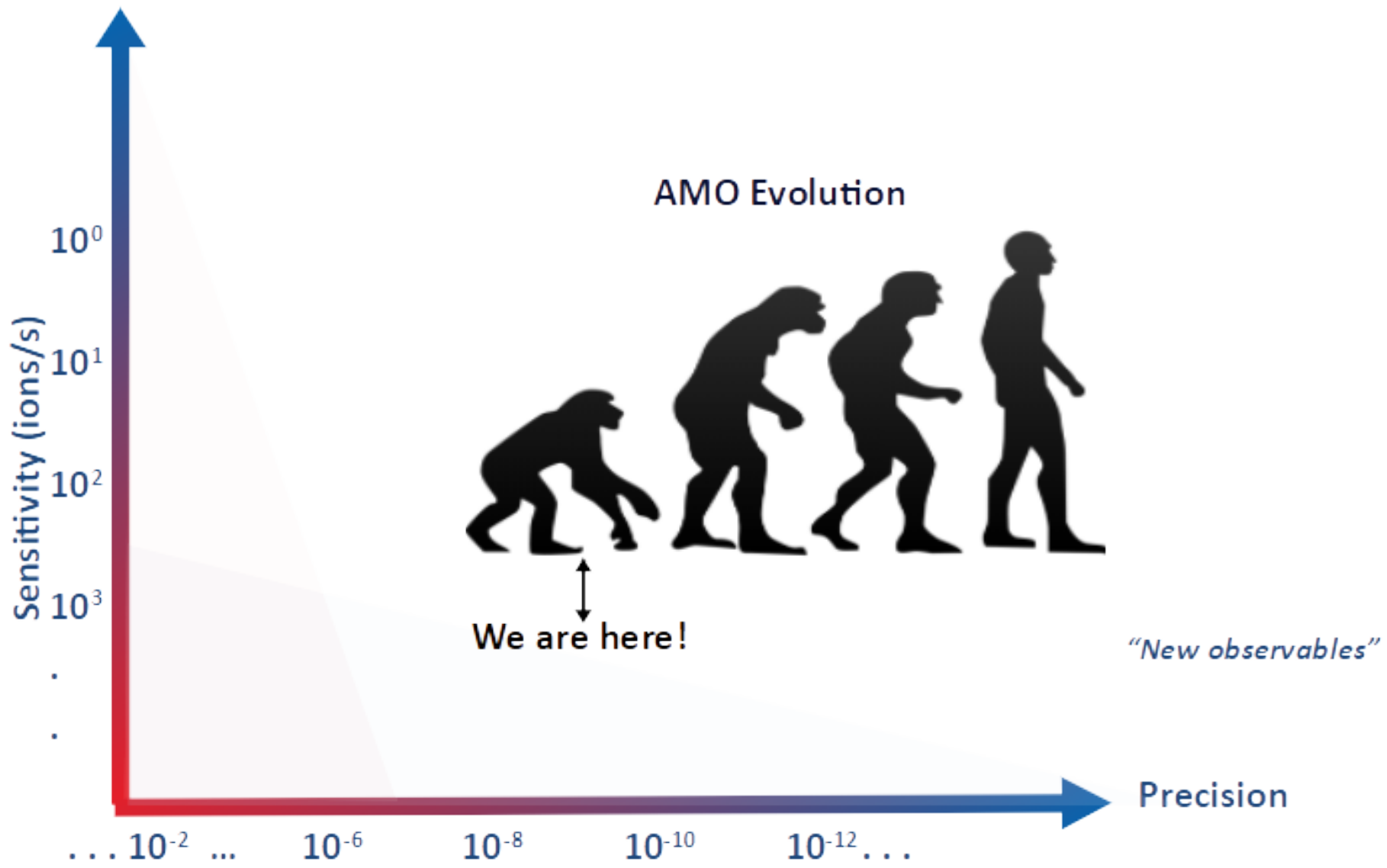
Panel 3: Experimental challenges and facilities

Panel 4: Community Building.

