

Seeking N-lightenment one cup at a time!

The Journey of Chai and Why?

Arnab Bhattacharya

Dept. of Condensed Matter Physics and Materials Science

Chair, Science Popularization and Public Outreach

Tata Institute of Fundamental Research, Mumbai

arnab@tifr.res.in

 ***chaiandwhy***

 ***@tifrarnab***



INSA Meeting, IISER Pune 27.12.2017





Why this title?

- Do research (sometimes) and talk (mostly) about science
- Nitrides have somehow been my friends...
⇒ B.Tech. (Molybdenum nitride) to TIFR (Gallium nitride)
- *N-lightenment* - nitrogen containing semiconductor materials that emit light

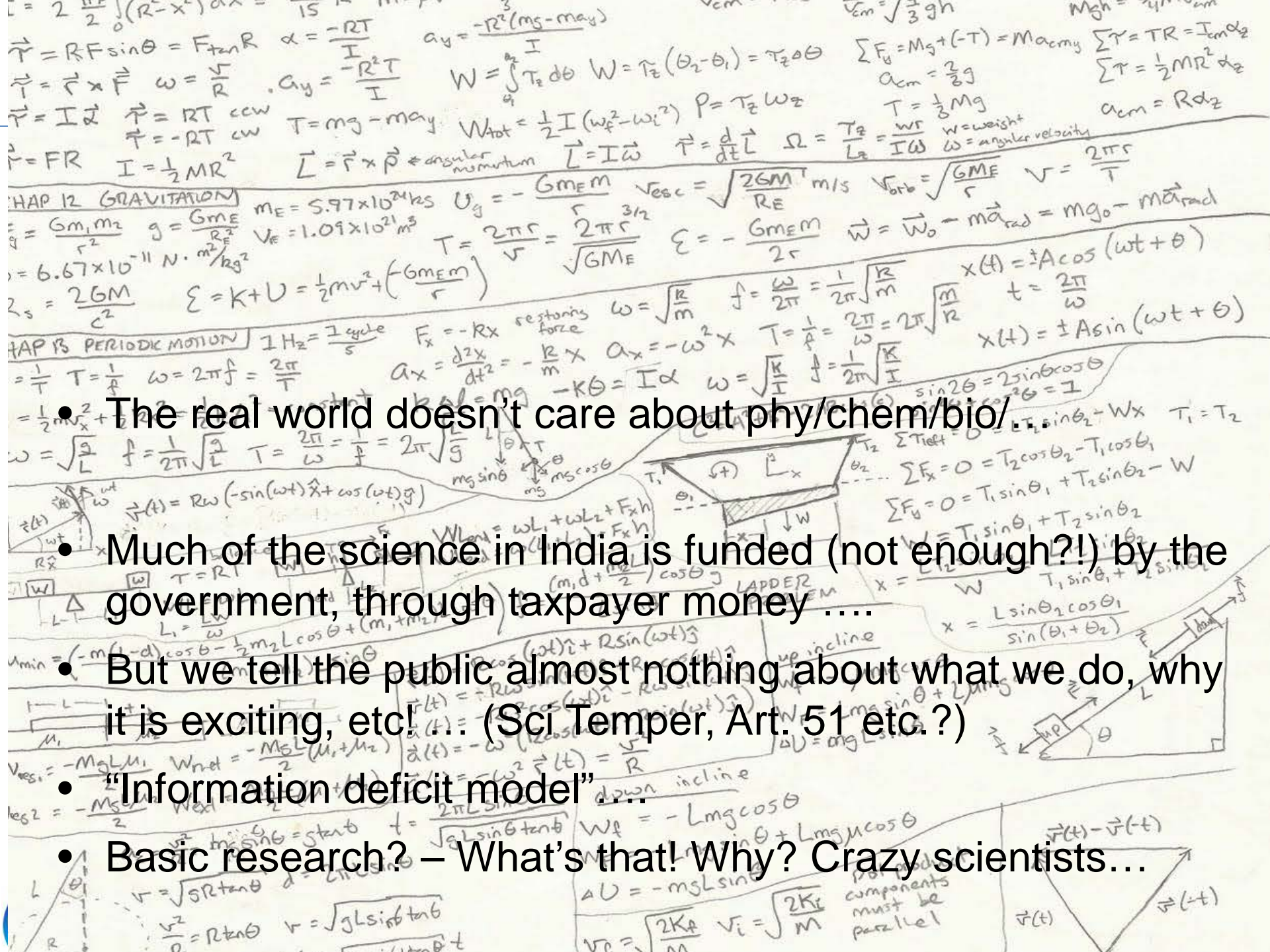


That got me started...

LED-ing up to more...

- Passion: get science out of the research lab into the public domain, engage people (kids!) and get them excited about science!
- But... reality was quite different!

A major learning experience...



- The real world doesn't care about phy/chem/bio/...
- Much of the science in India is funded (not enough?!) by the government, through taxpayer money
- But we tell the public almost nothing about what we do, why it is exciting, etc! ... (Sci Temper, Art. 51 etc.?)
- "Information deficit model"
- Basic research? – What's that! Why? Crazy scientists...

Major problem....

- What good is fundamental physics to the person on the street?

Major problem #2

- “Muggoo” Science... Not hands on
(hence no feel for reality, misconceptions)

Chai and Why?



