



**Radiation Safety  
Institute of Canada**  
Institut de radioprotection du Canada

Radiation Safety &  
Wellness Webinars

May 23, 2023

# The Canadian Light Source: Synchrotron Radiation Protection

RSIC Presenter: Lynn MacDonald  
Invited Guest: Grant Cubbon  
Canadian Light Source

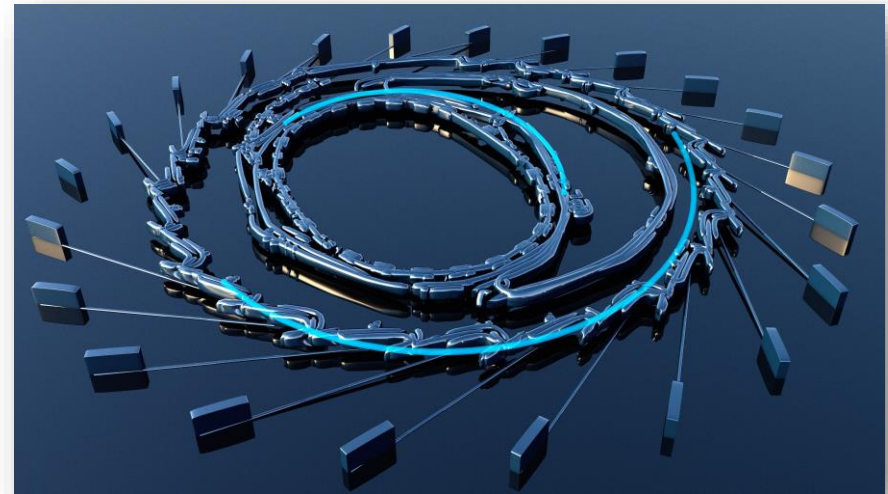
Good Science in Plain Language®



- Audio and video
  - During the presentation, from the presenters only
  - Use computer or telephone (call in)
  - Computer seems to give the best sound quality
- Use the **Chat** feature to talk to discuss with everyone
- Use Q&A feature to ask questions for Q&A portion
- Posted on webinar page
  - Video, answers to questions, copy of the slides
- Follow up email will be sent
  - Topics covered, time of attendance
- It may be possible to change your Zoom view if the controls are hiding the closed captioning.

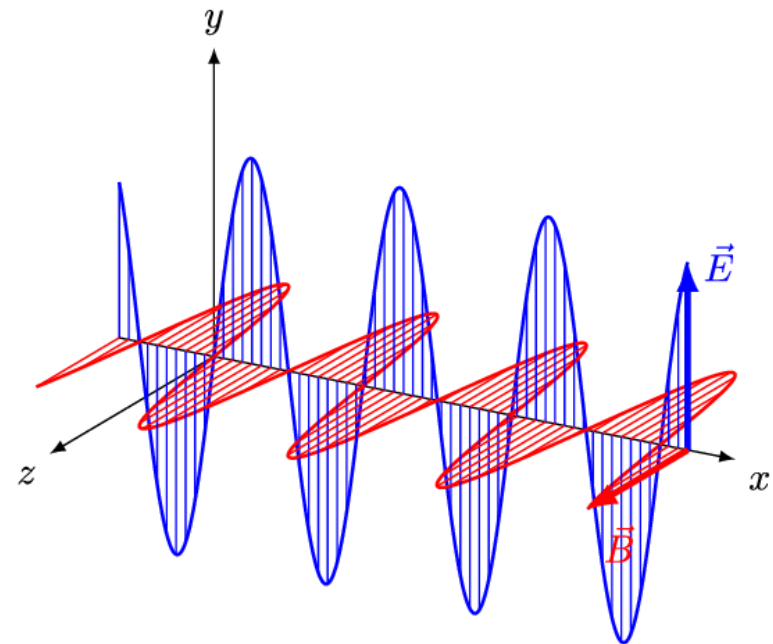


- Properties of EM radiation
  - Production
  - Interaction with matter
- Ionizing vs. Non-ionizing radiation
- Regulation of EM Radiation
- Guest Interview
  - Grant Cubbon
    - Canadian Light Source
    - Radiation Hazards
    - Radiation Protection
- Q&A





