

OPTICS OUTREACH AND GENDER EQUITY IN PAKISTAN

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Where Pakistan stands in education...

- The highest number of **out-of-school** children worldwide after Nigeria; Nearly 22.5 million
- Among the world's worst performing countries (Oslo Summit 2015)

Out-of-School Children by Stages of Education (in Millions)			
STAGE OF EDUCATION (GRADES)	ENROLLED	OUT-OF-SCHOOL	PERCENTAGE OUT OF SCHOOL
Elementary (1-5)	18.4	5.0	21.3
Middle (6-8)	6.3	6.5	50.9
Secondary (9-12)	4.8	11.3	70.0

Source: Ministry of Federal Education and Professional Training, Pakistan

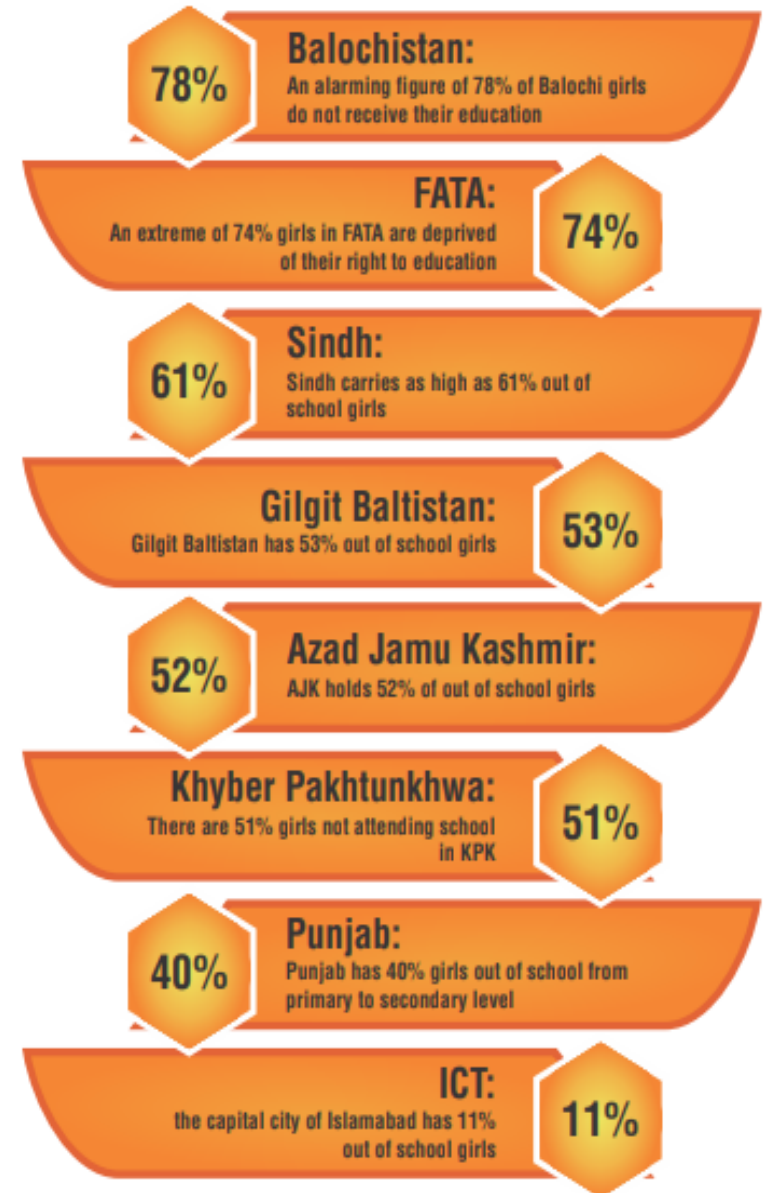
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“The State shall provide free and compulsory education to all children of the age of five to sixteen years in such manner as may be determined by law”

What about Girls education...

- Women are about **49.2%** of total population
- Gender imbalance at all levels of education
- The out-of-school rate for primary age girls is **32%** compared to **21%** for boys.
- By grade six, **59%** of girls versus **49%** of boys are out of school
- By grade nine, merely 13% of young women are still enrolled in school.
-



What are the challenges...

Poverty: Fundamental barrier for girls' education.

Beliefs: Girls should not be educated.

Gender Discrimination: Families prioritize boys' education to ensure a better economic future for the family.