"Terra incognita"



"Terra incognita"



AMO Evolution

Sensitivity (ions/s)

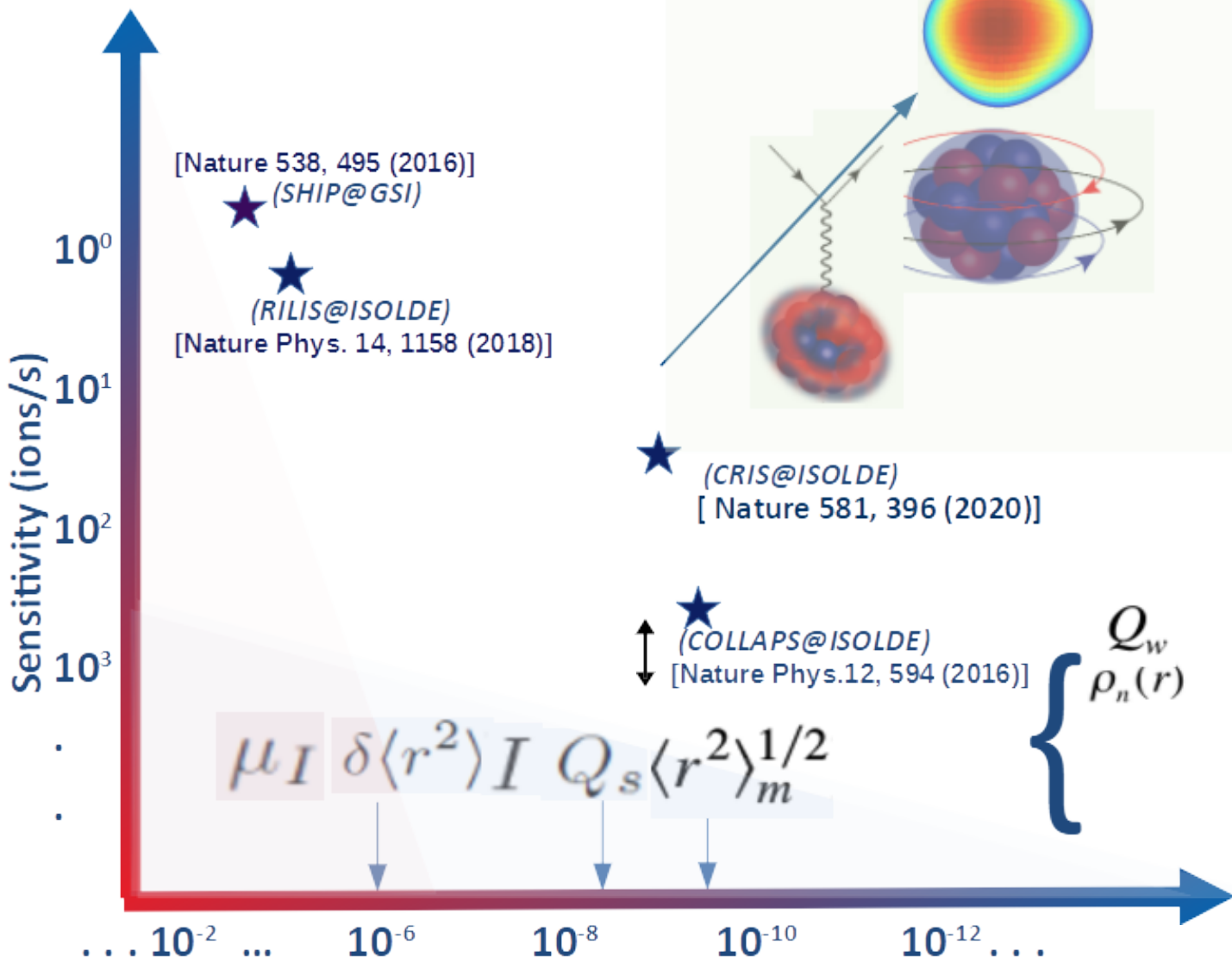
Precision

We are here!