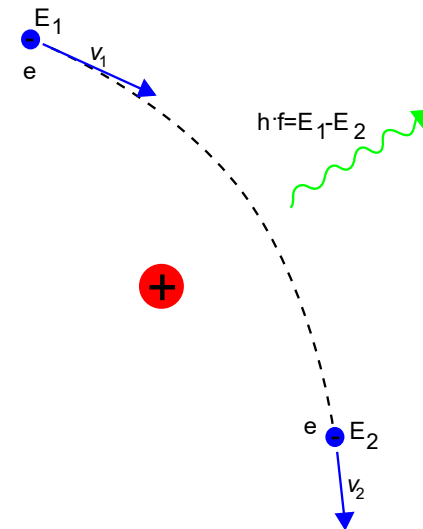
- Radiation is energy which travels out from a source.
  - Can be in the form of particles or waves
- Electromagnetic (EM) radiation
  - Oscillations of the EM field
  - Wave-particle duality
  - Particles of pure energy: photons



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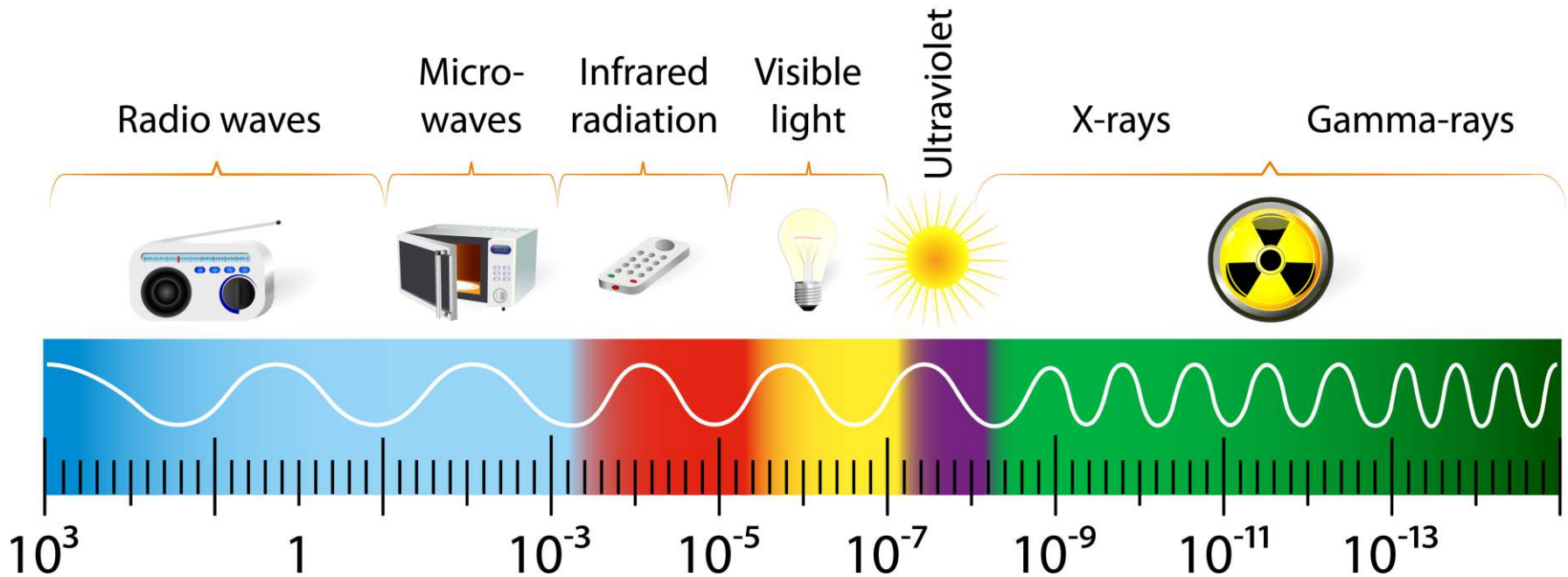
- When an electron drops from a higher energy orbital to a lower energy orbital
- When a radioactive nucleus undergoes an alpha or beta emission, but still has excess energy
- Charged particle slowing down or changing direction



