

# Shadow Box Demo instructions

*This demo really only needs one volunteer unless you have a large flux of visitors.*

## Before the demo

Thanks for volunteering! This demo (inspired by the original at Impression 5 Science Center) is a pretty simple way to show people how we can “see” (measure) invisible nuclei and how you might use nuclear theory to understand the results of your measurement.



Figure 1. “Seeing” the invisible.

You’ll need the Shadow Box Demo bin, which contains these instructions and the following equipment:

- Flashlights
- “Shadow boxes” with a small object inside a paper cube
- Boxes of “theoretical models,” examples of objects that could be inside a box

## During the demo

Set out the shadow boxes on a table with flashlights nearby. Put the “theoretical models” out of the way (in the tub?) so they’re not obvious when visitors start the demo.



Figure 2. Initial setup.

*Visitors may try to peek into the boxes - remind them that it’s not that easy with real nuclei!*

*Have them think about how to identify the invisible object (weight, sound when shaken, how it moved in the box by rolling or sliding, other?)*

*If there are lots of visitors, you can let them explore the boxes on their own - the information that relates to nuclear science is printed on their sides!*

*It’s OK if people figure out to use the “theoretical models” right away.*

*Kids really like the mystery and can be excited/proud when they figure out what the object is! Be sure to give some positive feedback. They may want to keep trying different boxes.*

When visitors approach your table, encourage them to pick up one of the shadow boxes and say: *At our laboratory (FRIB at MSU), we study the nucleus - it’s a particle so small that it’s invisible to the best microscopes. But we can still measure what it looks like!*

*In this box is a common object, but it’s invisible to you - how could you learn about it? (let them try/explain a few ways) If you used a flashlight, how could you tell what’s in there?*

It may take them some time to realize they should shine the flashlight from the top and look at the bottom! If they don’t, suggest it. They will likely identify the object in the box right away.



*How did you “see” the invisible object? When it casts a shadow, what is it doing to the light? Could you guess how we “see” an invisible nucleus?*

Suggest that they try to identify objects in other boxes. There should be some they cannot readily name - have them set those boxes aside.

Pull out the “theoretical models” boxes. *Guessing what an invisible nucleus looks like is very difficult! Thankfully, we have theorists who create models that suggest what shapes may exist. With these models of what might be in the boxes, could you figure out the ones that weren’t obvious?*