TIFR's unique science-café style initiative running since 2009
224 sessions and counting.... without a break!

A refreshingly different approach to outreach, now firmly on the
Mumbai science calendar!

Informal, fun, interactive, family friendly, hands-on...

NOT a lecture - Short Talk, Looong discussions...

Build on content developed for Chai and Why? to take science
out to schools, esp. rural audiences

How it all started





Chai and Why?

- 3 venues across Mumbai – Prithvi Theatre, Juhu (1st Sun.), Ruparel College, Matunga (3rd Sun.) and Alexandra School, Fort (5th Sun. (if))
- *Informal and accessible* discussions of science outside a traditional academic setting
- Engage people interested in science but who generally never have the opportunity to discuss / ask questions
- Festival specials, children's specials, Super-Science-Sunday etc.

Ready to witness some hydrogen bubbles being ignited



Dark matter in a galaxy far far away...

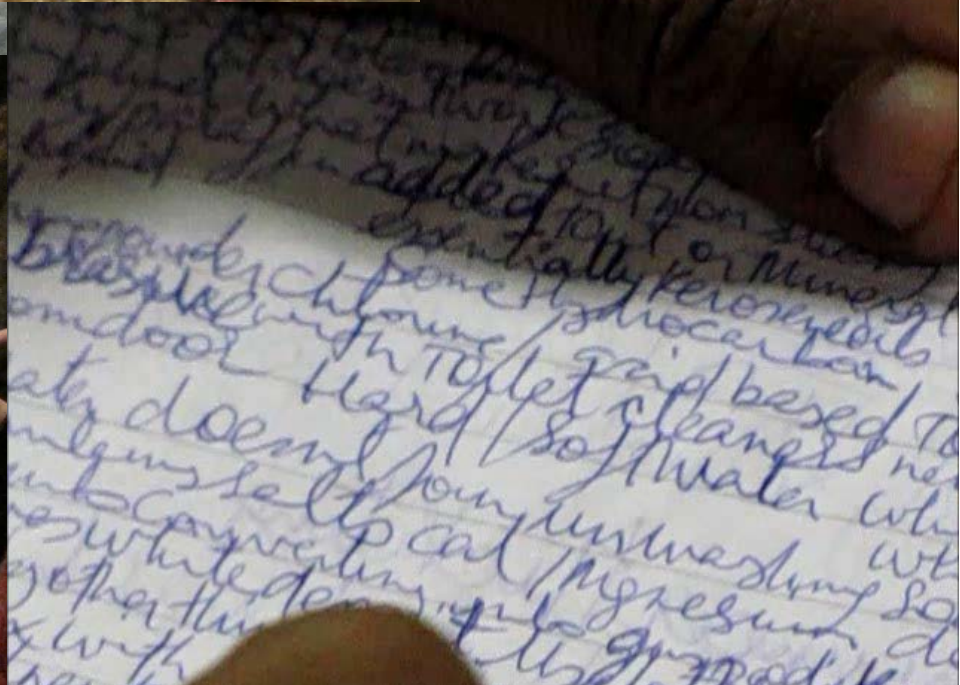




What have we covered?

- An amazingly diverse range of topics, across the sciences, and their connections to the world
- Topics in the news..
- Public surely has questions...
- Kids would like it...
- Hands-on stuff
- Wow experiments!

Audience ?





Titles matter!

Just find a good speaker (and a catchy title always helps!)

- **2G, 3G, 4G – yeh kya hai ji?** *(wireless communication)*
- **Ab TERA kya hoga?** *(THz spectroscopy)*
- **Suck, squeeze, bang, blow** *(jet engines)*
- **Chhota Bheem** *(motor proteins)*
- **Metal(e)s** *(stories about metals)*
- **Something nu broke the speed limit** *(faster-than-light neutrinos)*
- **Why this Cola very di?** *(science of carbonated beverages)*
- **Add a boon, subtract a curse** *(Maths in folk tales)*



Catchy titles

Why this Cola very di?

Fizziks and chemysteries of soft drinks

Arnab Bhattacharya

TIFR



TIFR@Prithvi
Chai and Why?

11am,
Sunday,
Jan. 1, 2012



Chai and Why? is on facebook!

Find us at www.facebook.com/chaibandwhy

The fizz in soft drinks arises from carbon dioxide dissolved in water. Lets look at the science of soft drinks through some fun experiments! The carbonation reaction is also vital for life – as a key step in photosynthesis. Join us for a bubbly New Year's special!



Taare
~~Saare ke saare~~
gamma ko lekar..

Atreyee Sinha
TIFR

Chai and Why?
Room 2-Sc
Ruparel College
Sun., Sept. 21, 2014
11:00am



The serenity of a starry night sky hides some of the most violent cosmic processes such as supernovae explosions, gamma ray bursts and colliding galaxies. These extreme events produce the most energetic gamma rays in the universe. Join us as we look at the journey of one of these gamma rays on its arduous travel through millions of light years of space tracing its story from birth till its death in our atmosphere in a shower of new particles.



Like **chaibandwhy** for more details
event updates and to post questions

Image : <http://www.allesoversterrenkunde.nl>



2G, 3G, 4G... Yeh kya hai ji?

2G, 3G, 4G... Yeh kya hai ji?!