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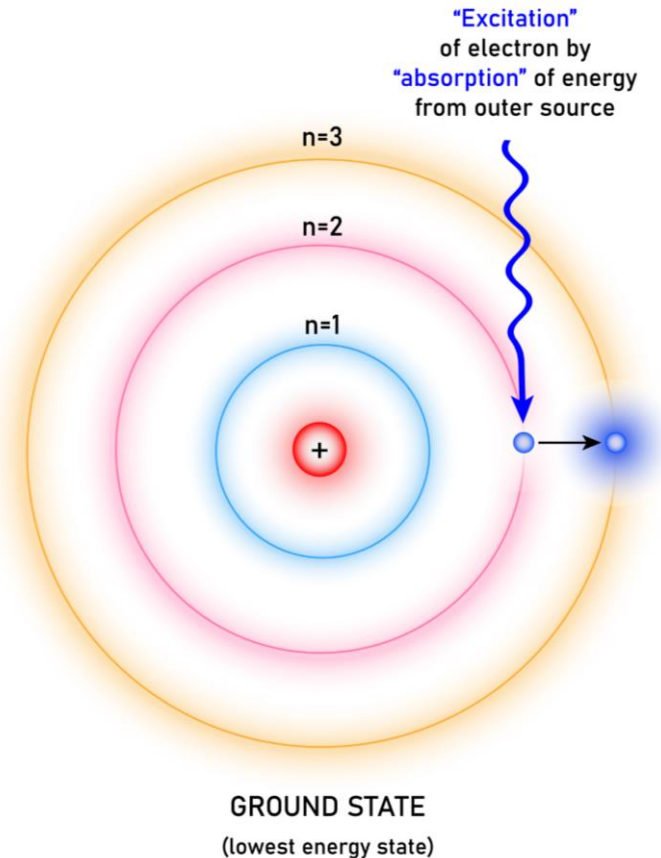
## THE ELECTROMAGNETIC SPECTRUM







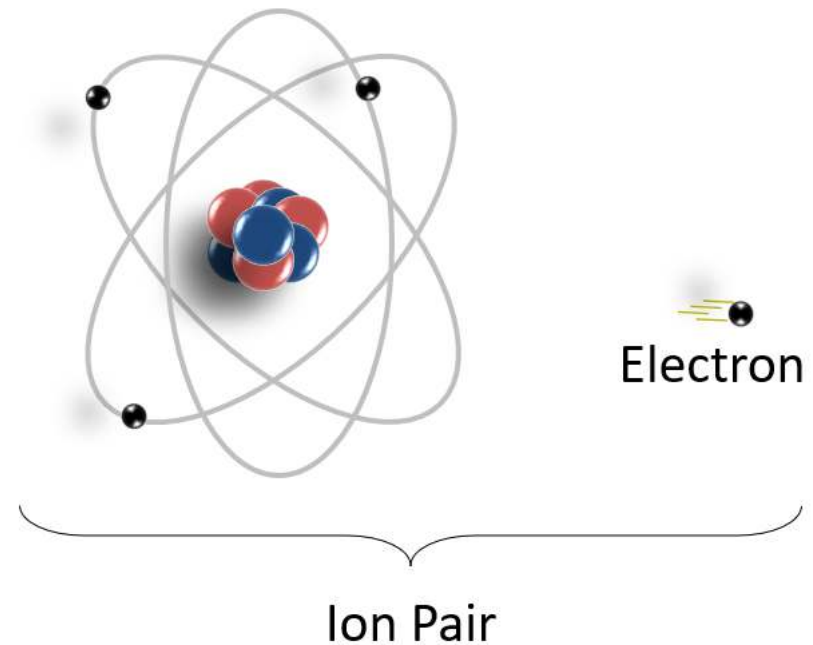
- EM Waves can:
  - Transmit
  - Reflect
  - Refract
  - Absorb
- Depends on the photon energy
- If absorbed
  - Heat
  - Photochemical effects
  - Ionize the atom
  - Pair production
  - Activate the nucleus





# Ionizing Radiation

- Removal of electron from the atom
- Results in a pair of charged particles
  - Electron
  - Charged atom/molecule
- Ionizing radiation is carcinogenic
- Ionizing EM
  - Some UV
  - X-rays
  - Gamma
- Photoelectric effect, Compton scattering