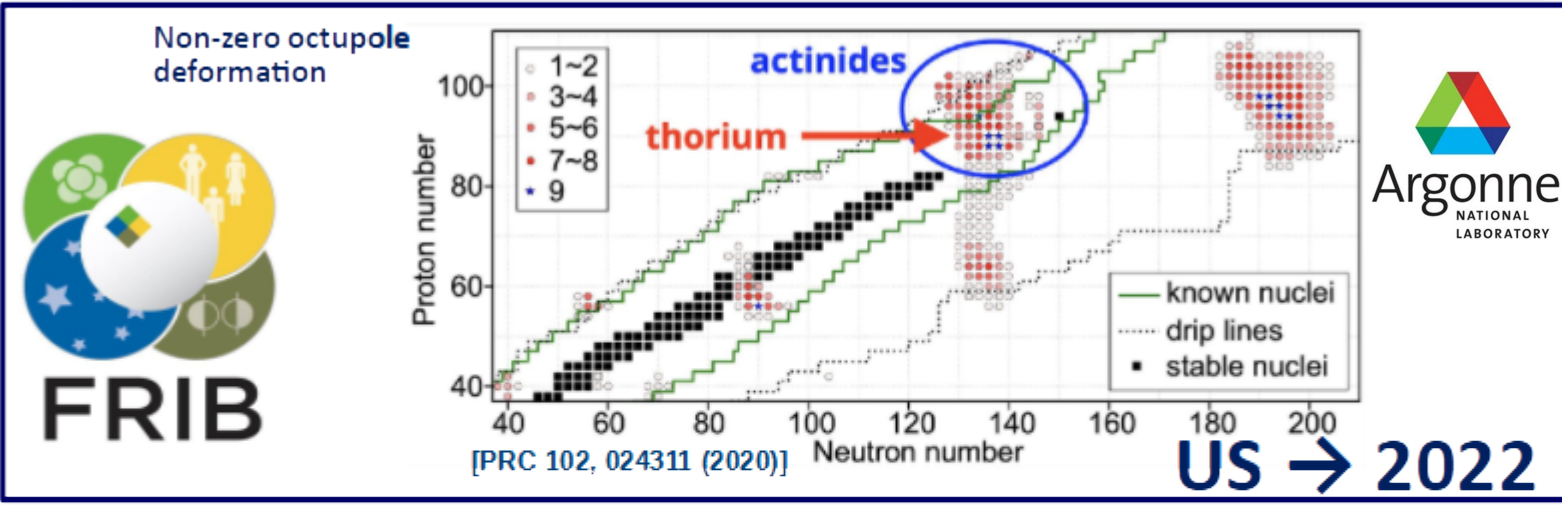
"New observables"

... 10^{-2} ... 10^{-6} 10^{-8} 10^{-10} 10^{-12} ...

“Terra incognita”



A Bright Future Ahead



→ Perspectives for facility dedicated to the study of radioactive molecules

Canada



Europe

NEW OPPORTUNITIES FOR FUNDAMENTAL PHYSICS RESEARCH WITH RADIOACTIVE MOLECULES WORKSHOP

June 28 – July 2, 2021



Cambridge, Massachusetts

Massachusetts Institute of Technology

Organizing Committee

Ronald Fernando Garcia Ruiz, (MIT, US)
Jens Dilling (TRIUMF, Canada)
Nicholas Hutzler (Caltech, US)
Robert Berger (Marburg, Germany)

International Advisory Committee

Vincenzo Cirigliano (LANL)
David DeMille (Yale)
Matt Dietrich (ANL)
John Doyle (Harvard)
Kieran Flanagan (Manchester)
Wick Haxton (Berkeley)
Andrew Jayich (Santa Barbara)
Stephan Malbrunot-Ettenauer (CERN)
Gerda Neyens (CERN & KULeuven)
Matt Reece (Harvard)
Marianna Safronova (U. Delaware)
Jaideep Singh (FRIB)
Amar Vutha (Toronto)

Supported by:



<http://web.mit.edu/RadioMolecules/>

Thanks to:



Lauren Saragosa



Elsye Luc