Onkar Dabeer
TIFR

11am
Sunday,
July 3, 2011

Prithvi
Theatre

TIFR@Prithvi
Chai and Why?



We are hooked to our mobile phones - talking, texting, browsing, tweeting, clicking, gaming - many of us just cannot live without them. The underlying technologies termed 2G/3G are much in news today (for good and bad reasons). But what is 2G, 3G, and the impending 4G? What principles underlie these technologies? Where is wireless communications headed? Come and find out!

Chai and Why? is on Facebook! Find us at www.facebook.com/chaiandwhy

Spectrum Occupancy

Technology	Band	Bandwidth
FM Radio	88-108 MHz	150 KHz
GPS	1.22 GHz	1 MHz
GSM	0.9/1.8 GHz	200 KHz
3G	1.9 GHz	1.25 MHz
WiFi	2.4/5 GHz	20 MHz
4G LTE	0.7/1.9 GHz	1.4-20 MHz





And the list goes on...

- Malaria - 100 years, and no cure...
- Should India go to space?
- Stem cells – hope or hype?
- Mathematics behind the financial crash
- Highways within cells
- Deciphering the Indus valley script
- Planets outside other stars...
- Science-based art
- Fermat's last theorem
- Lasers
- How humans throw and run
- ...



Chai and Why? on Facebook

- ~6900 followers, ~5-7K reach per week

Chai and Why?
@chaiandwhy

Education - Mumbai, India
4.9 ★★★★★ OPEN ALWAYS

Search for posts on this Page

100% response rate, 1-day response time
Respond faster to turn on the badge

4,878 likes +130 this week

Chai and Why
Published by Arnab

Hydrogen. Atomic No. abundant material in the planet Earth. There's p produces only water. V burning carbon to mee Because extracting, st Now, new technologies offer the promise of using sunlight to split water into H₂ and O₂ that might eventually make the Hydrogen economy a reality. For

THIS WEEK

- 7,216 Post Reach
- 1,178 Post Engagement
- 24 Call Now

Call Now Liked Message

@chaiandwhy

Go ahead! Like us now!
Or the next time you are on f/b



Chai and Why? Summer Specials

- Hands-on experimental sessions, especially for children in summer vacations, enjoyed by kids of all ages!!

Graphs and platonic solids



Packed audiences



How football free kicks bend



The science of baking



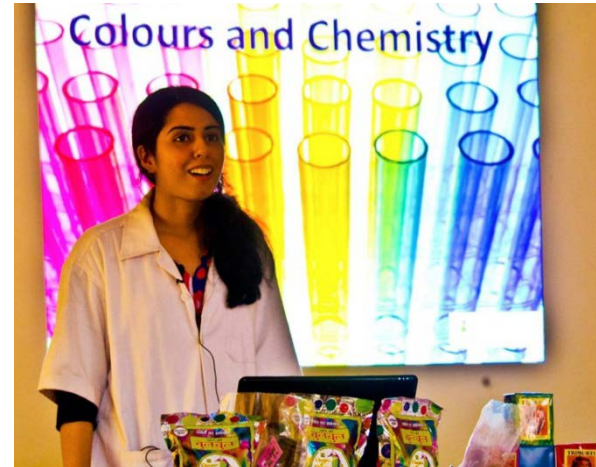
Chai and Why? Summer Specials

- Hands-on sessions → testing ground for many low-cost/no-cost expts

Origami and mathematics



Holi hai!



Science on the beach



Candle, candle burning bright



Scientists are like all of us...





Wake up on Sunday for Science!





When it goes viral...

I was sitting beside the door, I heard the theatre people tell each other that maybe this was record audience at Prithvi, they were wondering really hard why so many people had suddenly turned out to a science talk, to them Shiraz Minwalla seemed like 'Zakir Hussain' of Science, they went further to doubt whether Zakir Hussain himself could have drawn such crowds to Prithvi.

Unlike · Reply · Message · 5 · 21 hrs · Edited

1.2k interested 377 went 408 invited

INSIGHTS

78k Reached ⓘ
+14k this week

7.2k Viewed ⓘ
+3.8k this week

1.6k Responded ⓘ
+281 this week



“Field Trips” to Chai and Why?!!



Research Scholar at Tata Institute of
Fundamental Research
Molecular Biology

Minal Jaggar

**The Secrets of Fingerprints:
Seeing the invisible**

Sunday May 15, 2016 - 11am Ruparel College,
Senapati Bapat Marg, Matunga, Mumbai

Depart Sharp 09:45am MAC DONALD BVILI west
Arrival at 02:00 pm MAC DONALD BVILI west

Food and water has to be carried by the child.
Dress Code: White T-shirt

THIS IS NOT A PICNIC –
IT'S A LEARNING AND INTERACTIVE LECTURE

Curiosity is Encouraged



Beyond Chai and Why?



**The wonderful
laboratory
called home**

**Arnab Bhattacharya
TIFR**

10am

Thursday Oct. 21, 2010

KIIT Bhubaneswar

A wonderful laboratory awaits us at home! Lets discover the thin side of puris, gooey insides of boiled eggs, refreshing scents of oranges, colourful magic of soap bubbles, sticky shampoos, squishy world of toothpaste and a lot more!



Sikkim



Pune



© Shelley Watson



Mumbai

Beyond Chai and Why?

घर नावाची प्रयोगशाळा...

