

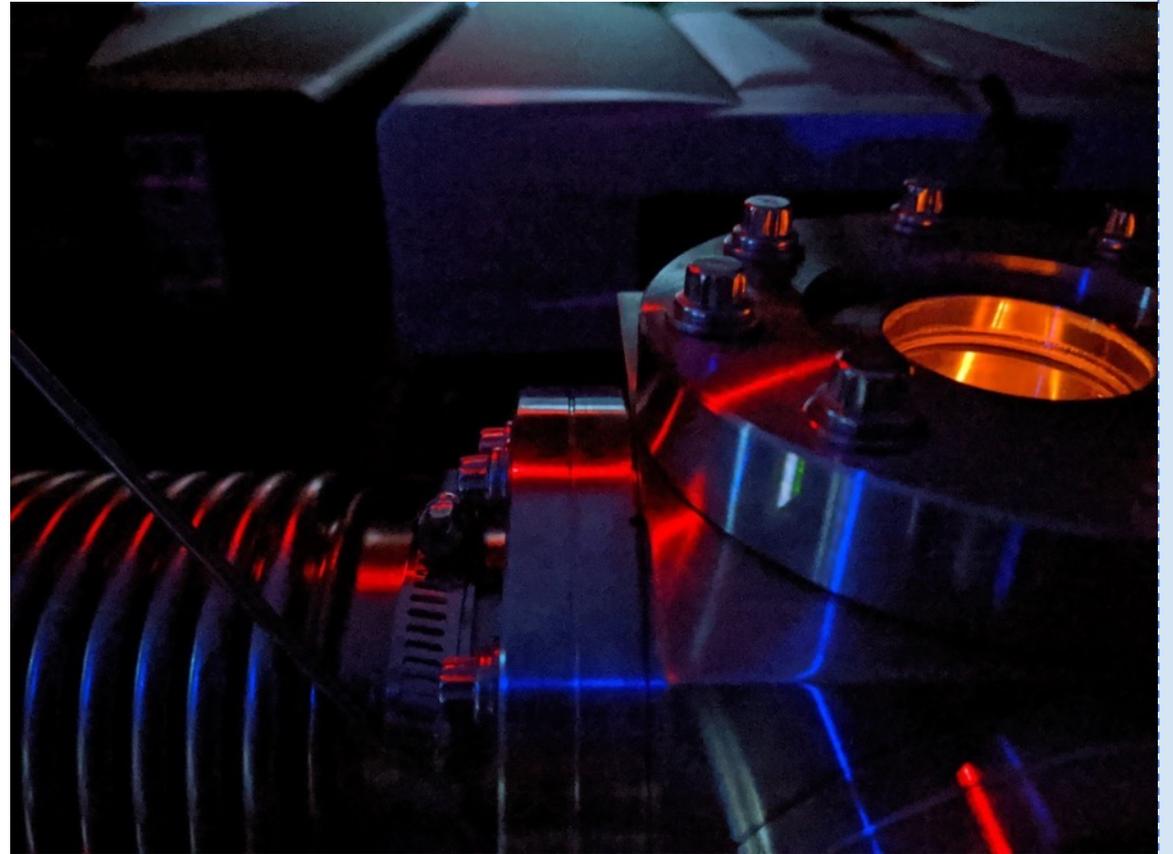
# Telescopic and Laboratory Investigations of The Surfaces of Active and Cometary Near Earth Objects

Teddy Kareta<sup>1,2</sup>, Vishnu Reddy<sup>2</sup>,  
Walter M. Harris<sup>2</sup>

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THE UNIVERSITY OF ARIZONA  
COLLEGE OF SCIENCE

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LABORATORY**

# Talk Topics & Publication Overview

- The Origin of the Geminids Meteor Shower
- Observations of 2005 UD and (3200) Phaethon
- Newly built vacuum heating chamber
  - Spectra of increasingly heated sample of the rare meteorite CI Orgueil (up to 1075 Celsius / 1350 Kelvin / 1970 F!)

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## Investigating the Relationship between (3200) Phaethon and (155140) 2005 UD through Telescopic and Laboratory Studies

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# (3200) Phaethon & The Geminids

- Parent: Geminid meteor shower
- Not *really* active.
- Sungrazing, not a comet orbit.
- Blue (B/F), non-cometary surface reflectivity.

