Pathway to Careers

Developing Photonics Education in Iowa's Rural High Schools

(Developing _____ Education in _____'s Rural High Schools)

Please feel free to ask questions
or comment at any time.

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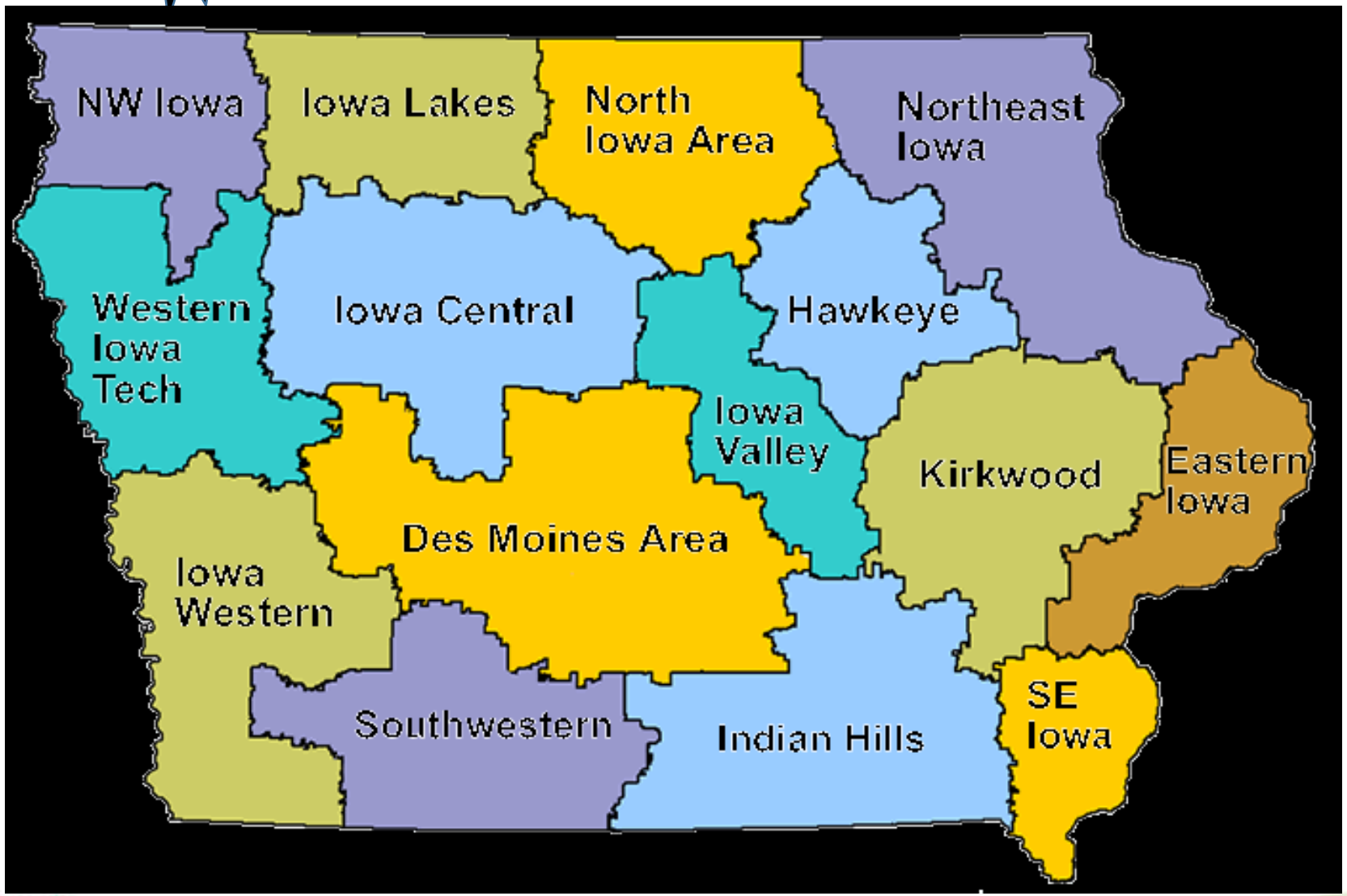

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Developing Photonics Education in Iowa's Rural High Schools

- Population of IA: 3.1 million in 99 counties; ~31.3k per county
  - IHCC's 10 - county area: 137,900; ~13.9k per county; 44% of state average.
  - Currently 4 – high schools have 17 students attending LEO 103 out of 1170.
- IHCC understands the national demand for Laser & Optics (photonics) technicians and seeks to increase the supply across the U.S.
- IHCC's Lasers & Optics Technology program began in 1985.
  - First graduating class was May 1987; Average 20 graduates per year
  - Graduates employed by 140 companies, in 42 states & 2 European countries
  - 8 – 10 job opportunities per graduate; 4 - 5 job offers; averaging $57.5k
  - Less than 1% of these grads employed in Iowa.

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- 2014: The Midwest Photonics Education Center (MPEC) was established as a NSF ATE center (2014 – 2018) at Indian Hills Community College (IHCC) in its Advanced Technology Center, Ottumwa, IA.
  - MPEC: Worked with a network of educational institutions and business partners in states throughout the Midwest and across the nation to lead an effort to increase the number of trained photonics technicians.
  - MISSION: To introduce university, community college, high school and middle school teachers to lasers & optics (photonics).
  - MPEC ended 8/2019 after a one year extension; its influence has not.

MPEC
MIDWEST PHOTONICS EDUCATION CENTER

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- 2018: The NSF ATE project grant, Developing Photonics Education in Iowa's Rural High Schools (RIPE), was awarded to IHCC (2018 – 2021).
  - A three-year mission to bring educational programming in the high-growth, high-demand field of photonics to a population rarely afforded such opportunities: rural Iowa high school students and teachers.
  - Our *primary goal* is to increase the number of rural Iowa high school students in the photonics technician pipeline.
    - Leverage MPEC's associations with industry partners to enhance the project's activities.
    - Develop new relationships with rural Iowa secondary schools and homeschool groups to build sustainability.