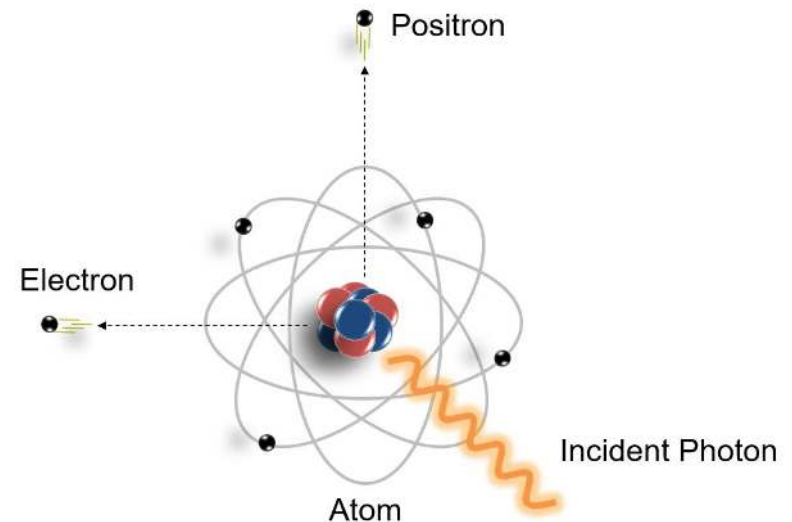






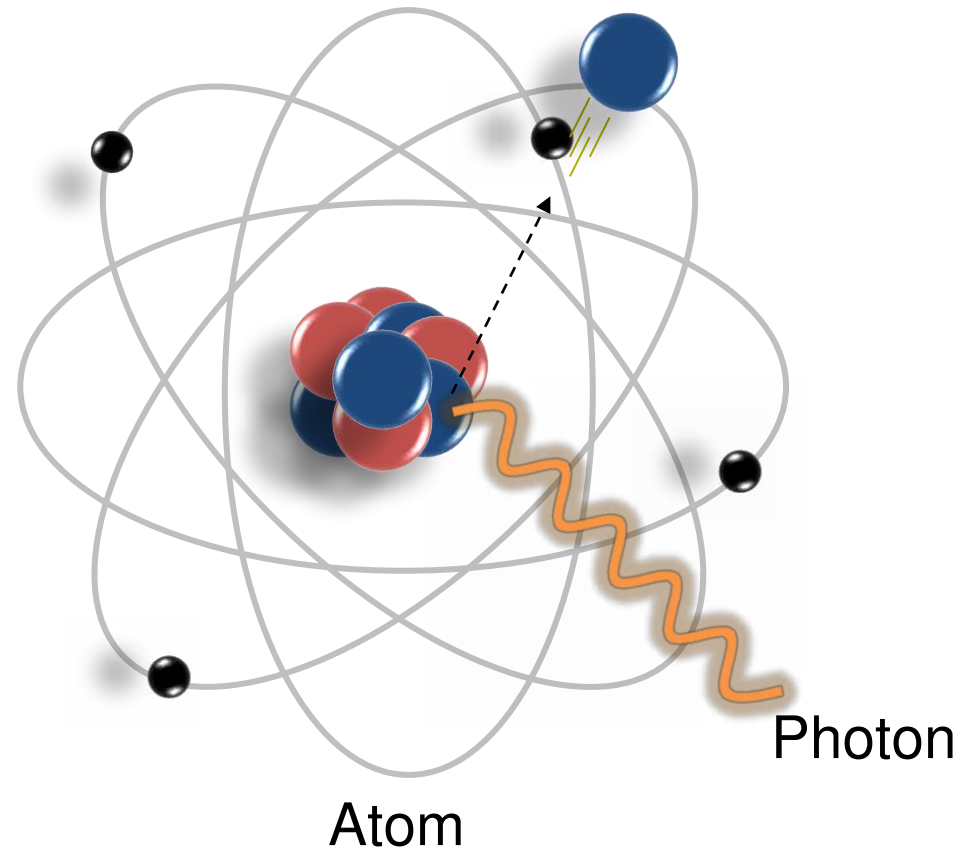
# Pair Production

- Energy is converted to mass
  - Happens near a nucleus
- Ejected electron can cause ionization
- Positron will interact with a nearby electron, releasing high energy photons





- Materials becoming radioactive due to exposure to radiation
  - Not the same as being contaminated
  - Neutron radiation
  - Very high energy photons
- Results in ionizing radiation





## Non-ionizing

- Purchase, lease, import, manufacture: Radiation Emitting Devices Act, Federal Ministry of Health
- In use: Province, Territory, or Canada Labour Code for Federally-regulated workplaces

## Gamma

- Nuclear Safety and Control Act, Canadian Nuclear Safety Commission (CNSC)

## X-ray

- $\geq 1\text{MeV}$ : CNSC
- $< 1\text{MeV}$ 
  - Purchase, lease, import, manufacture: Radiation Emitting Devices Act, Health Canada
  - In use: Province/Territory/Canada Labour Code



- During the interview, feel free to post questions in the Q&A.
  - The chat can get busy, so posting in the Q&A makes them easier to find.
  - If you do not have access to the Q&A functionality, please indicate you would like someone to post it there for you, and we will move the question over.