How do you make an object like this? How did it produce the Geminids? Why inactive?

Better find out before DESTINY+



# Phaethon... and 2005 UD

Phaethon is *thought* to be related to a smaller object called (155140) 2005 UD. Similar visible color, similar rare orbits, similar meteor showers!

(3200) Phaethon, Diameter ~ 5.7 kilometers

2005 UD, Diameter ~ 1.6 kilometers



Are their orbits similar enough?  
What is their relationship?  
NIR Observations?

# Phaethon... and 2005 UD

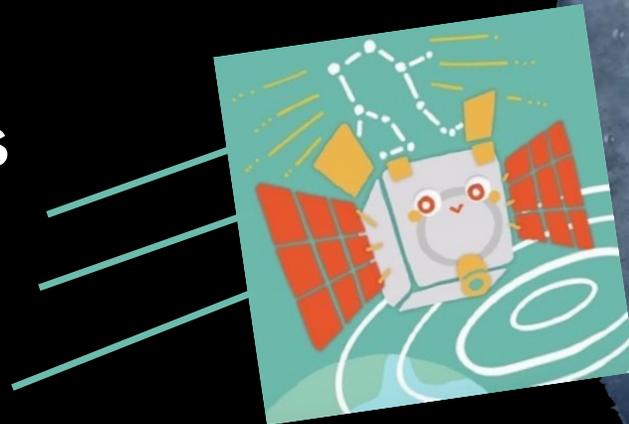
Perhaps *most* exciting is that Phaethon and possibly 2005 UD will be visited by JAXA's DESTINY+ spacecraft later this decade.