शुरेंद्र कुलकर्णी

kulsuren@gmail.com

आभावर - प्रा. अर्णव भट्टाचार्य आणि
सार्वात महत्वाचे आवर्ण चि. वेळप्रत आणि अंतर्ग

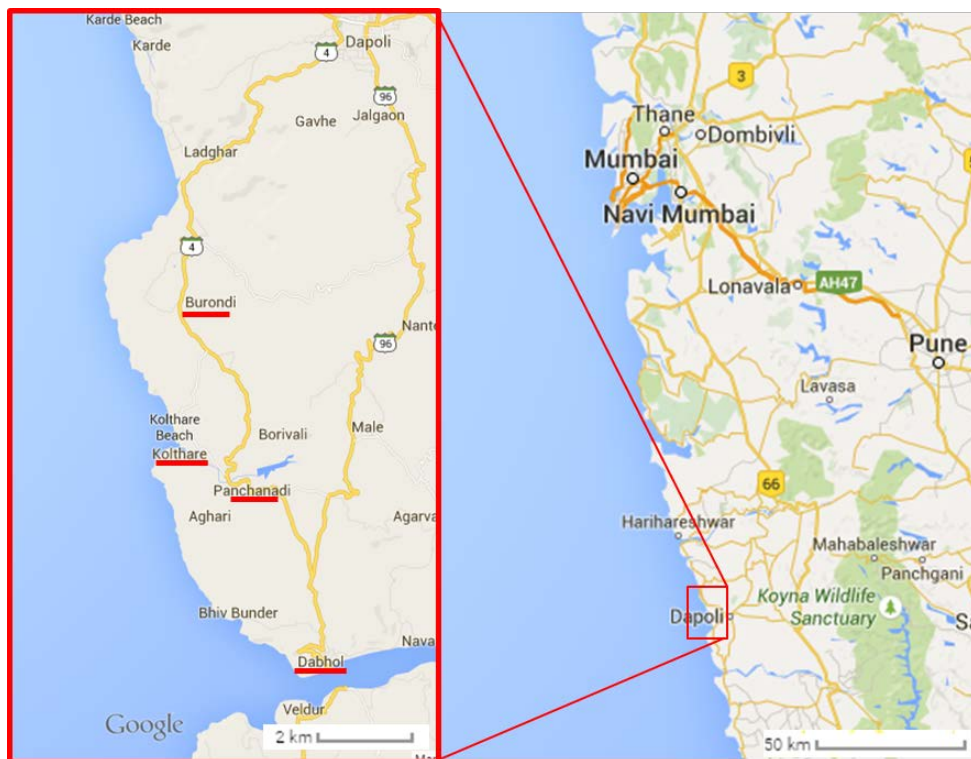


Beyond Chai and Why?



Rural outreach

Chemistry outreach in rural Maharashtra
Villages in Ratnagiri district– July 2015
Kolthare, Karajgaon-Burondi, Dabhol , Panchanadi





Beyond Chai and Why?



Malshiras

2.5 days

**4200+
students**



Beyond Chai and Why?



Inside Pench Tiger Reserve

Aug. 2013

Out of the lab!!



Candles etc.



Candles etc.