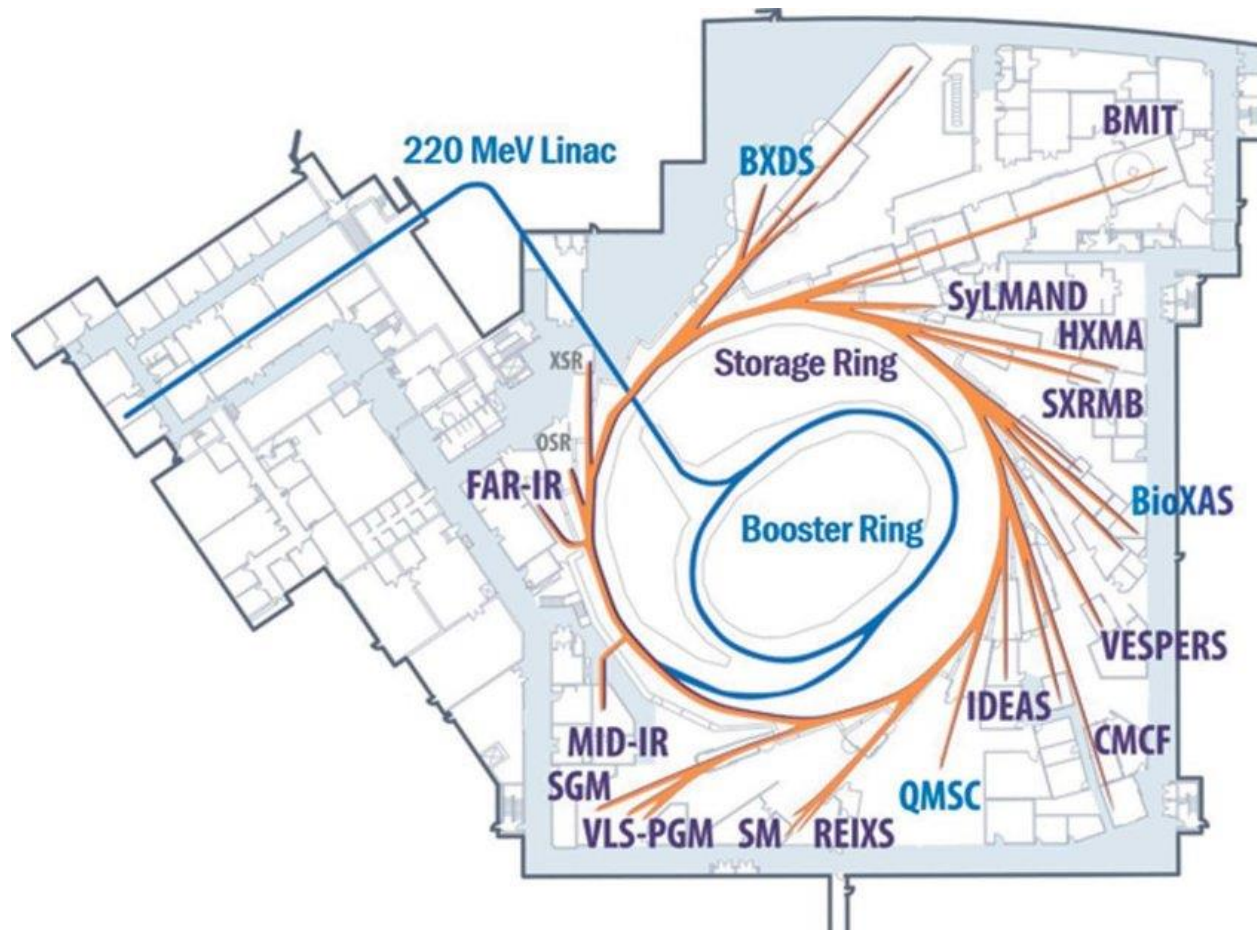
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**Canadian  
Light  
Source**      **Centre canadien  
de rayonnement  
synchrotron**