(3200) Phaethon, Diameter ~ 5.7 kilometers

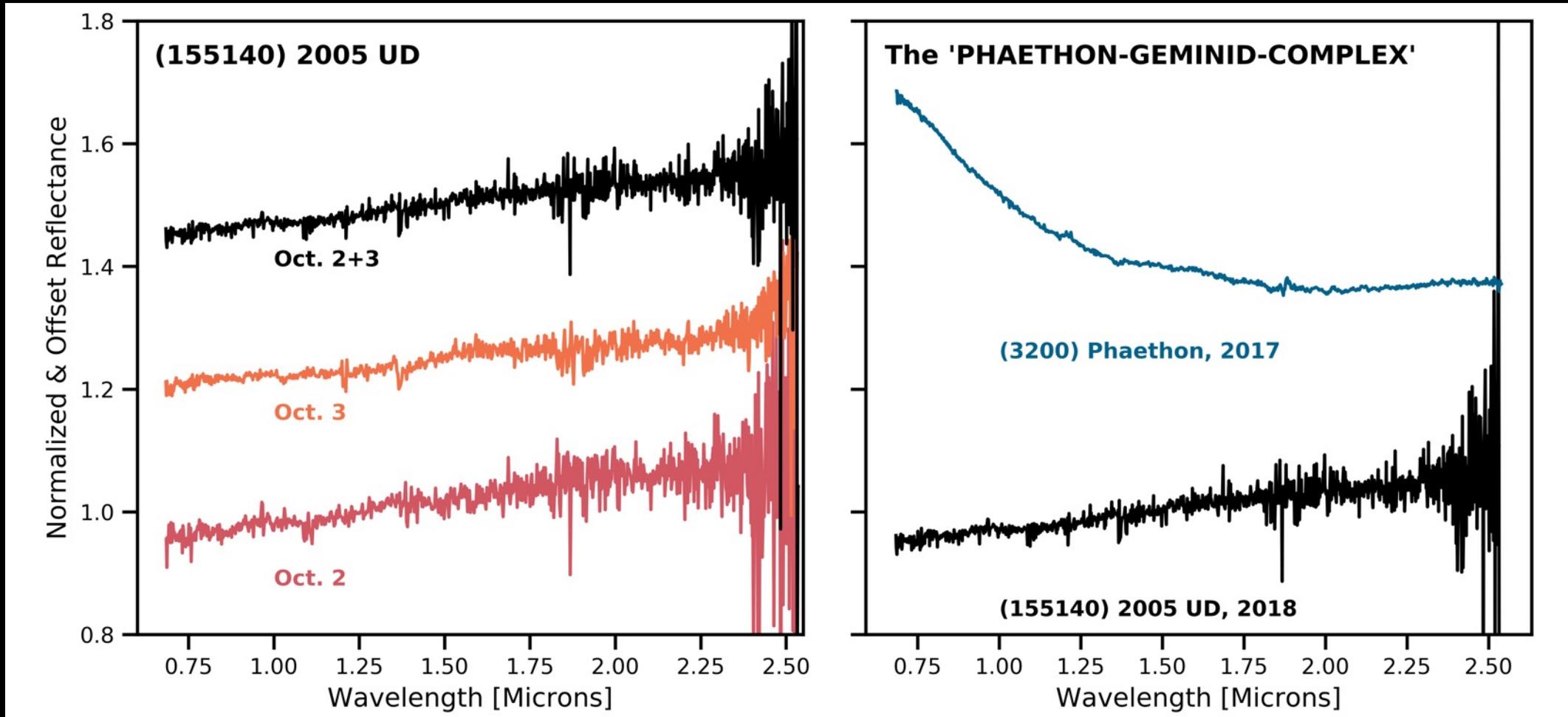
2005 UD, Diameter ~ 1.6 kilometers



What observations and studies are useful *now*?

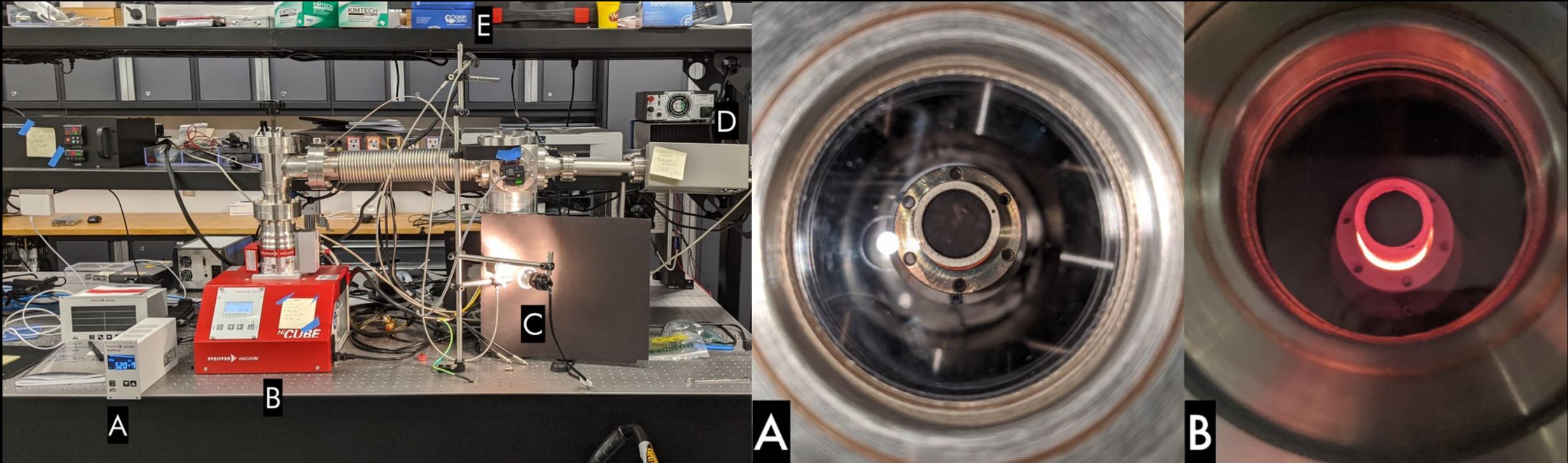


Phaethon spectrum is rotationally-averaged, from Kareta+ 2017.