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- This goal will be met through three objectives:
  - 1. Offer an engaging, dual credit photonics course to rural Iowa high school students via a hybrid online learning platform
  - 2. Provide photonics-related professional development and follow-up assistance to science and technology teachers to have photonics concepts infused into their courses.
  - 3. Host a photonics summer institute to provide high school students & teachers with more in-depth exposure to the field.

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- 1. Offer an engaging, *dual credit photonics course* to rural Iowa high school students via a *hybrid online* learning platform
  - High School Photonics Fundamentals courses (2)
    - Two, eighteen week high school semesters.
    - Together they transfer as the IHCC Photonics Fundamentals course (1)
  - Each course consist of three learning units (LU) which include
    - *Online* "lecture" content (syllabus & course schedule) for
      - LU reading assignments (texts supplied by IHCC)
      - LU slide presentations with audio & transcript
      - LU Study Guide which is submitted/graded

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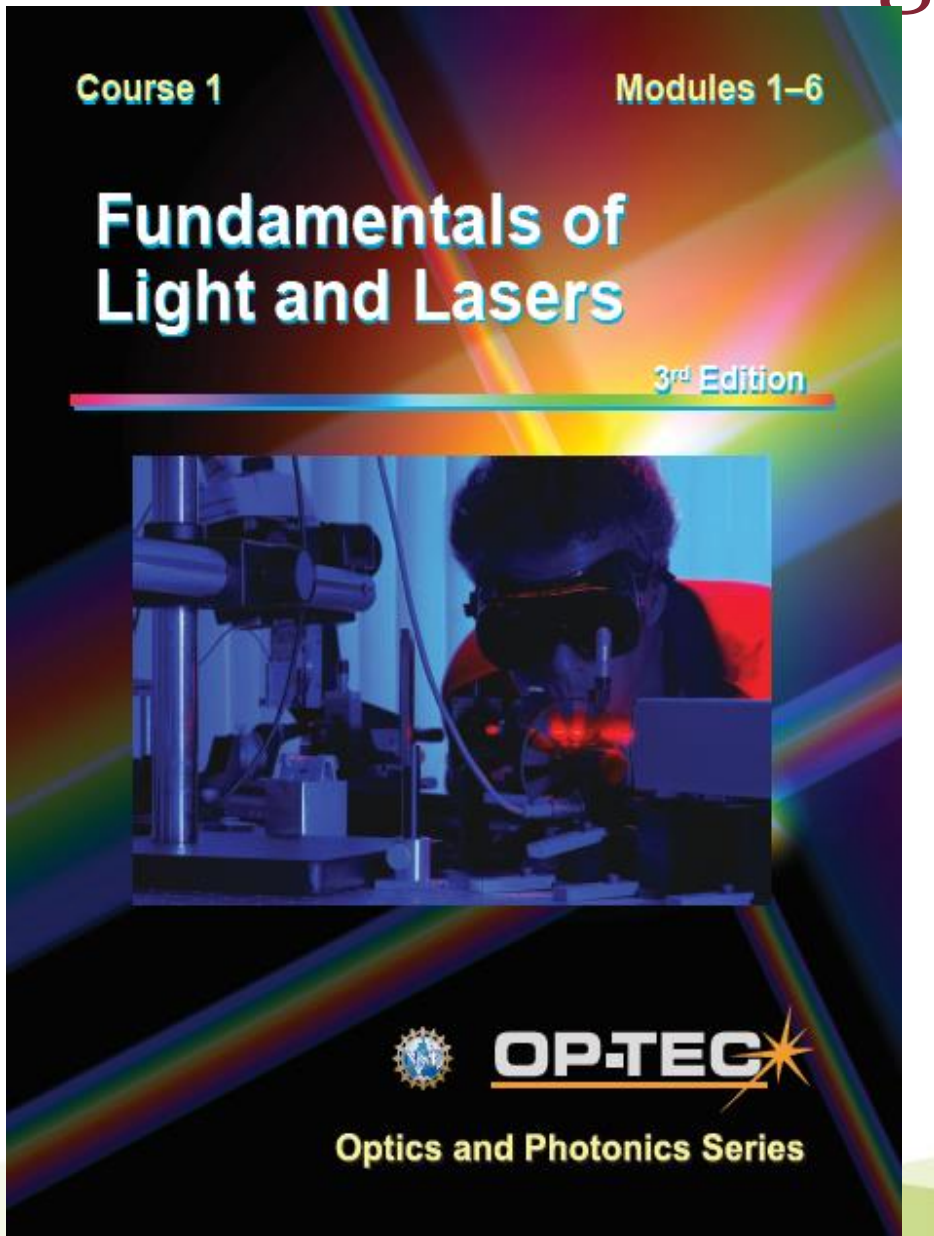

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- Each course consist of three (3) learning units which include
  - LU Lasers & Optics Labs: 15 total: 2/LU - Course 1 (6); 3/LU - Course 2 (9)
    - *Hands-on* labs (IHCC supplies the kits)
      - These Kits have the necessary components and equipment to set-up and complete 30 photonics labs
        - Lab Instruction Booklet included with purchase of Photonics Kit
    - Instructions for each lab are contained in the course learning unit
      - 2 – videos are supplied to assist in lab completion.
    - Lab Write-Up is submitted & graded
  - LU Test
    - Students may use the presentation, study guide, text and lab results
    - Each LU test has a time limit.