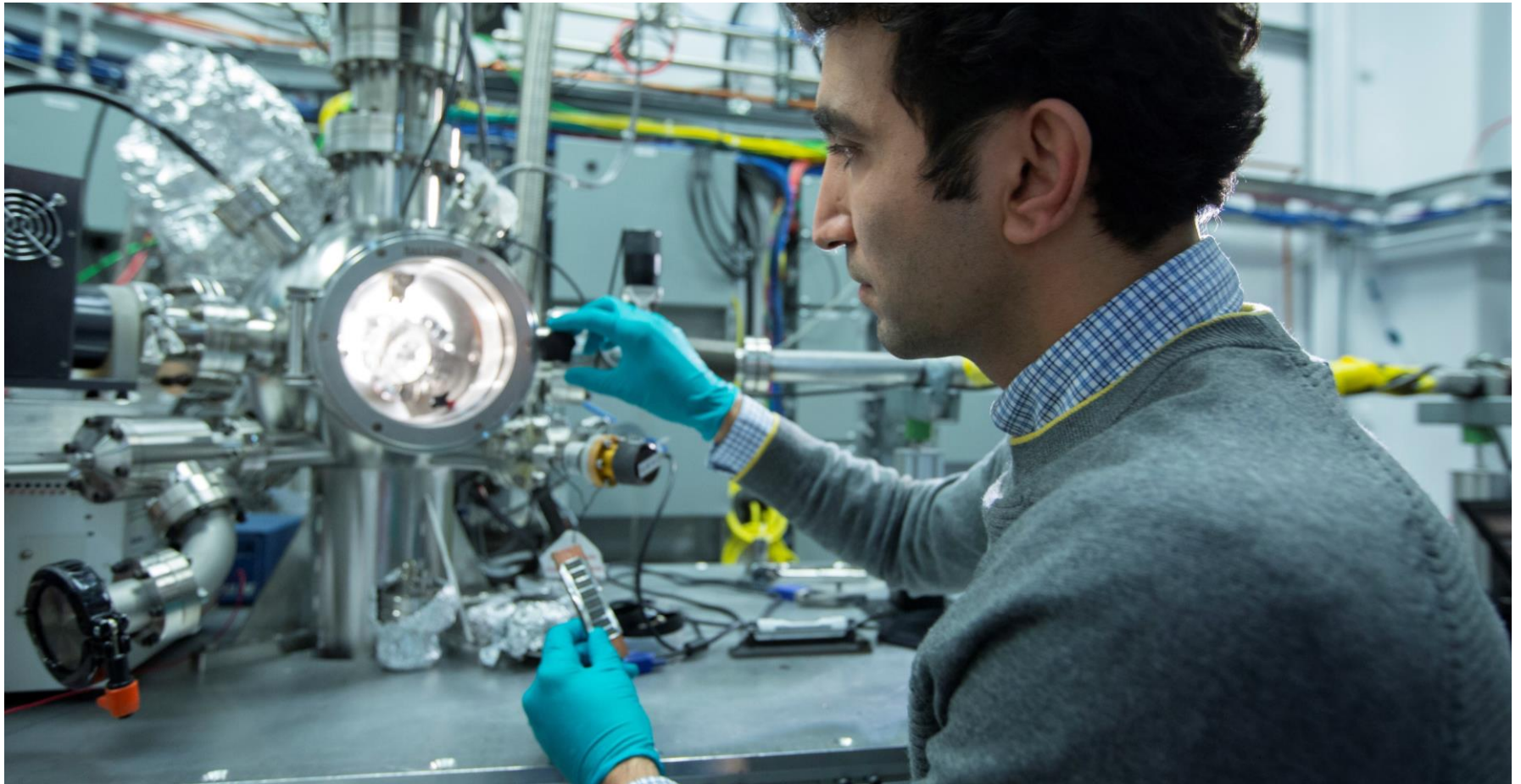


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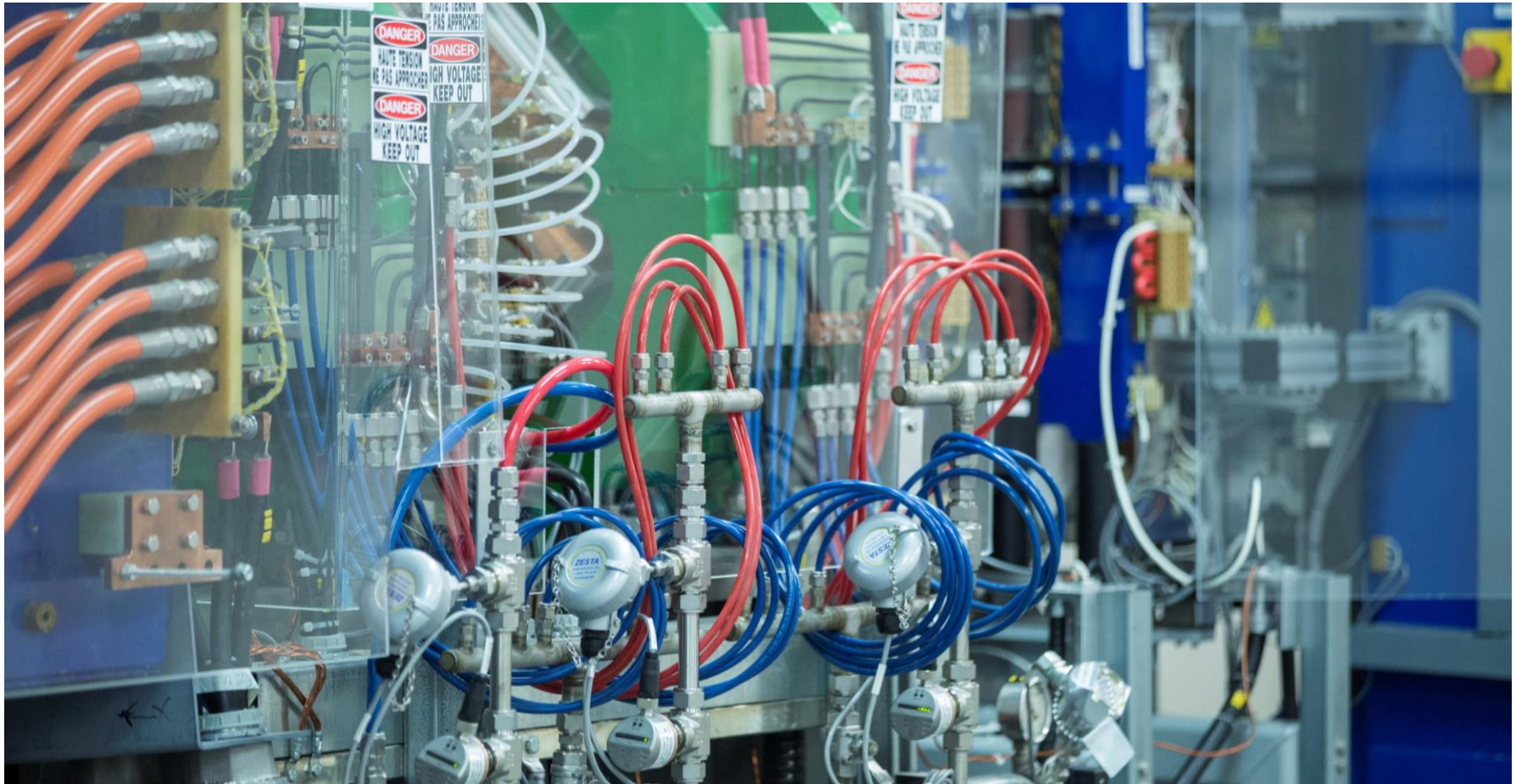