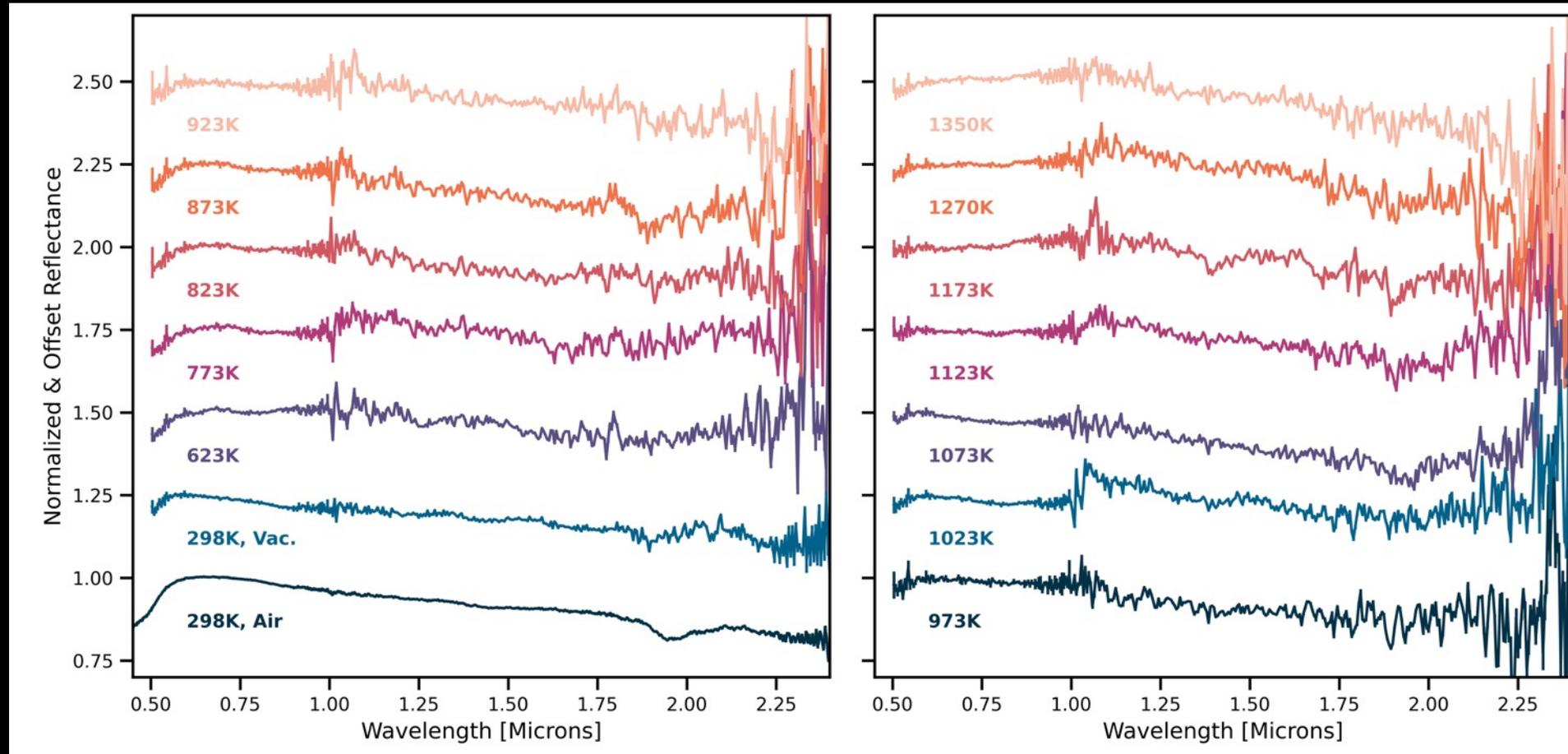
We observed **2005 UD** on three nights in 2018 and found it to be red-sloped and linear in the NIR. Challenging to explain its different spectra from **Phaethon** – but we had some ideas.

**Idea:** the two objects are made of the same material but have been heated to different extents. **Problem:** existing laboratory data does not go to high enough temperatures.



**Solution:** We built a chamber that can pump down to a near-vacuum to heat meteorites to successively higher temperatures and measure how their reflectivity changes.

So, what did the heating do?



When heated to a temperature similar to Phaethon's peak temperature, the heated meteorite looks *similar* to Phaethon. Not the same for 2005 UD. We argue that they only have similar properties *coincidentally*.

# Talk Summary

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- First NIR obs. of ‘mini-Phaethon’ 2005 UD, red and linear, not similar to Phaethon’s surface.
- New laboratory dataset of heated CI Chondrite spectra for comparison with near-Sun objects. Decent match for Phaethon, not 2005 UD.

Accepted in PSJ , on ArXiv at:  
<https://arxiv.org/abs/2109.01020>



Thanks for watching my talk! Please feel free to send me an email about any of this!