

Pyroelectric Fusion

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22.012 Final Presentation

Agenda

- What is Pyroelectricity?
- Pyroelectric Materials
- Pyroelectric Fusion Today
- Pyroelectric Fusion for the Future

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- *What is Pyroelectricity?*
- Pyroelectric Materials
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Pyro / electricity



Courtesy of the Building and Fire Research Laboratory.



Courtesy of the National Oceanic and Atmospheric Administration.

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- What is Pyroelectricity?
- **Pyroelectric Materials**
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Pyroelectric Materials

Natural:

- Quartz, tourmaline, and other ionic crystals
- Bone and tendon



Courtesy of the Department of Conservation.

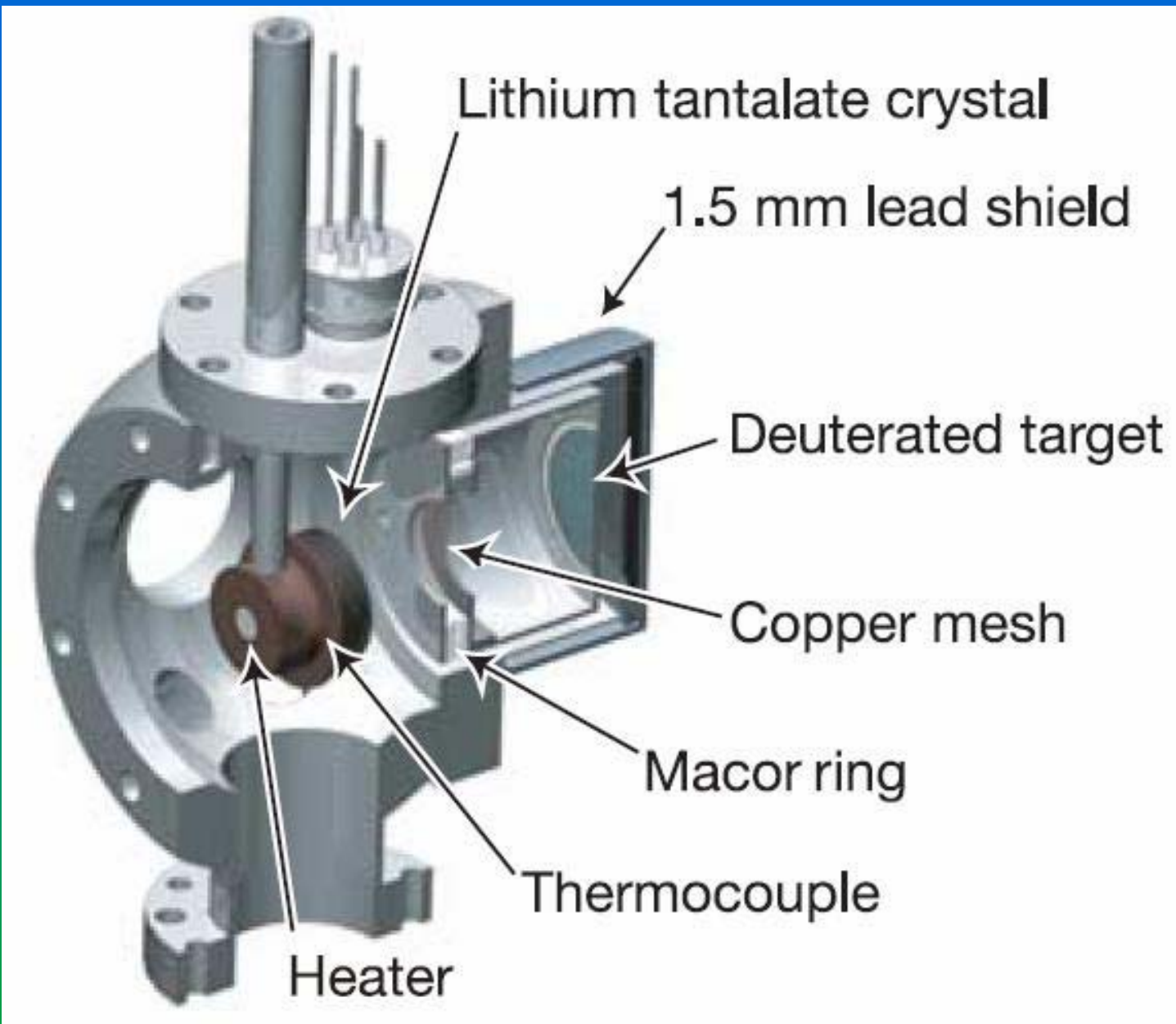
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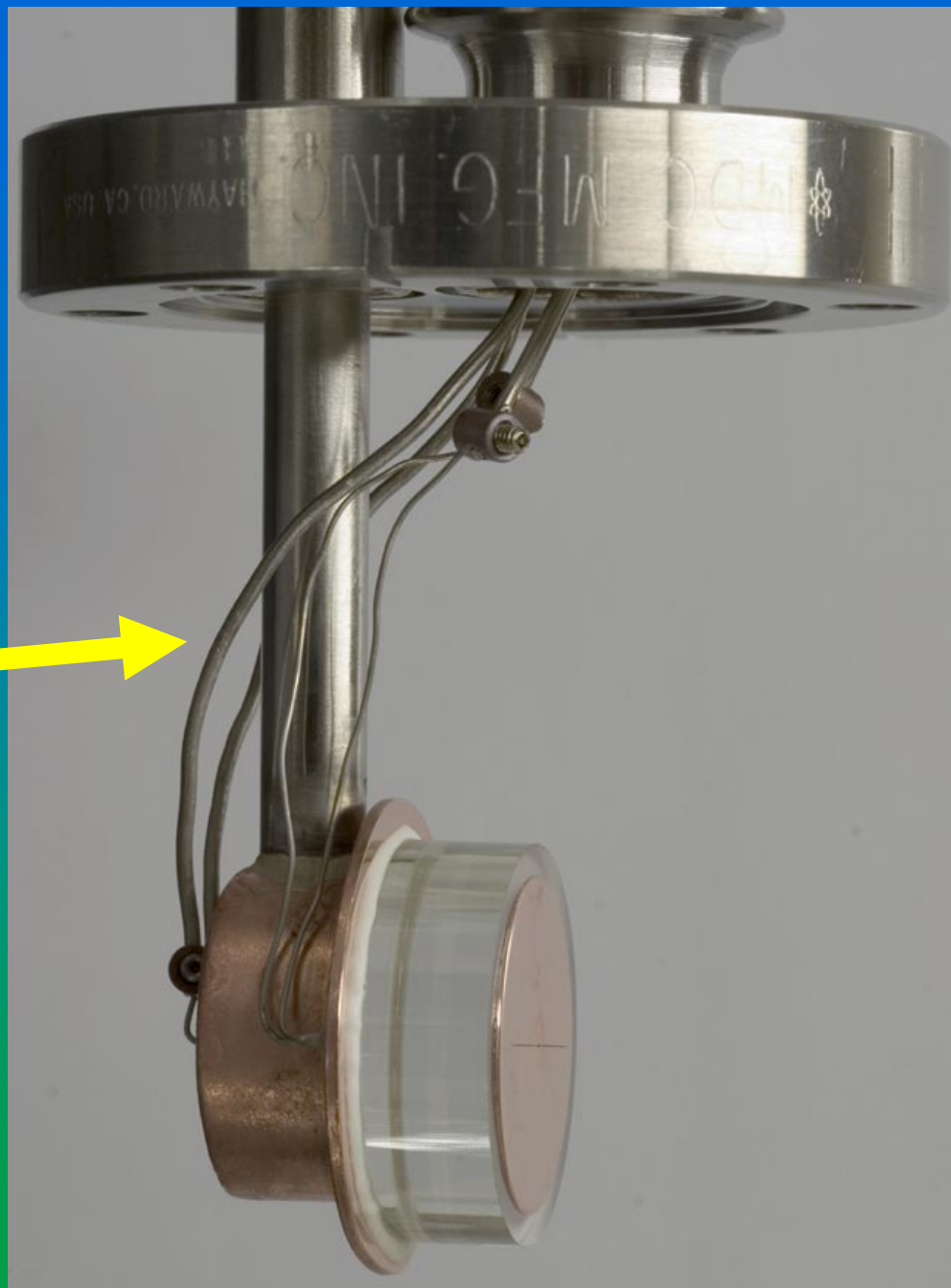
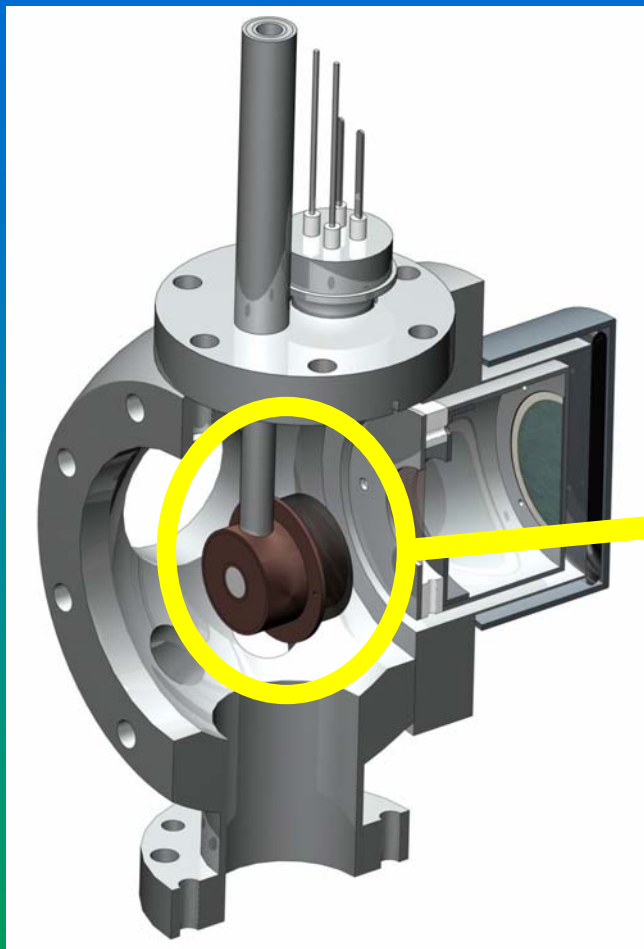
- Gallium Nitride (GaN)
- Cesium Nitrate (CsNO_3)