Accessibility:

Girls from remote rural areas of the country are unable to attend school because they cannot afford the cost of transportation

Insecurities: Girls from poor communities often face harassment

Social Norms: Attitudes vary significantly across different communities



How and where to start...

- Reach out to help **government schools/colleges** for girls
- To provide **inquiry-based training** to High school and college teachers
- Help students to actively contribute to the learning process
- Foster science as a force that can **build up active citizens**
- To emphasize the relationship between **science skills** and **future employability**.



When we started...

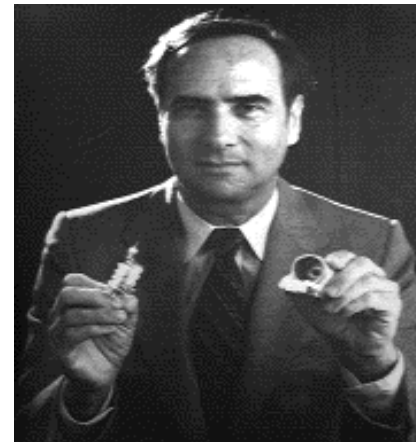
- Active learning in Optics (ALO): Self funded group established in January 2016 under the umbrella of ICTP and QAU.
- It brings physical sciences to under privileged Girls schools/ colleges/ universities: Provide an **enriching science experience in a friendly atmosphere.**
- Outreach activities organized to support and encourage girls students to **pursue careers in sciences.**



Why hands on optics..

- The United Nations designated 2015 as International year of light (IYL) and Light-based Technologies.
- Interest is focused on both the achievements and the new frontiers of optics and photonics
- International day of Light is celebrated on 16 May each year, the anniversary of the first successful operation of the laser in 1960 by physicist and engineer, Theodore Maiman

**Leads us to do something
personal for IdL and Girls
education**



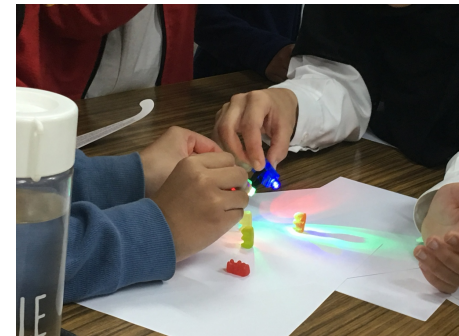
What we usually do...

- What is light?
- What is the role of light in our daily lives?
- Laser vs ordinary light
- Magic tricks based on optical illusions
- Laws of geometrical optics
- Diffraction with single and double slit Interference
- Polarization of light



What we do for younger girls...

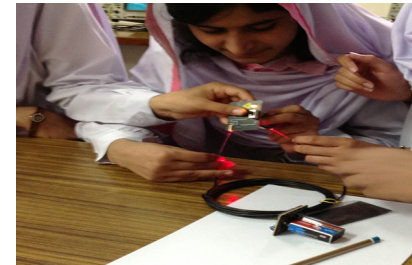
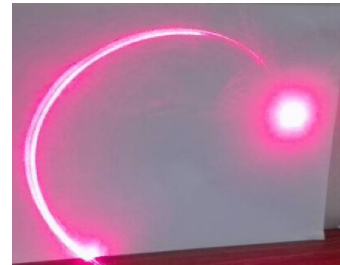
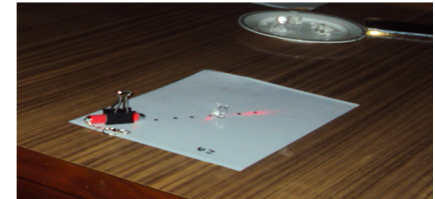
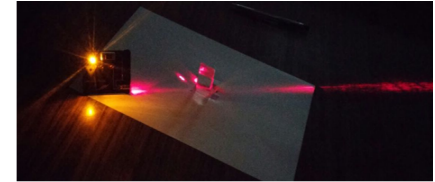
- Introduction to light sources
- Properties of light
- How to draw virtual image
- Concept of colors/filters
- Absorption of different colors of light
- Generation of White light
- Optical illusions



What for senior girls...