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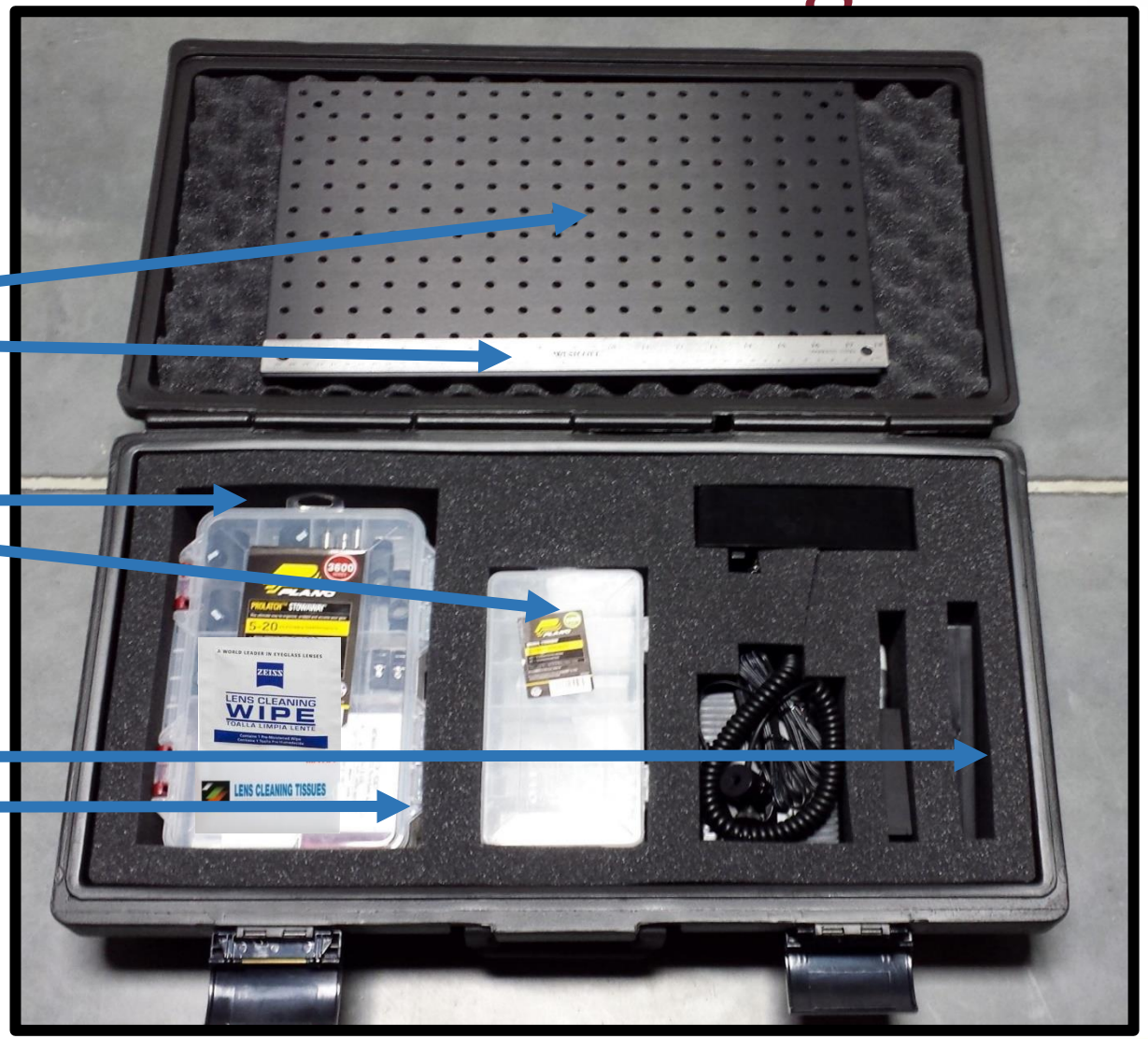
Developing Photonics Education in Iowa's Rural High Schools

- Optical Breadboard/Plate & 45.7mm (18") Stainless Steel Ruler
- 2 - large & 2 - small storage boxes
- Photometer Detector with Thumb Screw & Cord placement
- Lens Cleaning Wipes & Tissues