**** Lithium Tantalate (LiTaO_3) crystal → used in fusion ****

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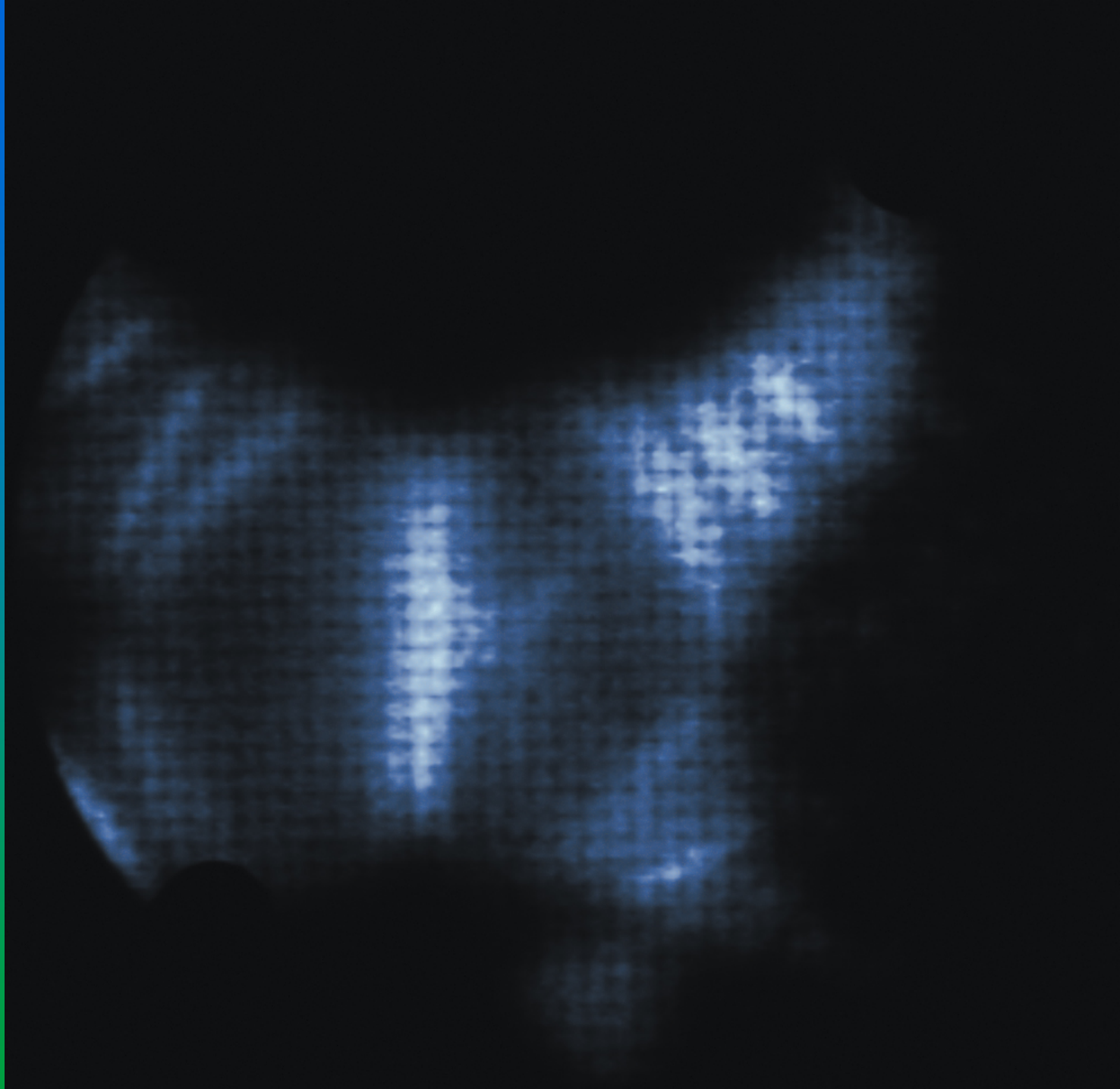