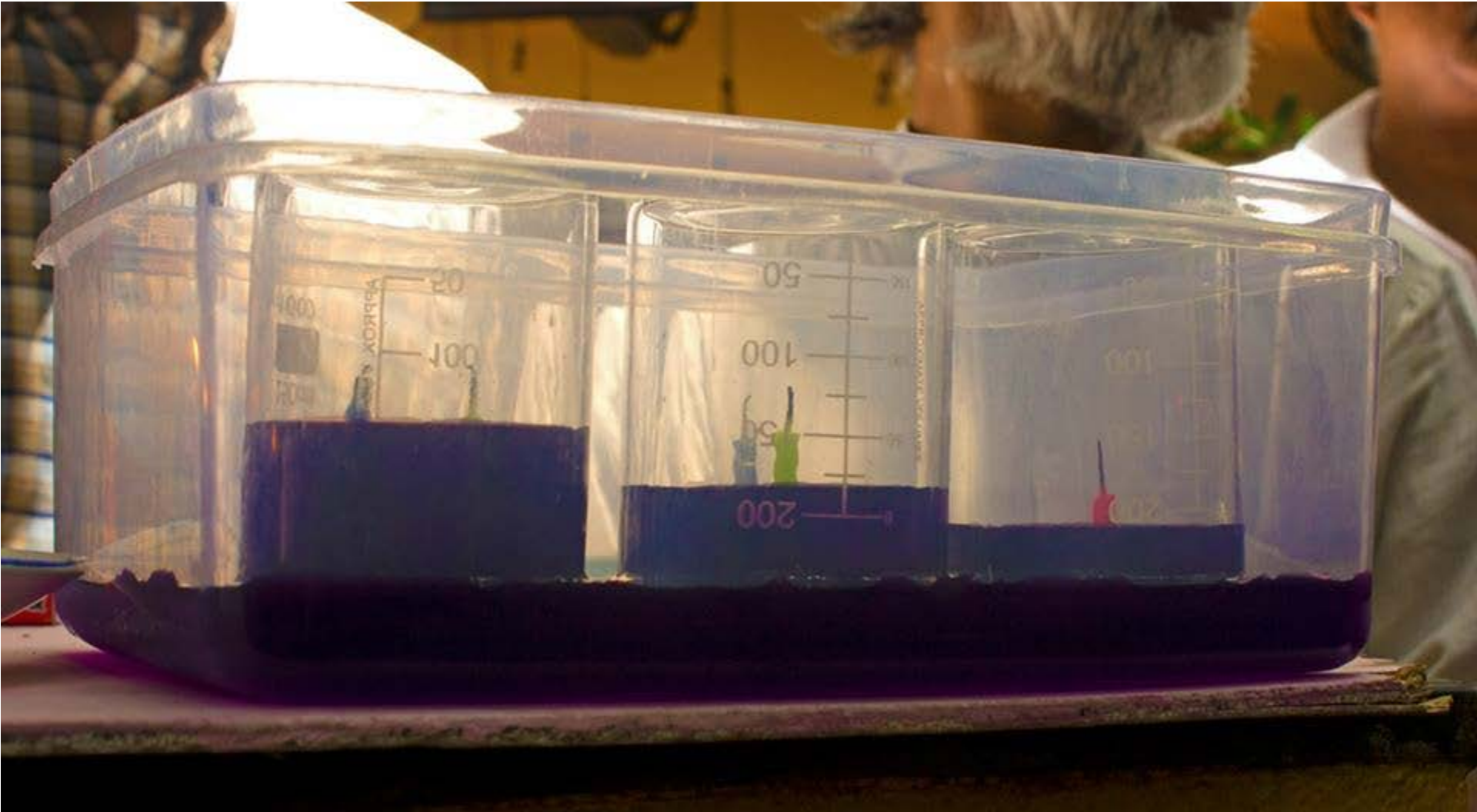


Candles etc.



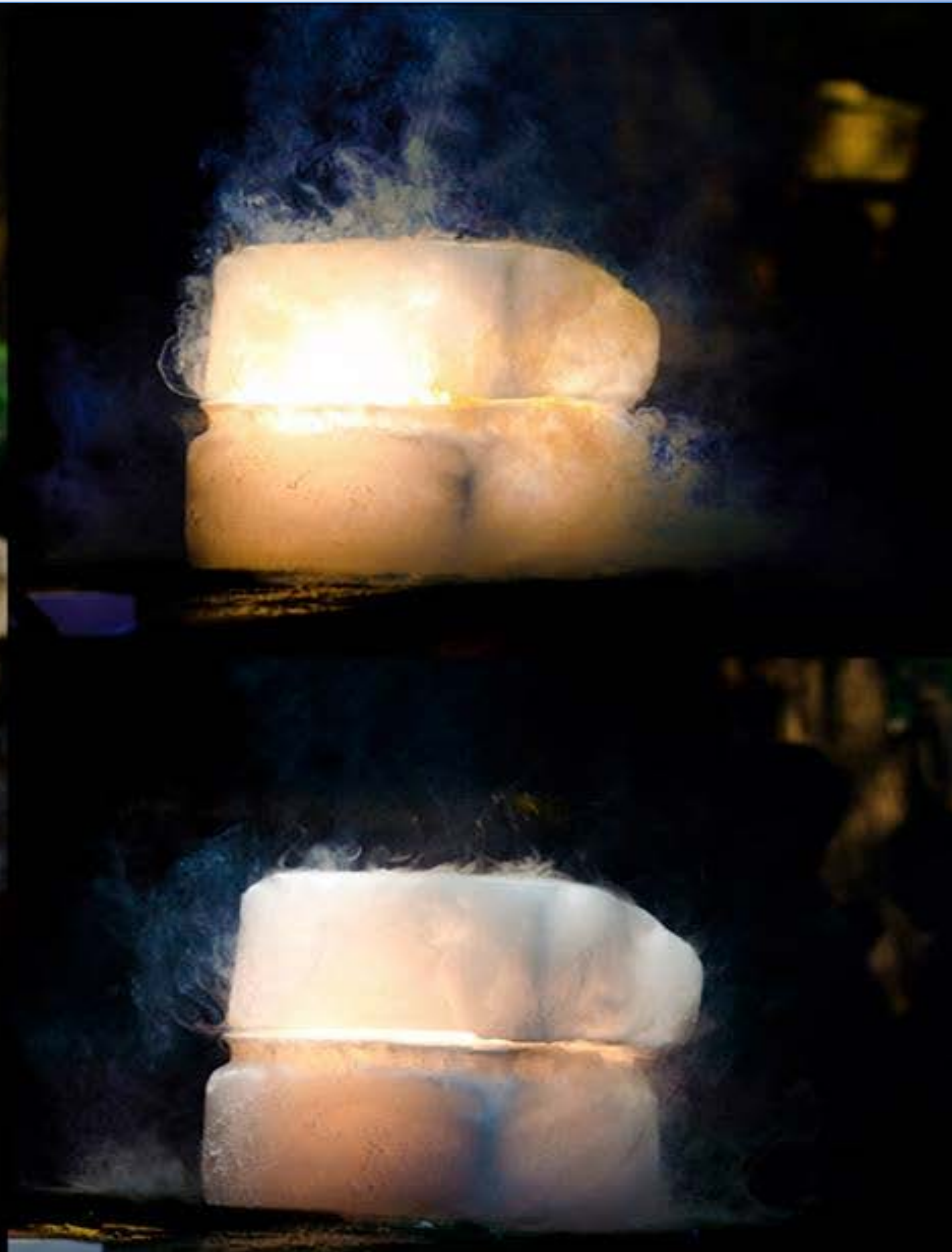


Candles etc.