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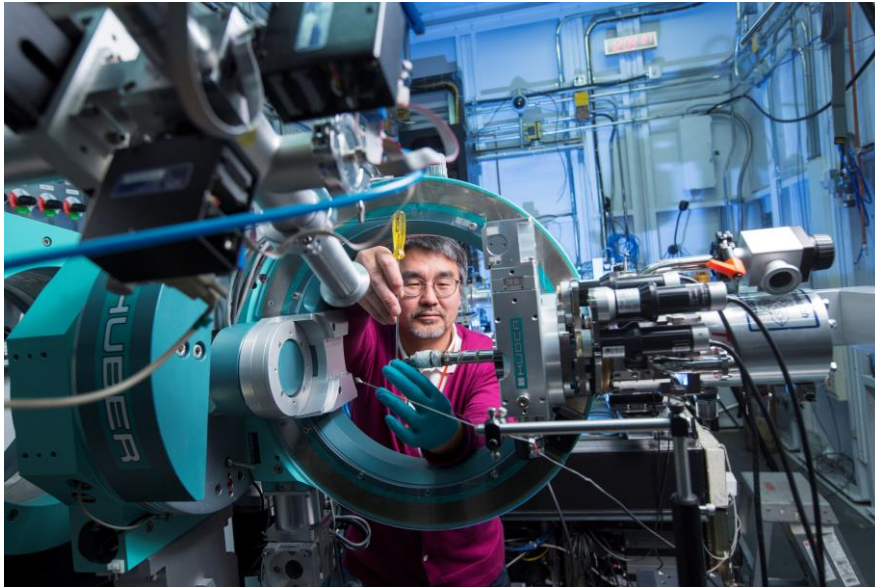






