

# AN INTRODUCTORY UNDERGRADUATE EXPERIMENT IN SECOND HARMONIC GENERATION



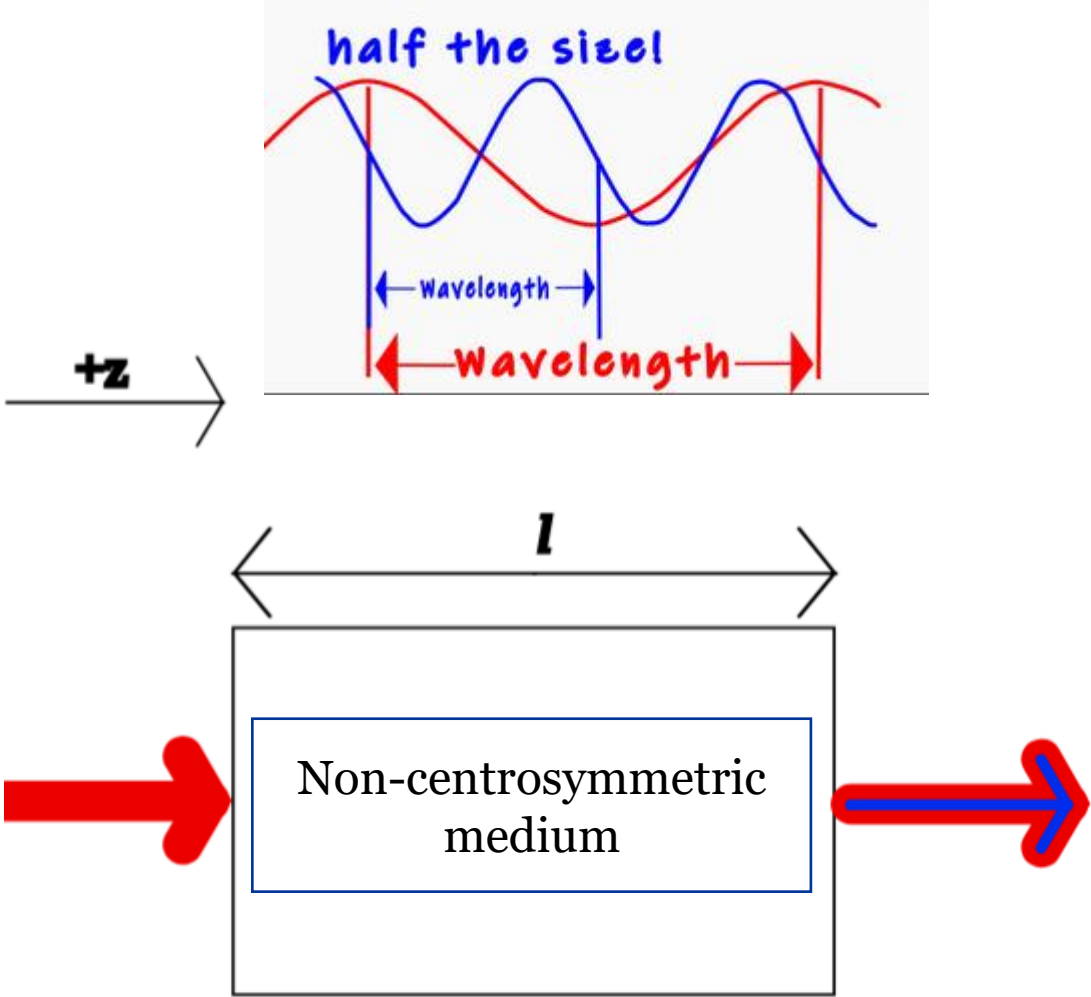
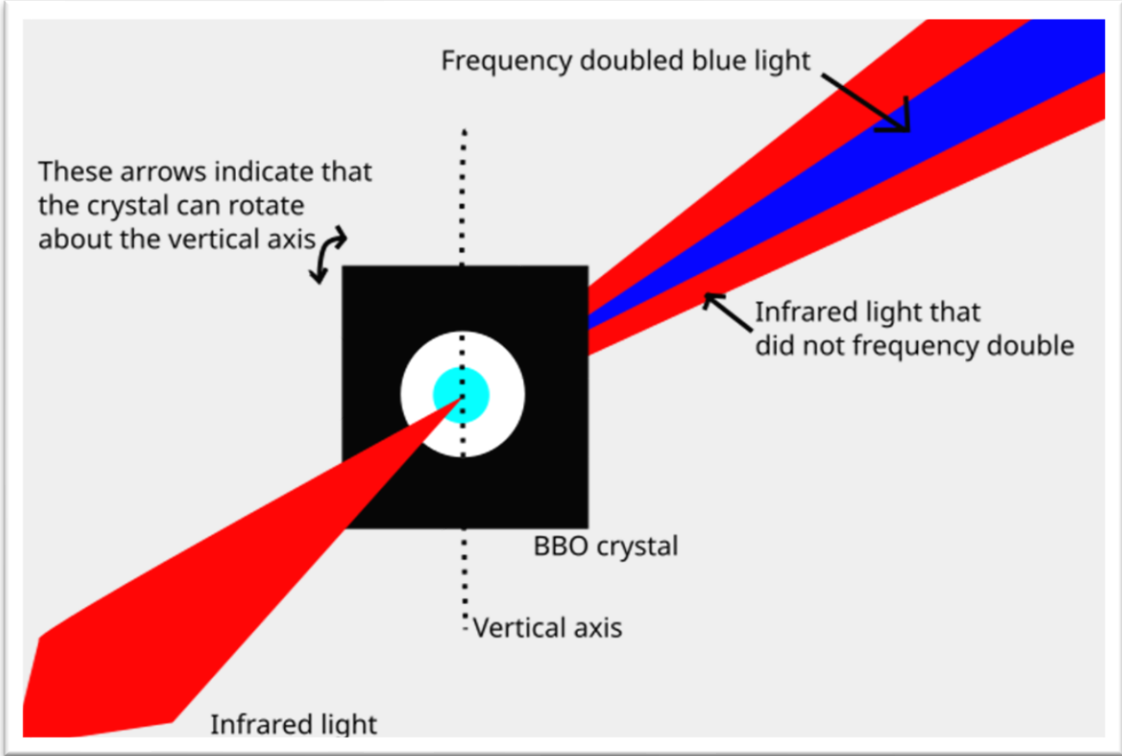
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# Second Harmonic Generation aka Frequency Doubling