Geometrical Optics

- Law of Reflection
- Law of Refraction – Snell's law
- Finding critical angle
- Total internal reflection
- Working principle of fiber optics



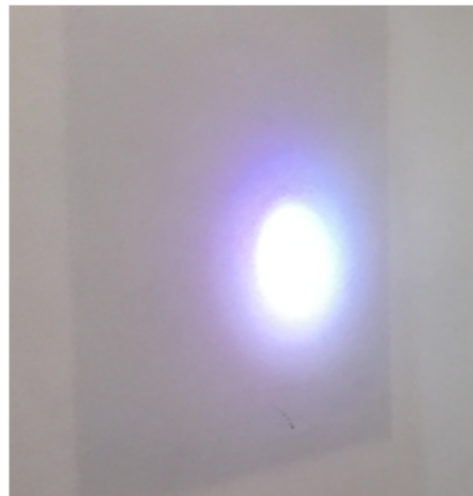
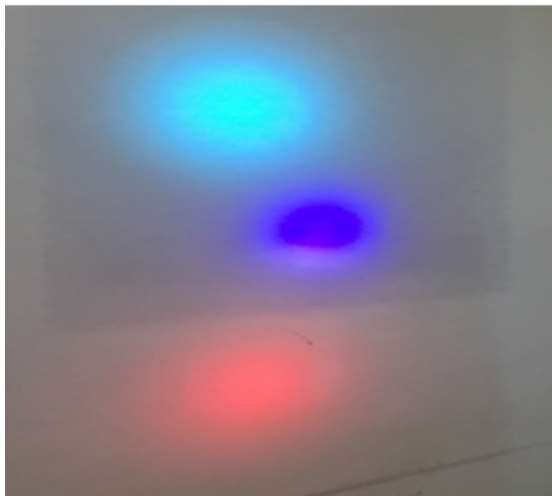
What for senior girls...

Refraction and Total internal reflection



What for senior girls...

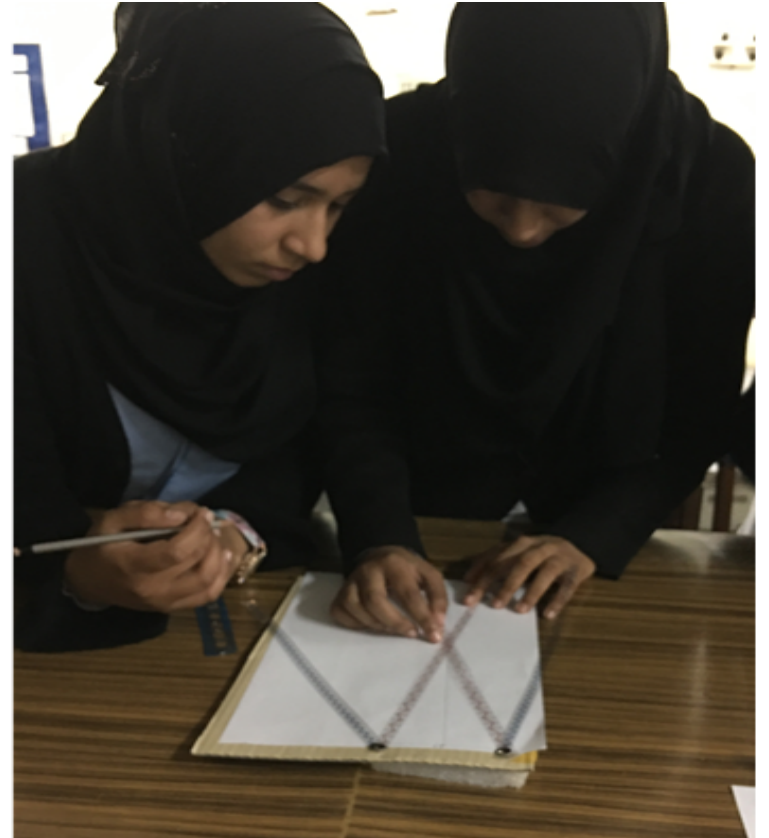
Generation of white light



What for senior girls...

Interference

- Constructive Interference
- Destructive Interference
- Finding position of maxima and minima for blue and red wavelengths
- Finding the position of green wavelength on intensity pattern



What for senior girls...