Mg burning in dry ice



Flame tests



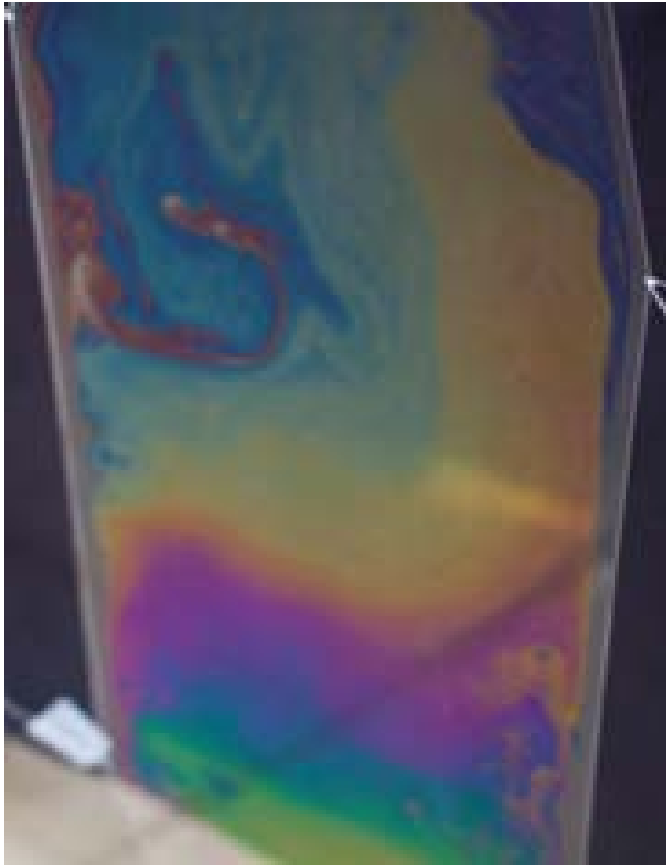
Cornflour...



A lot of cornflour...



Flowing soap films



Chocolate is always good!

(polymorphism in cocoa butter)



Misconceptions!

Our solar system...

- Have you seen something like this before?

*Planets are grains/seeds/
marbles scaled to 10cm
diameter Sun.*

Here the sun is slightly
bigger...(availability of fruit!)





Dispelling “chemophobia”

Herbal, Natural, Organic...
Chemical Free?!



TIFR@Prithvi
Chai and Why?

Ranjan Das
TIFR

AN ALL NATURAL BANANA



INGREDIENTS: WATER (75%), **SUGARS (12%)** (GLUCOSE (48%), FRUCTOSE (40%), SUCROSE (2%), MALTOSE (<1%)), STARCH (5%), FIBRE E460 (3%), **AMINO ACIDS (<1%)** (GLUTAMIC ACID (19%), ASPARTIC ACID (16%), HISTIDINE (11%), LEUCINE (7%), LYSINE (5%), PHENYLALANINE (4%), ARGININE (4%), VALINE (4%), ALANINE (4%), SERINE (4%), GLYCINE (3%), THREONINE (3%), ISOLEUCINE (3%), PROLINE (3%), TRYPTOPHAN (1%), CYSTINE (1%), TYROSINE (1%), METHIONINE (1%)), **FATTY ACIDS (1%)** (PALMITIC ACID (30%), OMEGA-6 FATTY ACID: LINOLEIC ACID (14%), OMEGA-3 FATTY ACID: LINOLENIC ACID (3%), OLEIC ACID (7%), PALMITOLEIC ACID (3%), STEARIC ACID (2%), LAURIC ACID (1%), MYRISTIC ACID (1%), CAPRIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, E515, OXALIC ACID, E300, E306 (TOCOPHEROL), PHYLLQUINONE, THIAMIN, **COLOURS** (YELLOW-ORANGE E101 (RIBOFLAVIN), YELLOW-BROWN E160a), **FLAVOURS** (3-METHYLBUT-1-YL ETHANOATE, 2-METHYLBUTYL ETHANOATE, 2-METHYLPROPAN-1-OL, 3-METHYLBUTYL-1-OL, 2-HYDROXY-3-METHYLETHYL BUTANOATE, 3-METHYLBUTANAL, ETHYL HEXANOATE, ETHYL BUTANOATE, PENTYLACETATE), NATURAL RIPENING AGENT (ETHENE), **RADIOACTIVE ELEMENT** POTASSIUM-40 (4µg)

Prithvi Café Sunday, May 7, 2017, 11 a.m.

Many ads ask us to buy products that are herbal, natural or organic, and hence supposedly “free from chemicals” and therefore better for us in some way. There is an unfortunate but general public perception that “chemicals” are harmful. In reality, the air we breathe, the water we drink, and the food we eat, and every substance in this world consists of one or more chemicals. In this interactive session, we’ll do some simple experiments and discuss why “chemical-free” just isn’t possible!