# THE EXPERIMENTAL QUESTION

The frequency doubling phenomenon can be described by a lot of different variables. Which of them drive the process itself?

# Why do this work?



Students need to learn *how to learn* from experiment<sup>[1,2]</sup>



Our students largely view theoretical pursuits as the “default” path in physics careers<sup>[3,4]</sup>

[1] N. Holmes and C. Wieman. Physics Today 71, 1, 38 (2018); <https://doi.org/10.1063/PT.3.3816>

[2] J. R. Hoehn and H. J. Lewandowski, Investigating undergraduate students’ views about the process of experimental physics, Phys. Rev. Phys. Educ. Res. **18**, 020146 (2022).

[3] E. M. Smith, M. M. Stein, and N. G. Holmes, How expectations of confirmation influence students’ experimentation decisions in introductory labs, Phys. Rev. Phys. Educ. Res. **16**, 010113 (2020).

[4] E. F. Redish, J. M. Saul, and R. N. Steinberg, Student Expectations in Introductory Physics A..., 1998.

# Our Key Andragogical Principles

01

The question is meant to be exciting to students

02

Subject mastery is not expected before or after experiment completion

03

Students should return to these concepts in future years of study

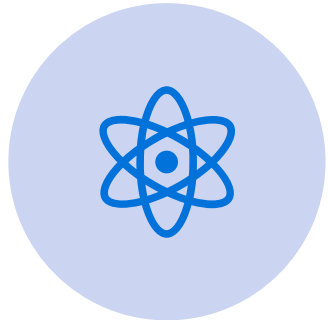
# What should students learn from this experiment if subject mastery is not required?



How to identify relevant variables that impact properties in a system



That experimental methods can develop understanding in a way theory can't



That questions can be answered by developing measurable techniques in the lab instead of through independent analysis at home



That doing labs can be fun

# DELIVERING THE EXPERIMENT

- Delivering in advanced laboratory (for now)
  - Needed to test the durability with students who have some experience
  - We need to see how ready our students are to work at a higher level of inquiry in this type of course



# NEXT STEPS



Assess student epistemology in all our lab courses



Develop andragogy driven by epistemic themes emergent in our students



Deliver this experiment (and more) in our lab stream

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