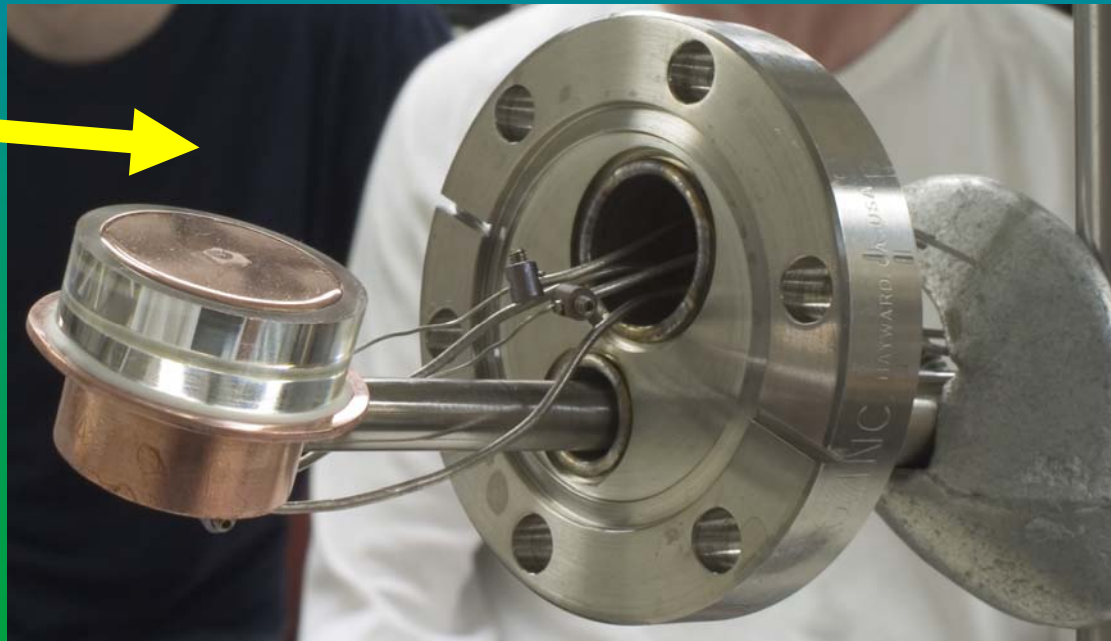
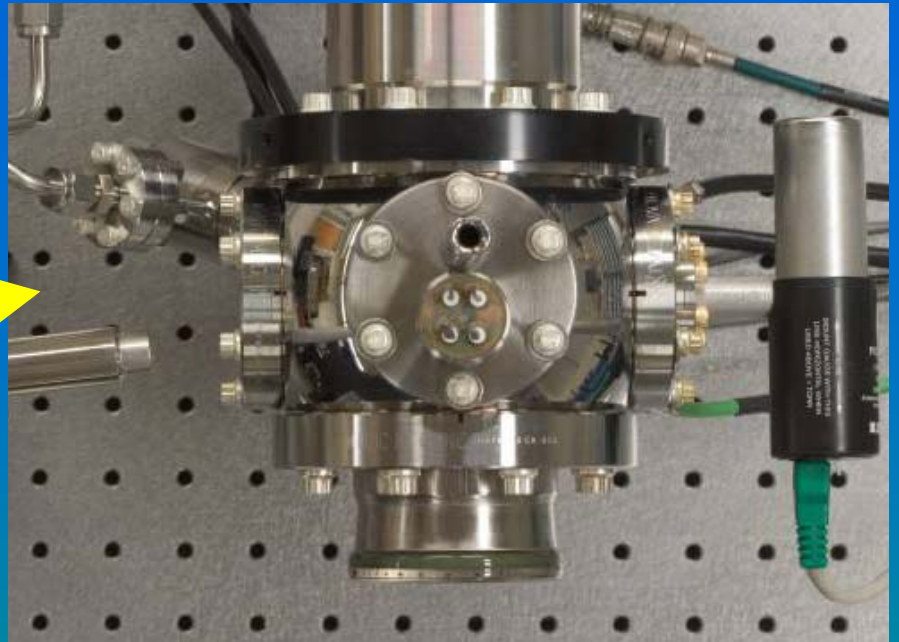
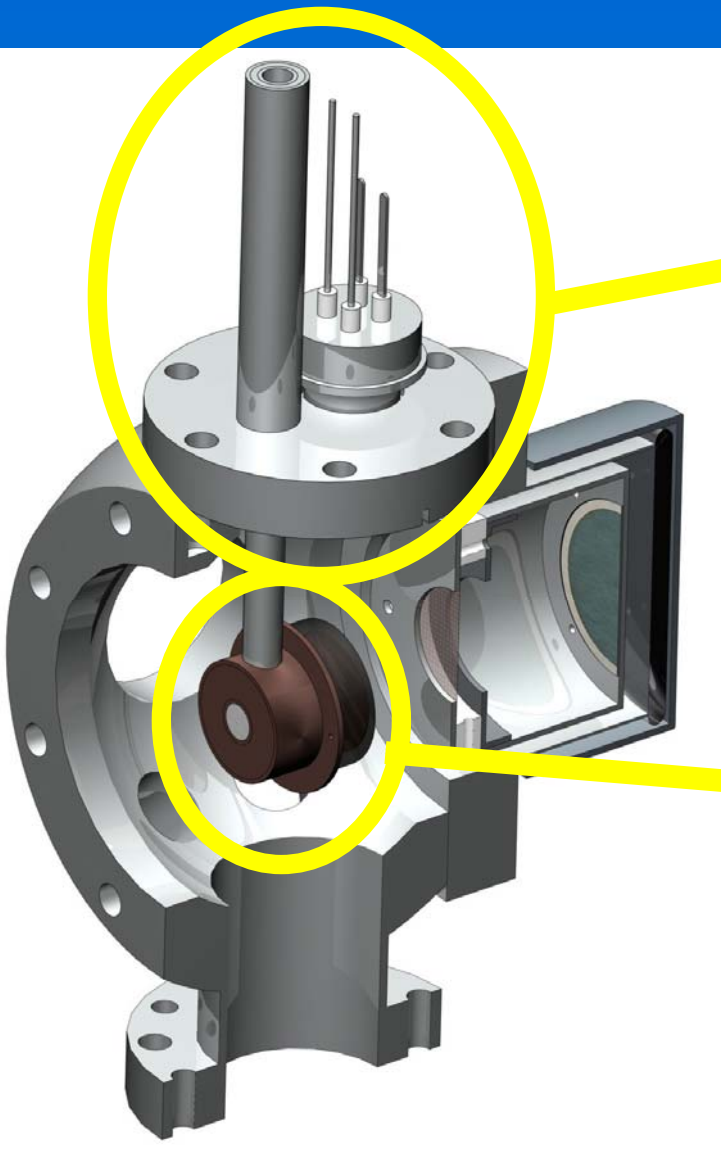
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Timeline

2002 – Idea Proposed (Naranjo and Putterman)

2004 – more in depth discussion (Brownridge and Shafroth)

2004 – use in neutron production (Geuther and Danon)

2005 – key ingredient → tungsten needle (*Nature* paper)

2005, April – Pyroelectric fusion demonstrated

(UCLA team headed by Brian Naranjo)

2006, February – confirmed and improved upon

(RPI team led by Jeffrey Geuther)

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So why is this useful?

"I believe that we could build an egg-sized device...and by plunging it into ice and warming it with your hands, you can generate a reasonably large fusion signal."

(Putterman)

Conclusion

- Pyroelectric fusion is very new (last 2 yrs)
- Pyroelectric effect
- D-D fusion
- Low energy generation, but applications as a neutron emitter

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