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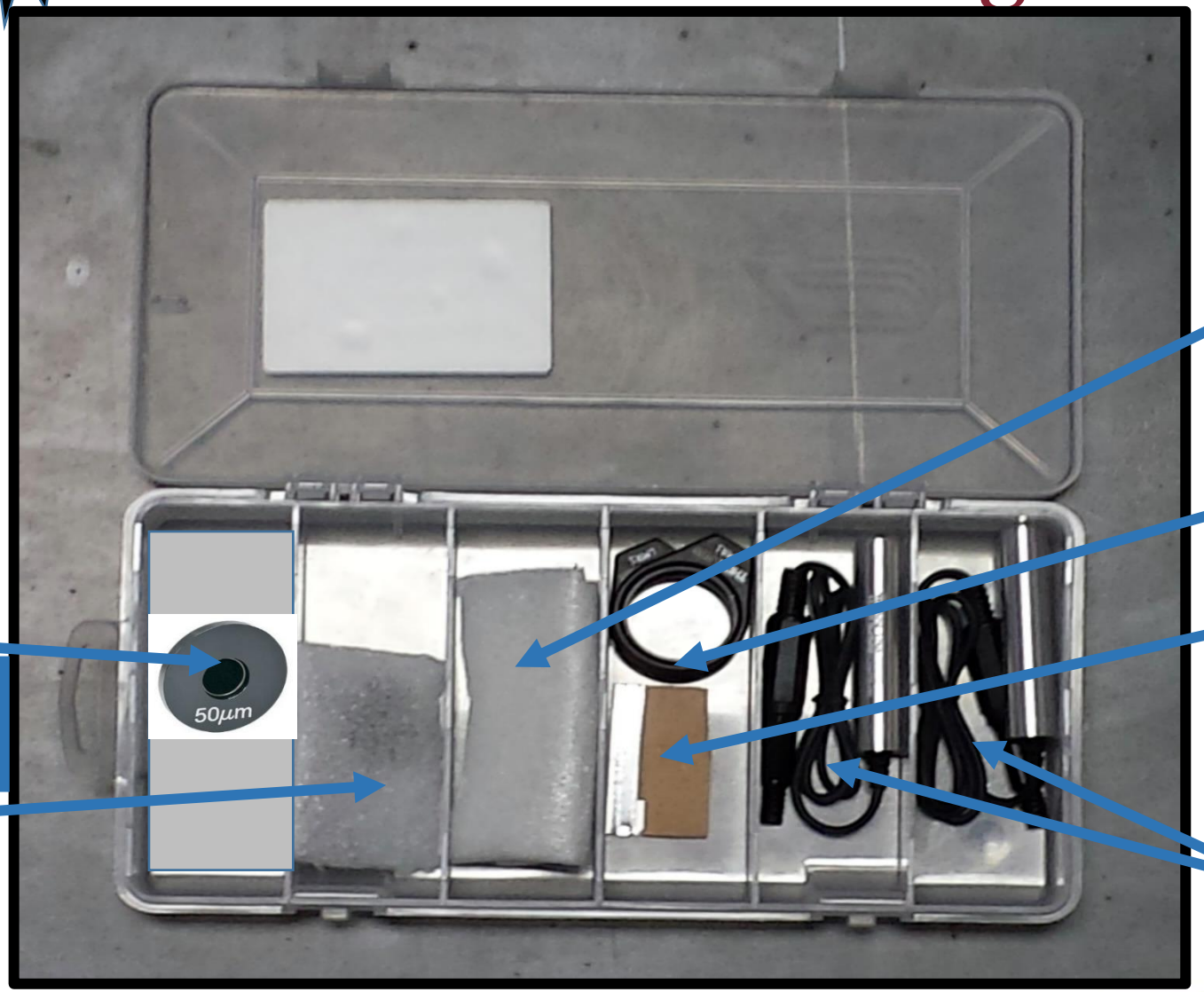
Location of components in Small Storage Box #2



Mounted 50 µm Precision Pinhole

Polarizer, Glass, green, 25mm diameter

Microscope Slide

2 – Lens Mount, Fixed

Razor blade

2 – Laser Diodes with cords neatly wrapped

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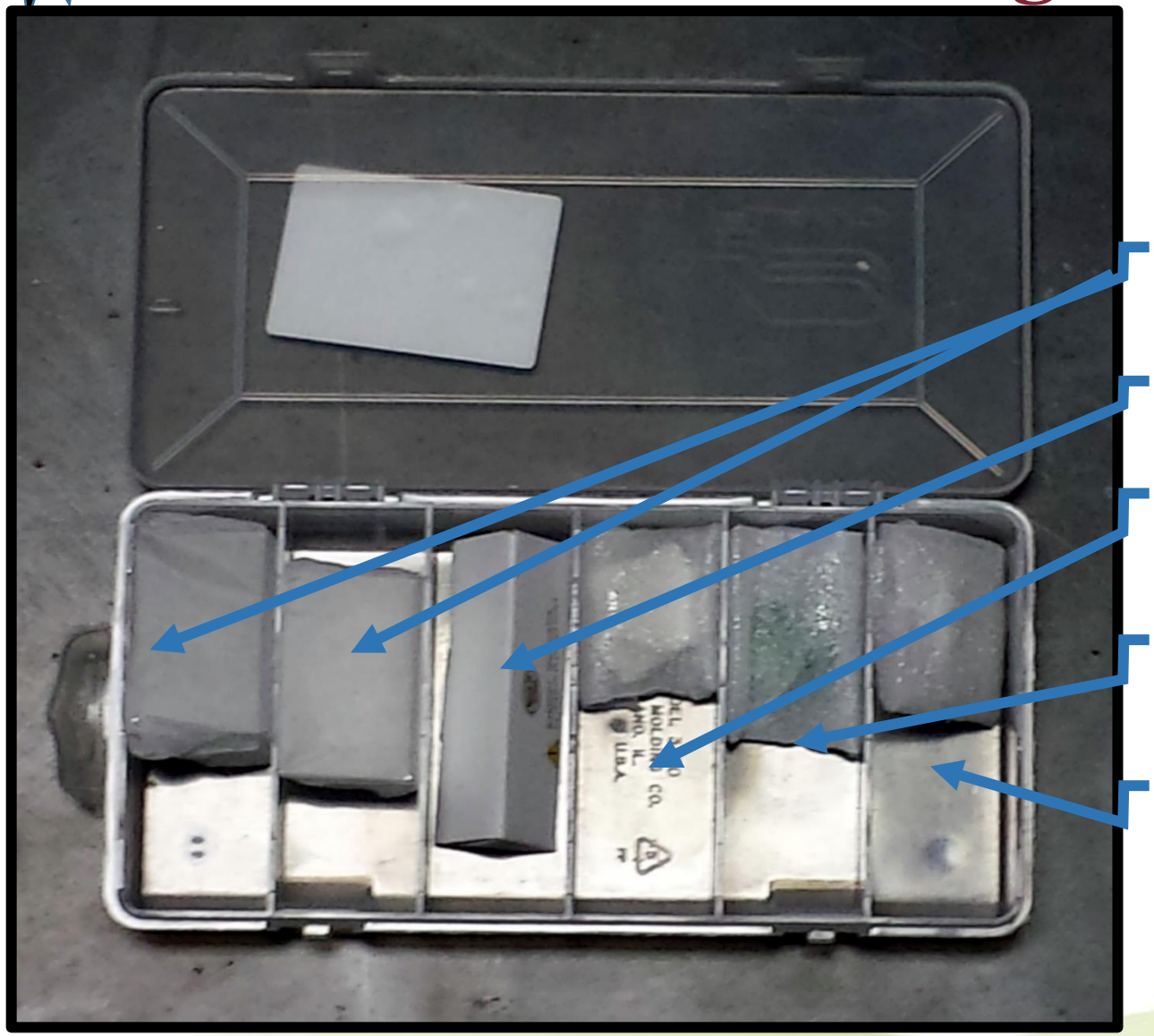
Location of components in Small Storage Box #1