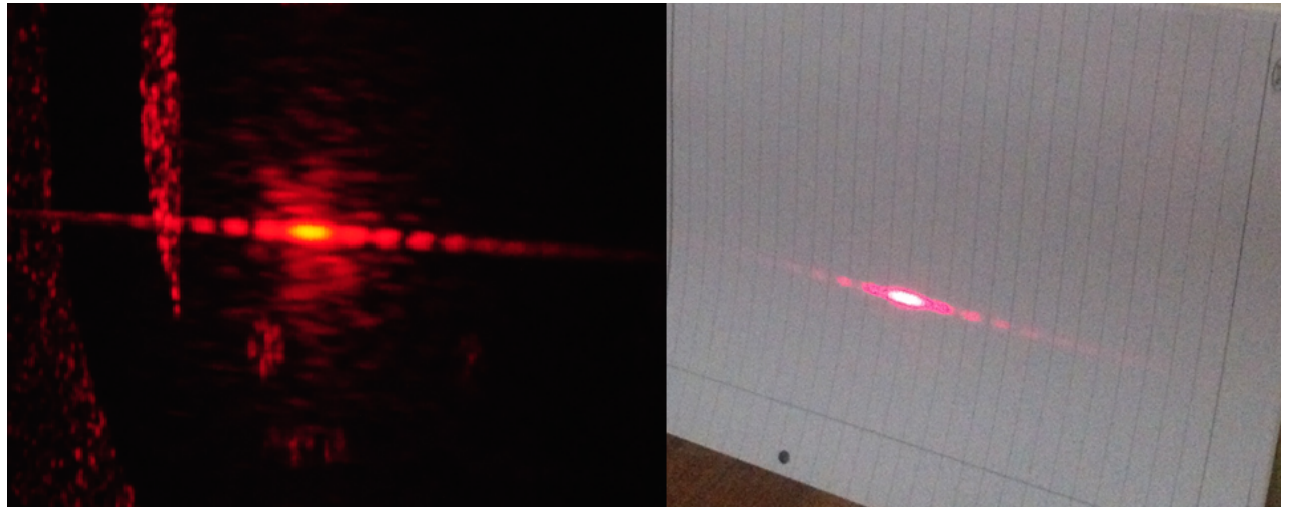
Scattering



What for senior girls...

Diffraction

- Diffraction with single slit
- Diffraction with double slit
- Diffraction from CD
- Diffraction from obstacles
 - Pin hole
 - Spring wire
 - Human hair
 - Curved obstacle



What for senior girls...

Polarization



How many activities so far...

More than **40 Optics Outreach** activities for girls/female schools/colleges/universities

Around **10 Optics Outreach activities** for boys and girls together



Middle/High School



Undergraduate student



Female universities



What we did during pandemic...



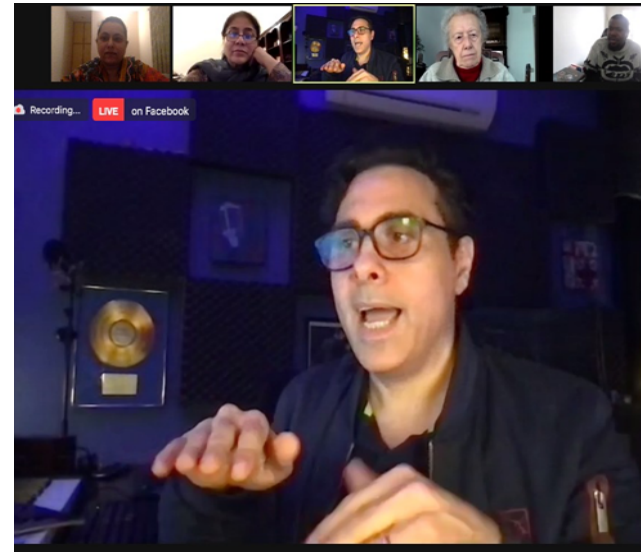
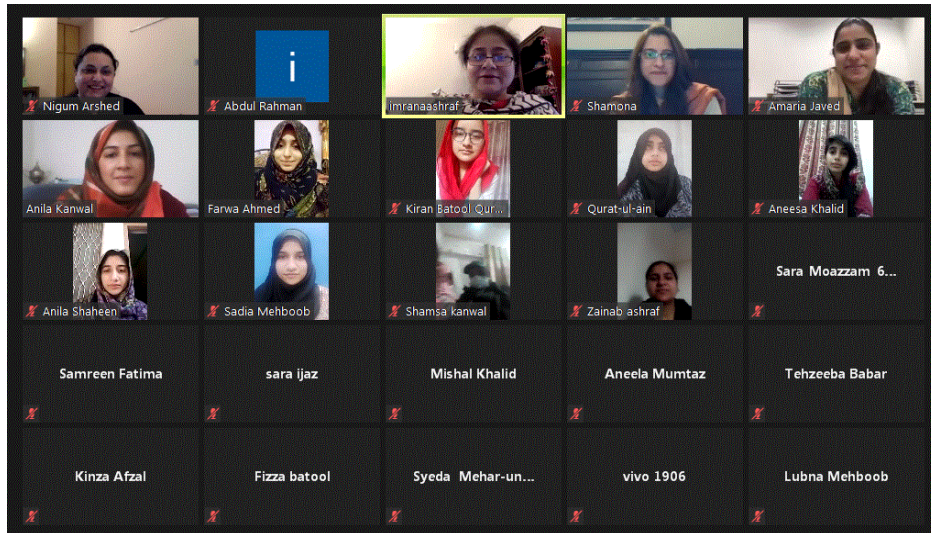
What we did during lockdown...

