**Advanced Labs - Zoom Discussion**

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**Participants (20):**

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* David Bailey (University of Toronto, dbailey@physics.utoronto.ca)
* Eric Black
* Paul Arpin
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* Michael Durst (Middlebury College, mdurst@middlebury.edu)
* Ernie Behringer (Eastern Michigan U)
* Istvan Danko (University of Pittsburgh - izdanko@pitt.edu)
* Mark Chantell
* Kosta Popovic (Rose-Hulman Institute of Technology, popovic@rose-hulman.edu)
* Kevin Van De Bogart

**General Discussion Questions:**

1. **If you are an instructor thinking about this topic for Fall 2020, what are the different areas that you should be thinking about?**
	1. **Objectives:** What you want your students to get out of the Advanced Lab (e.g. experience using certain equipment, data analysis skills, reading journal articles, building an apparatus, writing a research proposal, designing and performing experiment for given problem, etc.)
	2. **Safety Standards for In-Person and Remote Options:** Expect PPE requirements and social distancing for in-person labs, also need flexibility and options for those who may need to do course remotely
	3. **Supplies:** What equipment, software, lab tools you would need to accomplish (a) given (b)
	4. **Identify potential challenges:** Providing equitable experience for in-person and remote students; students cannot work physically close to each other on same piece of equipment; creating an environment that is still encourages resilience & persistence (not giving them all the answers, but still keeping them from getting completely stuck)
2. **For each of the areas that were identified, what are some options? Which options work? Which options don't work?**
	1. **Objectives Options**
		1. Shift emphasis away from some learning objectives and onto others more applicable to remote and/or socially-distant learning
		2. Easier Objectives for Remote and/or Socially-Distant Learning: designing experiments, writing research proposals, reading journal articles, data analysis, computational and/or simulation skills
		3. More challenging options: constructing apparatus from lab kits (shipping logistics, cost issues); hands-on experience using certain equipment (though can potentially use remote-controlled labs and/or online simulations to accomplish learning goals)
	2. **Safety Standards for In-Person and Remote Options:**
		1. Lab stations separated in space and/or time
		2. Required PPE
		3. Most instruction online
		4. Limit in group size that can meet in person
	3. **Supply Options:**
		1. Videos of Using Equipment
			1. Not as good: Instructor takes video and provides data (less engagement from students, though perhaps instructors can acquire data synchronously while taking instructions from students)
			2. Better Option: On-campus students set up lab themselves, make video with remote feedback from partners, and acquire data for their lab group
			3. Possible Option: Interactive Video - hard to produce oneself, and those available are typically not free and not really geared towards advanced lab (e.g. <https://www.pivotinteractives.com/>), but more advanced material available through book by Walter Smith - "Experimental Physics: Principles and Practice for the Laboratory" (Taylor & Francis, 2020) Website: ExpPhys.com)
		2. Lab Kits
			1. Arduino kits (some pre-prepared that students can buy directly) - Forrest Bradbury had good experience with that (<https://arxiv.org/abs/2006.06881>)
			2. This site will create and build lab kits for particular curricula (<https://www.holscience.com/>)
			3. Combination of hands-on science lab kits, virtual learning tools and customized digital curriculum (<https://esciencelabs.com/>)
			4. If creating your own, make sure to get extra supplies and consider shipping/return options (Customs for shipiping to China was annoying) - Mark Chantell had good experience with that with Electronics
			5. DAQ devices and LabView (Eric Black had good experience with that)
			6. Audio signals via headphone jack and Audacity
		3. Online simulators
			1. Circuit Simulator: <https://www.multisim.com/>
			2. Oscilloscope: <http://expphys.com/public/scope_intro.htm>
			3. Lock-In Amplifier: <https://advlabs.aapt.org/items/detail.cfm?ID=13360>
			4. Simscape: <https://www.mathworks.com/products/simscape.html>
		4. Remote-Controlled Labs
			1. <http://rcl-munich.informatik.unibw-muenchen.de/> (You can switch to English by clicking on the British flag)
			2. OpenSTEM Labs: <http://stem.open.ac.uk/study/openstem-labs>
			3. Remote Glow Discharge Experiment (<https://www.pppl.gov/RGDX>)
		5. Publicly-available datasets and/or resources
			1. Lots of data sets for data science, astrophysics, etc.
			2. IBM Quantum Computers Online (<https://quantum-computing.ibm.com/>)
	4. **Addressing potential challenges Options:**
		1. Remote collaborative group work (deliberate mix so that on-campus person acquires data for the rest)
		2. Provide open-ended labs with scaffolding (make sure there is time for the instructor to talk synchronously with students each week to go over ideas and help brainstorm solutions)
3. **What are some resources that are useful for this topic that haven't been discussed yet? Can anyone give a recommendation for or against these resources?**
	1. "Experimental Physics: Principles and Practice for the Laboratory" (Taylor & Francis, 2020) Website: ExpPhys.com
		1. We are developing 25 remote labs, some that require kits, but mostly based on interactive videos and fairly sophisticated computer simulations.
	2. Good LED experiment for students to do at home (by Lowell McMann and used by Ernie Behringer) - <https://www.compadre.org/advlabs/items/detail.cfm?ID=13808>
	3. BFY 3 proceedings: <https://advlabs.aapt.org/BFY/Proceedings/2018/>
	4. BFY 2 proceedings:

<https://advlabs.aapt.org/BFY/Proceedings/2015/>

* 1. Modelling the bounce of ping pong ball (developed by Declan Mulhall) and used this for analysis (<https://www.fon.hum.uva.nl/praat/>), Ernie suggested Phyphox could work as well
	2. Build a telescope, 2 pinholes and look at pinhole interference (Lowell McMann)
		1. Here's a link to the 'beyond the Rayleigh limit' experiment - written as a lecture demo.<https://aapt.scitation.org/doi/abs/10.1119/1.1463736>
	3. Focus on scientific writing and having peer-review process
		1. Here are our peer review instructions and formal checklist for students (David Bailey):<https://www.physics.utoronto.ca/~phy326/Draft%20Review%20Form%202020S.pdf>[, https://www.physics.utoronto.ca/~phy326/Formal\_Report\_Checklist.pdf](https://www.physics.utoronto.ca/~phy326/Formal_Report_Checklist.pdf)
		2. Provided info on good peer review procedure (Melanie Lott provided inspiration --<https://advlabs.aapt.org/items/detail.cfm?ID=13805>)
		3. Had to submit a self-reflection with draft and letter to the editor
		4. This is a good 3-part series on writing a scientific paper, including responding to reviewer feedback. <https://www.biophysics.org/blog/how-to-write-a-biophysics-article-worthy-of-publication-part-1-from-lab-notebook-to-first-draft>
		5. Go to journal website and write an article for those specifications (Kosta Popovic)
		6. This was the homepage for the peer review project this past spring quarter: [https://wiki.uchicago.edu/display/phylabs/Journal+Article+and+Peer+Review+Overview](https://wiki.uchicago.edu/display/phylabs/Journal%2BArticle%2Band%2BPeer%2BReview%2BOverview)
		7. JAUPLI-B paper exchange for anonymous peer review across universities across institutions (check out on the ALPhA Slack Workspace).
			1. (From ALPhA newsletter) As we prepare to roll out, JAUPLI for next year, we asking for your input so that we can gauge interest and get your feedback on how JAUPLI-B can best serve the needs of the advanced lab community. Please take a moment and fill out this short survey:<https://forms.gle/6p1tDyyYPaXsB4Ex8>
	4. Have journal club with discussion to guide how to write
	5. Join the ALPhA Slack workspace for helpful discussions and info
		1. Invite link: <https://join.slack.com/t/alpha-advlab/shared_invite/zt-fetswz6u-PWK9KxcQ28btPb79T4IKWg>
1. **What ways can we help each other moving forward?**
	1. In general, just having a way of sharing all the resources available. (This definitely provided a nice venue for that!)