- 2 – Prism, Right Angle
- Prism, Equilateral
- Bi-Concave Lens Ø25.4mm f = -25mm
- Plano Convex Lens Ø25.4mm f=200mm
- Bi-Convex Lens Ø25.4mm f = 25.4mm

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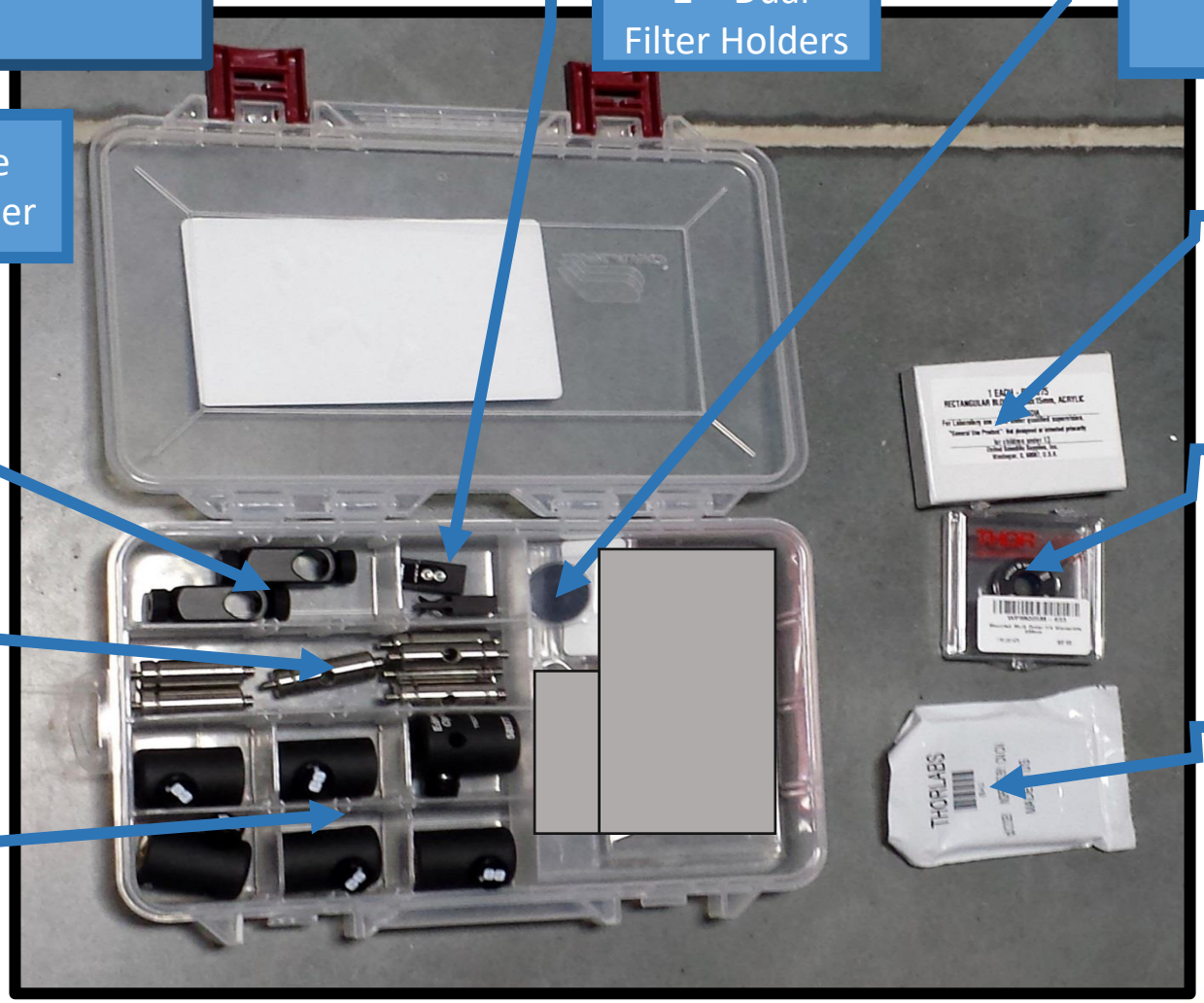
Location of components in Large Storage Box #2