Composition: Each ml contains:

रोज़मैरी तैल	Rosmarinus officinalis	15 mg
शहद	Honey	10 mg
नीम तैल	Azadirachta indica	2 mg
टी ट्री तैल	Melaleuca alternifolia	2 mg
नीलगिरी तैल	Eucalyptus globulus	2 mg
आंवला एक्स.	Emblica officinalis	2 mg
गुडहल एक्स.	Hibiscus rosa-sinensis	2 mg
शिकाकाई एक्स.	Acacia concinna	2 mg
मेथी एक्स.	Trigonella foenumgraecum	1 mg
तुलसी एक्स.	Ocimum sanctum	1 mg

Base material: Aqua, Surfactant base, Vit E, Vit B5, Sod. Benzoate, Methylisothiazoline and Sorbic acid, Colour: CI-47005, CI-42090, Sugandhit Dravya - Q.S.

Uses: Prevents hair fall, removes dandruff, dirt from hair and scalp.

Direction for use: Apply 2-3 ml on wet hair and massage gently, leave for 1-2 minute and rinse off.

For best result use daily.

Herbal composition, may result in change of colour of product over a period of time. This does not change the effectiveness of the product.

Mfg. Lic. No. Uttra/Ayu-181/2009

For MRP. ₹ (inclusive of all taxes),

Batch No. & Mfg. Date : See at bottom

Best before : 24 months from the date of mfg.

Net. Vol. : 200 ml



FOR EXTERNAL USE ONLY
Store in a cool, dark & dry place

भारत में निर्मित
MADE IN BHARAT

Mfd. by :

PATANJALI AYURVED



Beyond Chai and Why?



Kunjkhed, Aurangabad district

Reward





Summary



- Various routes for sharing our science with the larger community
- Chai and Why?
 - Firmly established in the Mumbai science calendar
 - Many interesting asides
- Nothing like some experiments!
- They are easy, they will go wrong!
- We're still learning, and are open to new ideas... *(and anyone wanting to join, or better still, fund us ☺)*
- A small attempt at both sharing and discovering the “fun” of fundamental research!

Acknowledgements

- Prithvi Theatre (2009 onwards)
- Ruparel College (2011 onwards)
- Alexandra School (2015 onwards)
- Ruia College (2009-10)
- All our fantastic speakers
- Our volunteers, from TIFR and beyond
- Our enthusiastic audience



**Special thanks: Antara Bhattacharya
Surendra Kulkarni**





Thank you!

Science!

ताज वो शम्मा हैं, उल्फ़त के सनमखाने की
जिसके परवानो में मुफ़लीस भी हैं, ज़रदार भी हैं
संगेमरमर में समाये हुये ख्वाबों की कसम
मरहले ~~प्यार~~ के आसान भी दुश्वार भी हैं
दिल को एक जोश इरादों को जवानी दी हैं

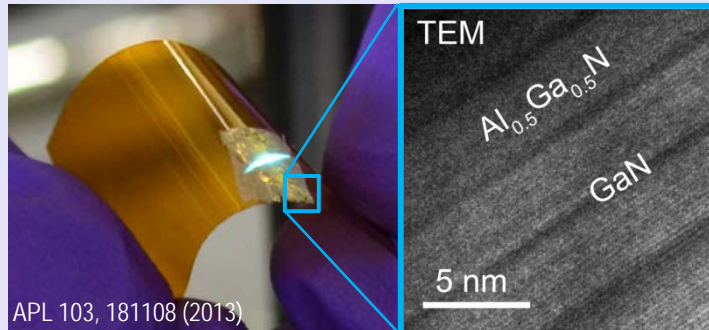


Enjoying the journey at an institute of **FUN**damental research!

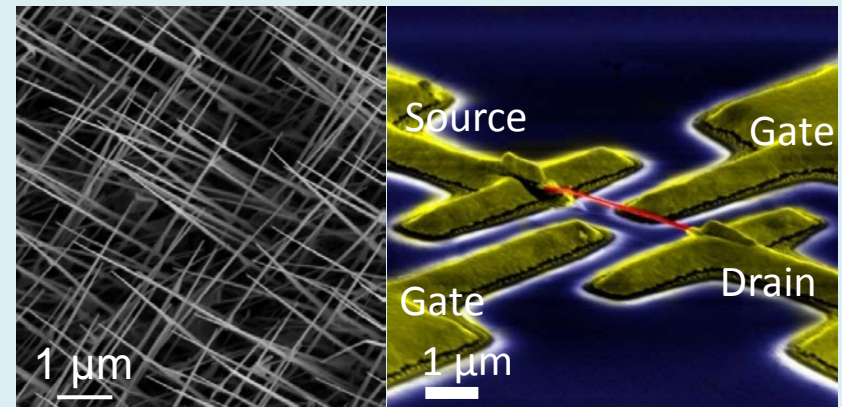
Just so you don't forget!

We also do research...