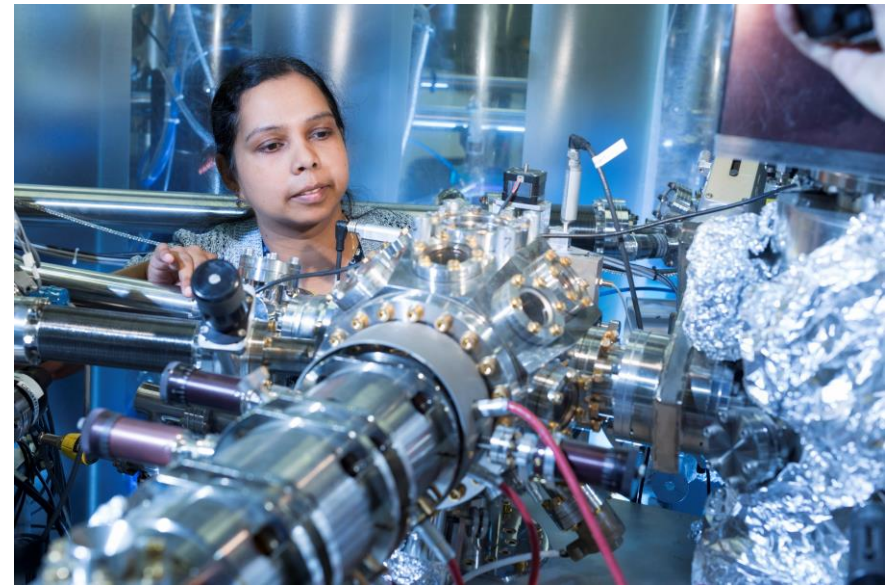
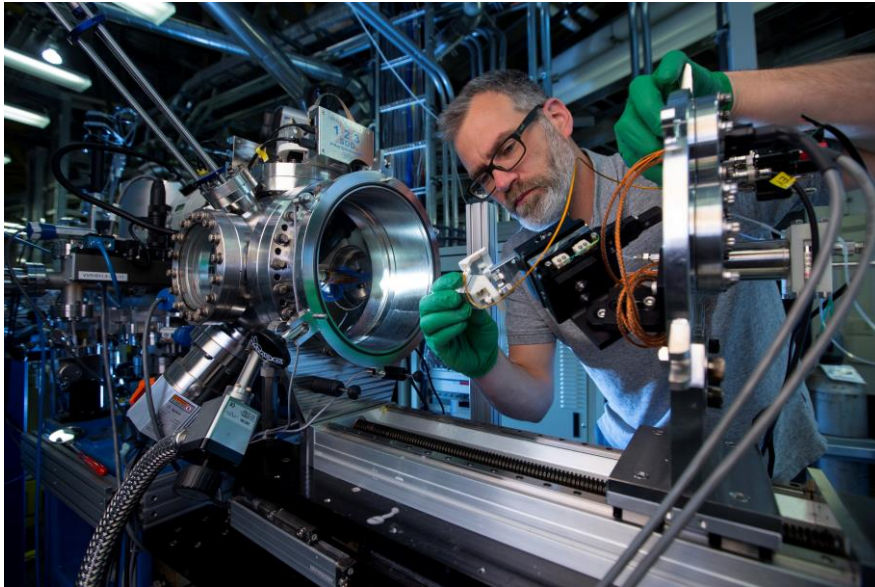


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- Questions posted in the Q&A
- To ask a question verbally
  - use “raise hand” button
  - When asked, press spacebar or unmute to speak
- Questions we do not get to
  - Answers will be posted to our website and link to resources emailed out







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***“Good science in plain language”<sup>®</sup>***

***Thank you for listening!***

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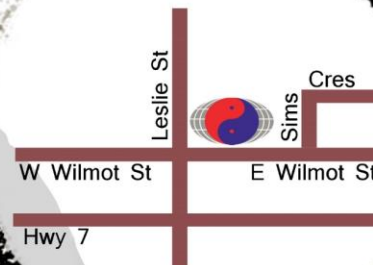
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