2 – Right-Angle Clamp/Post Holder

7 – Posts, 2 piece

6 – Post Holders

2 – Dual Filter Holders

Mounted Single Slit, 100µm

Block, Acrylic

Wave Plate, Multiple Order, ¼ Wave

2 – Base, Mounting

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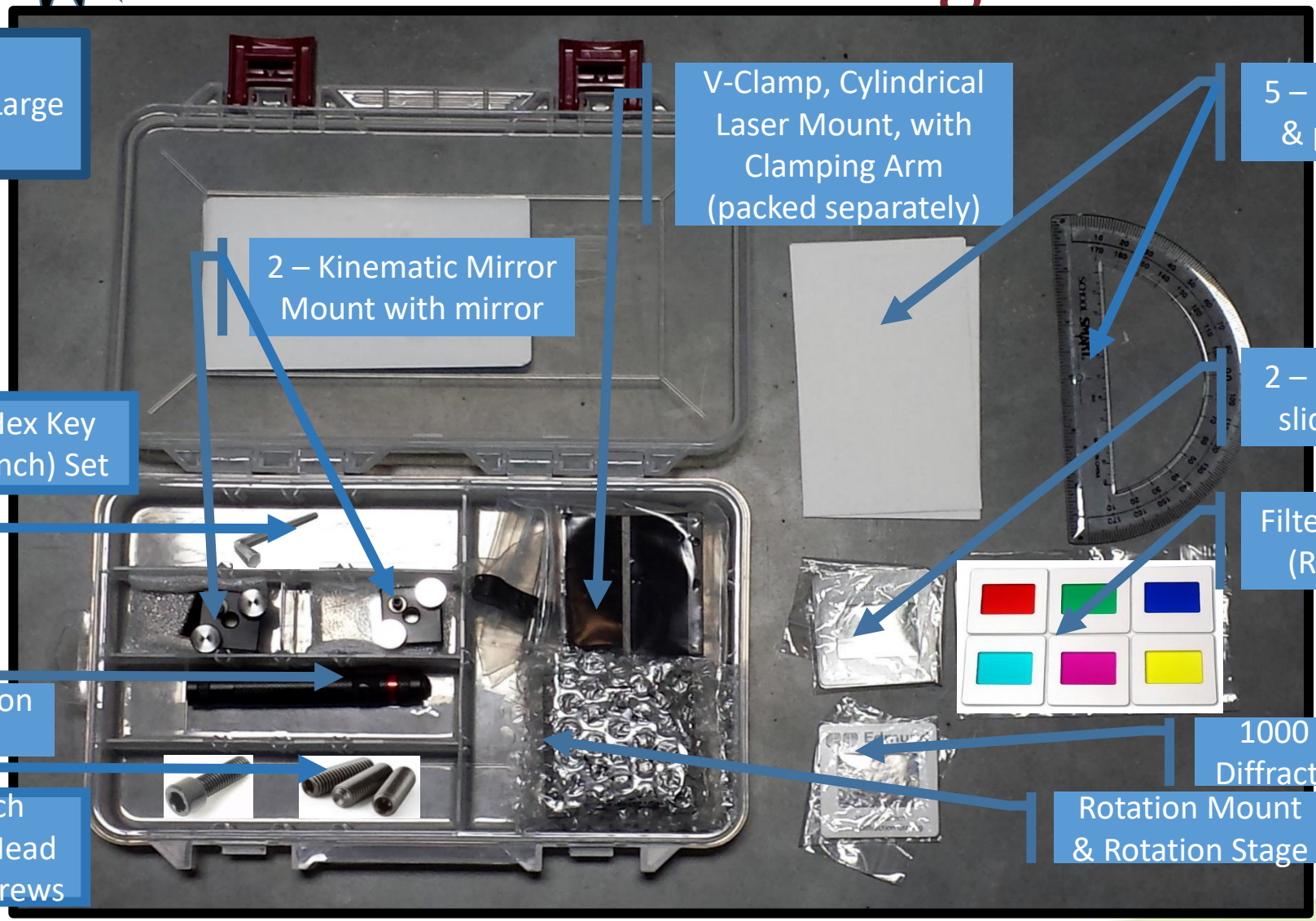

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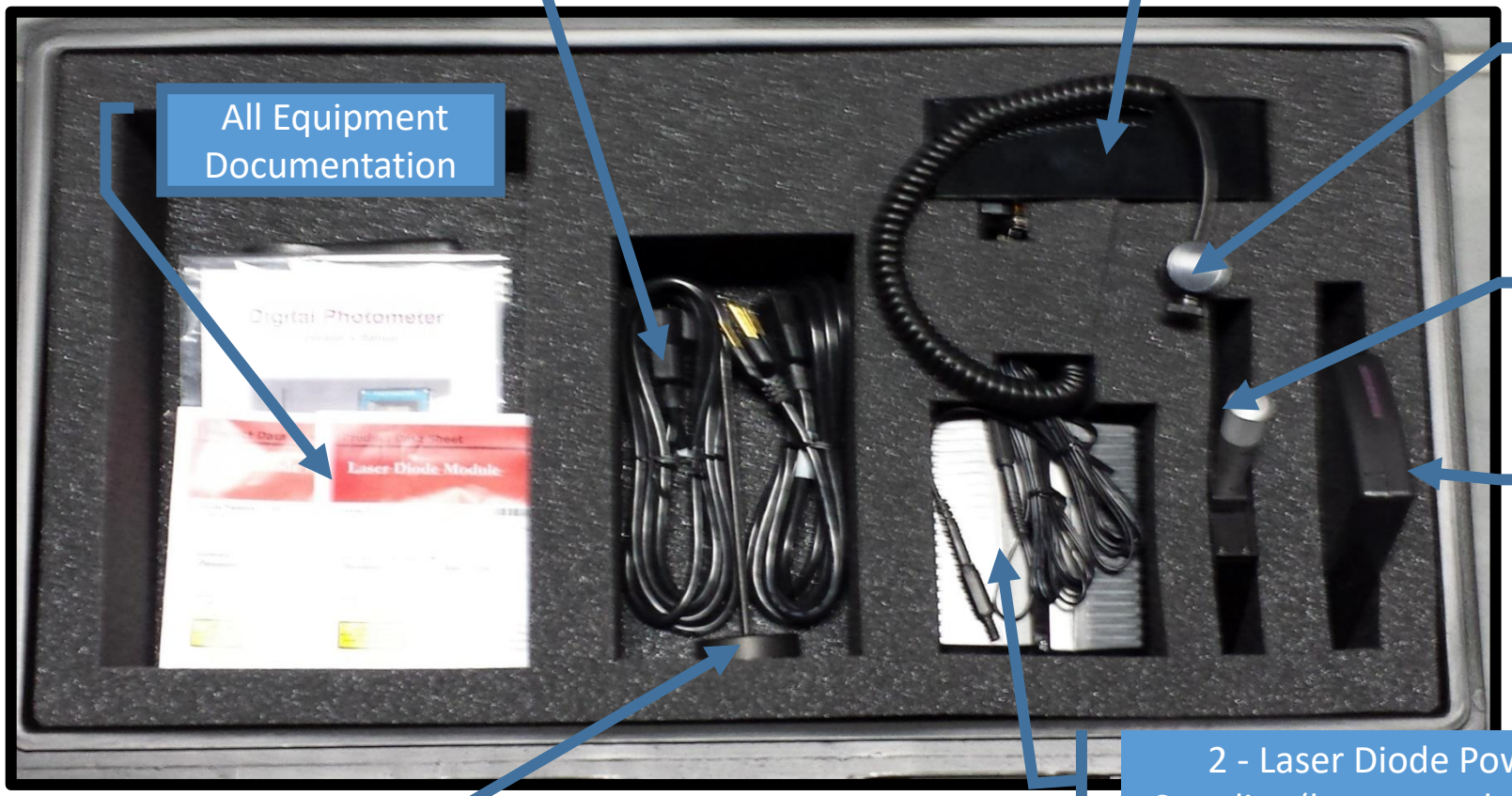