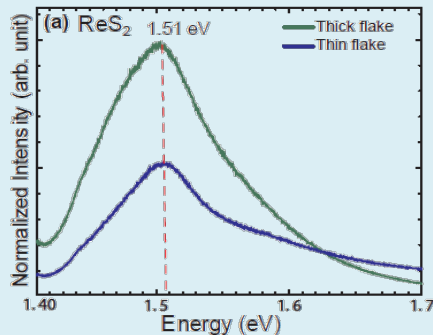
Near-UV emitting AlGaIn quantum wells on flexible substrates



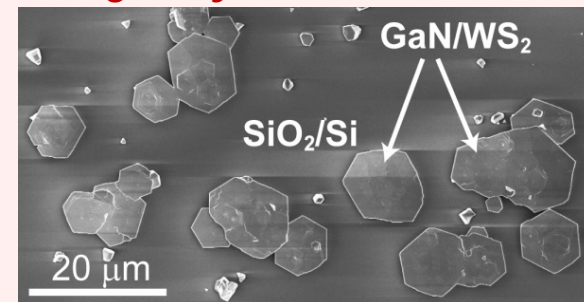
GaN nanowires and resonators



Thickness independent PL from ReS_2



GaN single crystals on exfoliated WS_2





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Thank you!

Thank You!

Questions? : email arnab@tifr.res.in

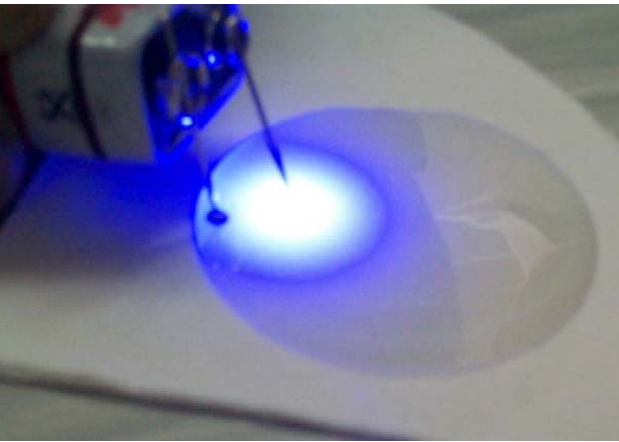


Epitaxy – deposit atoms layer by layer



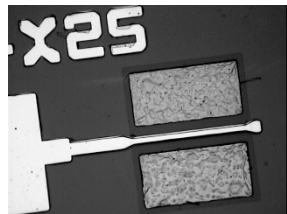


Nitride semiconductors: from materials to devices

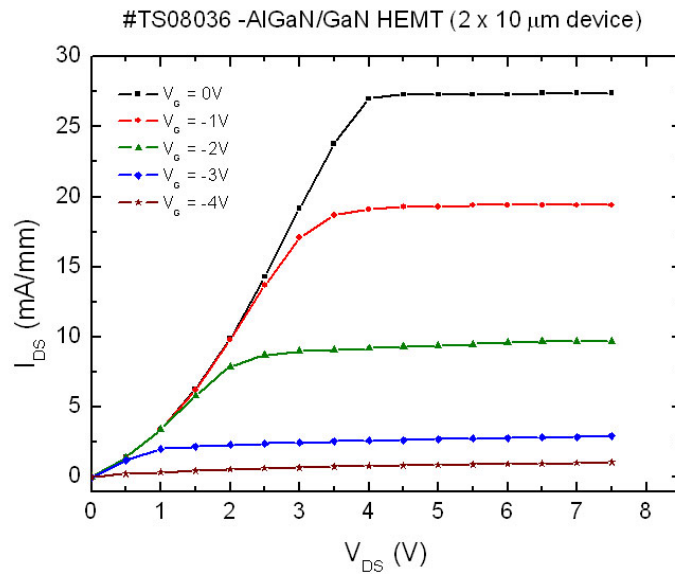


TIFR set up India's first epitaxial growth system for GaN based semiconductors in 2005

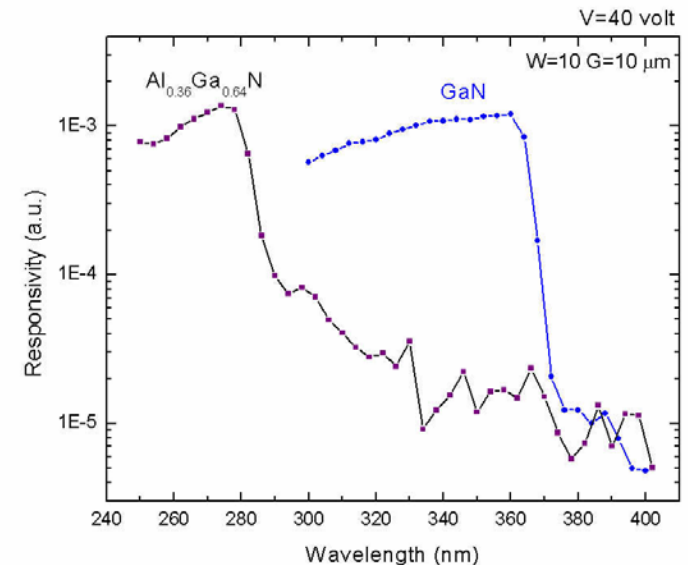
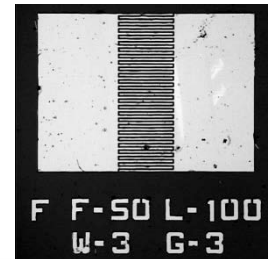
Reasonable progress has been made in various nitride materials and devices



**AlGaN/GaN HEMTs
(High Electron Mobility Transistors)**



AlGaN solar-blind UV detectors





Story #2

Chai and Why? *and some outreach experiences*