- Pandemic has greatly impact the social nature of science and collaboration.
- To reach out masses we felt the need to gather our academia and help our younger generation.
- Leads to foundation of Pak-ICTP Alumni Society
- More **than 20 online** lectures by distinguished scientists has been conducted so far

That includes:

- Steven Weinberg Lecture Series
- Abdus Salam Lectures Series

What we did during lockdown...



ALO and PIAS organized a unique event to celebrate IDL 2021 and also highlight importance of female education. Aaron Haroon Rashid has produced Pakistan's first full length 3D animated series "Burka Avenger", to emphasize the importance of girls' education.

What we have learned...

- Topics should be selected according to the theoretically background of students.
- The activities should be according to the age of students.
- Start with introductory session explaining aims of hands-on activities
- Student should be encouraged to make predictions/ ask questions
- Emphasis on conceptual understanding through observation

What we hope...

- These girls will continue in science
- May do outreach themselves and be a role model for a new group of girls.
- Be better-informed citizens capable of making decisions for the betterment of everyone

What I experienced ...

Being a woman

- being a daughter and later a daughter-in law
 - being a wife
 - being a mother of young girl
-
- Especially Asian culture where having an uneducated male heir is a greater source of pride to a mother than a daughter with an advanced degree.
 - Knowing how female children have been treated in remote areas of my beautiful country makes me **want to do so much more**

What I feel...

Pakistani girls really do embody light

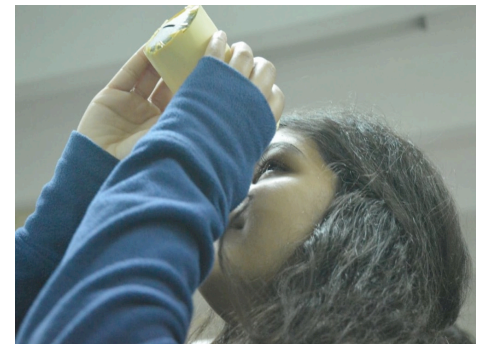
Their faces transmit a positive energy that says clearly:

- We are your future -take care of us and we will take care of you
- As good citizens
- As mothers
- As teachers
- As productive members of an enlightened society

where culture and traditions do not have to be in conflict with the realization of the potential of young girls.

What I believe...

If you educate a man-
you educate an
individual but if you
educate a woman
you educate a family



What about Future moves...

- The ALO group is planning to establish a regular calendar of outreach- hands on activities in Optics.
- Mostly we are doing these activities with schools and colleges in Islamabad and it's twin city Rawalpindi
- From 2019, we extended these activities to Khyber Pakhtunkhaw (KPK).
- To extend the limit of these activities to remote area of Pakistan and eventually make it a regional activity.

To take ALO (active learning in optics) to ALPS (active learning in physical sciences)

How you can reach us...

<https://www.facebook.com/opticsworkshops>

<https://www.facebook.com/PakICTPALumni>

<https://www.facebook.com/ICO-Territorial-Committee-of-Pakistan-105684732000592>

<https://www.dropbox.com/sh/r5k51z5fusga1mr/AAAlsdxEFWTiNqk8OGpaQj0Ba?dl=0>

Who are volunteers...



Thank you