Placement with storage boxes removed

2 - A/C Cords for Power Supplies

Photometer, Digital, 2µW, 2mW, 20mW settings

All Equipment Documentation

Photometer Detector with Thumb Screw & Cord

Translation Stage, Single Axis

Spectroscope

Base with Rod for Optical Detector

2 - Laser Diode Power Supplies (bottom to bottom) with cords neatly wrapped

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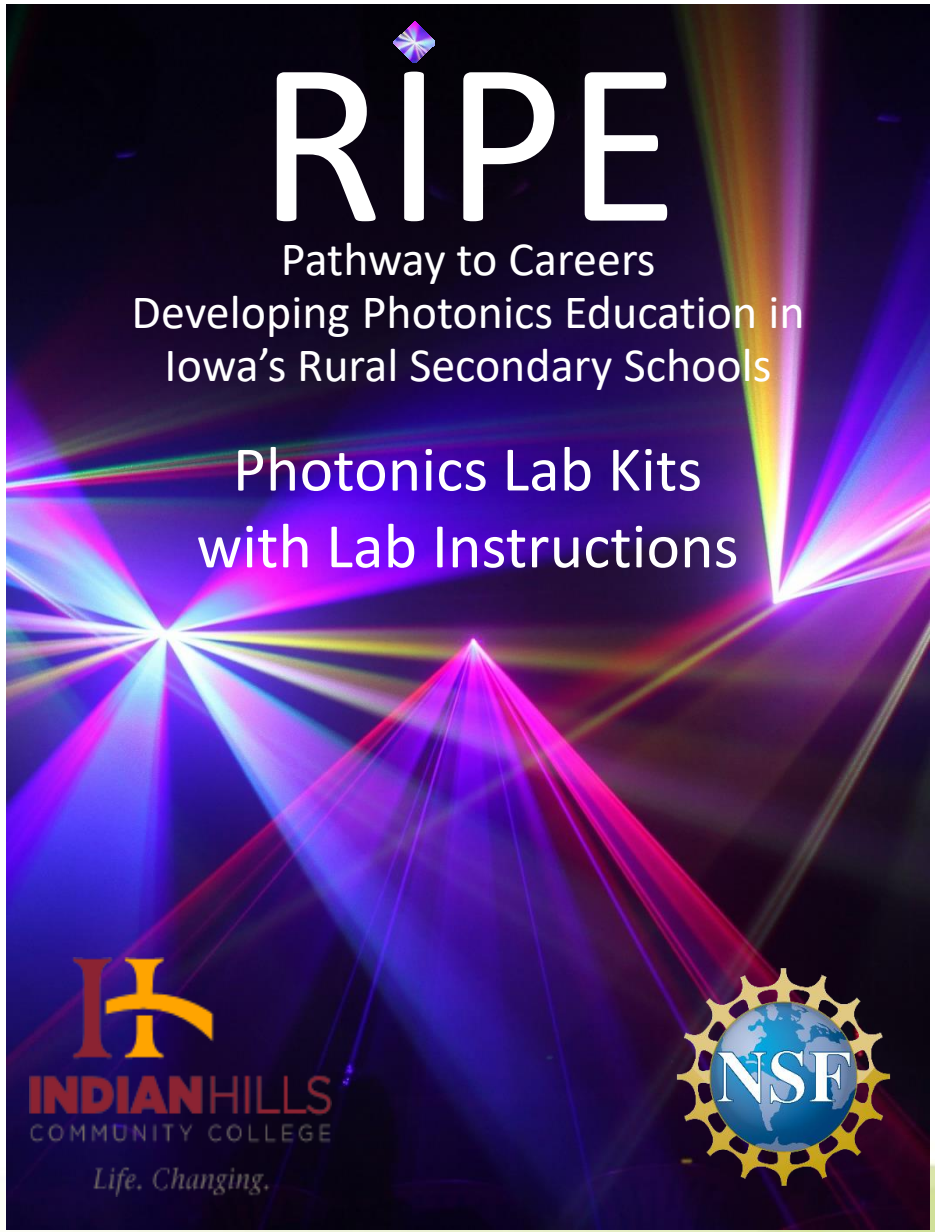
Lab Instruction booklet contains thirty labs that can be completed using the Photonics Kit.



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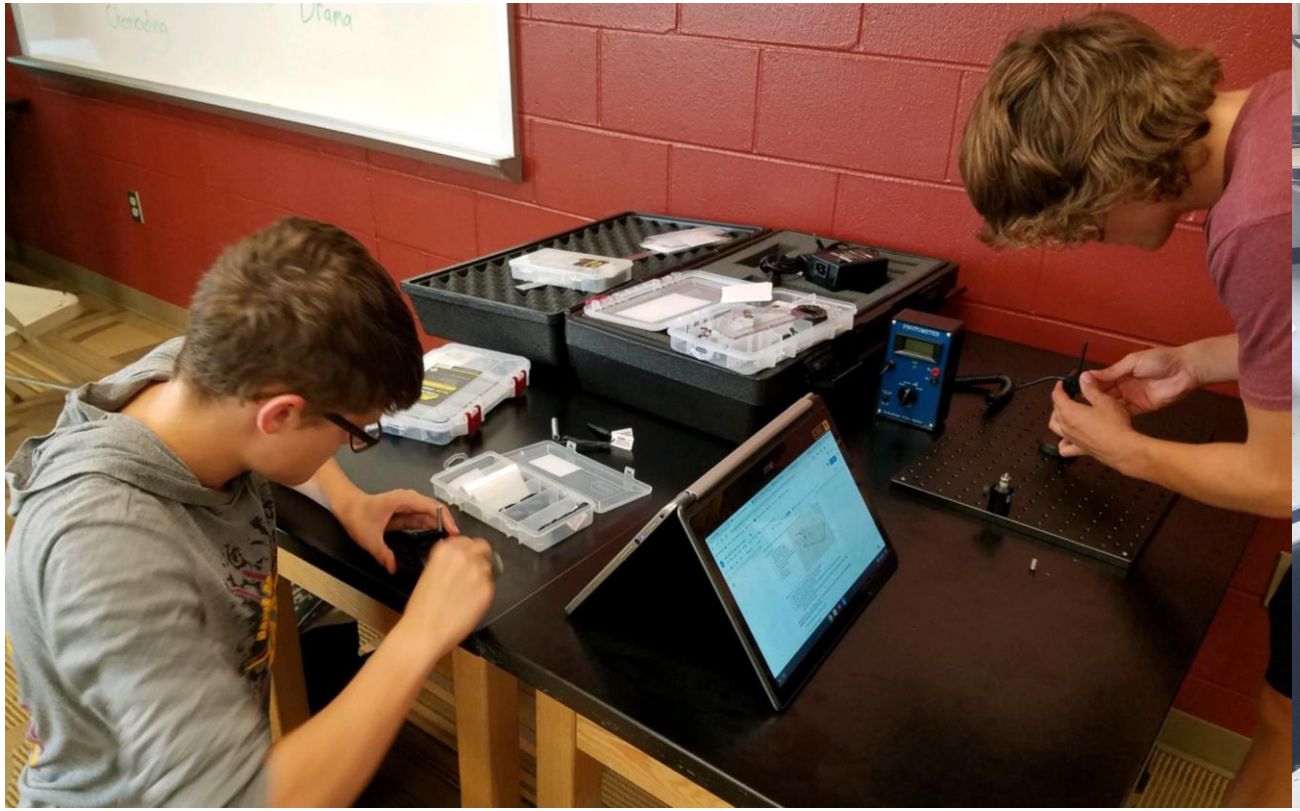

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- 2. Provide photonics-related professional development and follow-up assistance to science and technology teachers to have photonics concepts infused into their courses.
  - Each school has a STEM "facilitator" to oversee the class time.
    - Ensure security for the lab kits and answer ancillary questions.
  - Laser/Optics Technology Symposium: 2 – days each summer.
    - Generated and presented for STEM teachers.
    - CEU's may be obtained.
    - 4 – hours: Presentation on the basics of photonics
    - 12 – hours: Hands-on training with the RIPE (MPEC) Photonics Kit

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- 3. Host a photonics summer institute to provide high school students & teachers with more in-depth exposure to the field.
  - Photonics Fundamentals Institute: 4 – days each summer.
    - Meet & greet; tour of IHCC facility with emphasis on Laser Optics lab; expert panels; local company tours utilizing lasers; hands-on lab activities for teacher/student teams, etc.
    - CEU's may be obtained
  - Initially contacted eight schools and currently have four participating with a total of 19 students enrolled.
    - Assuming five of them enroll in Hills' laser/optics program, it will be a 25% increase.

Developing Photonics Education in Iowa's Rural High Schools

- Compared to other teaching methods
  - Online/hybrid dual credit
    - Lecture content is online
    - Lab content is hands-on with donated labs
  - Online
    - No hands-on labs.
  - Face-to-face
    - Not available to multiple high schools and therefore students/teachers

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- Strengths, Weaknesses
  - Strengths:
    - Available to large number of students in multiple high schools
    - Concept presented to eight high schools
    - Four participated
    - 19 students presently enrolled
  - Weaknesses:
    - Most high school students have not taken an online course
    - Most STEM Facilitators do not know the content
    - Communication factor is highly reduced even though we are using Blackboard Collaborate, etc.

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- Opportunities, Threats
  - Opportunities
    - Students and teachers (facilitators) are becoming informed and involved
    - Educate students/teachers/counsellors about benefits of lasers & optics
    - Outreach to include more high schools and their administration
    - Increase the number of students in photonics careers.
  - Threats
    - Started with 20, currently have 17; 15%.
    - The fear of the unknown to be voiced to other students
    - Lack of commitment for sustainability

Developing Photonics Education in Iowa's Rural High Schools

- How best applied/implemented
  - Expert knowledge person to develop content and labs
  - Available teacher/trainer
    - The four high schools (6 sessions) have class times at six intervals from 8:00 a.m. to 3:22 p.m.
  - Necessary lab components in a single kit to support all labs
  - Enough kits for all involved students
    - One kit per two students
      - One kit per three is acceptable with designated roles that rotate
        - Lab Write-up author
        - Lab Technician
        - Lab Team Leader

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Questions? Comments?

Thank you for your attention and participation.

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