Lepton Photon 2023: Poster Prizes

- Comments
- **People's Choice Poster (cash prize)**
- Special Mention Poster #1
- Special Mention Poster #2
- **Best Poster (cash prize & book)**

People's Choice

Eliot Jane Walton

The Queer History of Physics

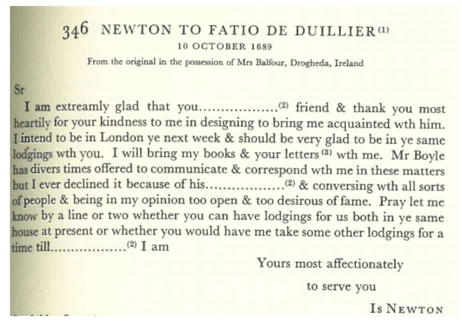
The Queer History of Physics

Eliot Jane Walton, QueersInScience (QiS)

Queer(ing) Historical Research

- Sexuality is **discursively constructed**: it is composed of an individual's attraction, their relationship to that attraction and the social and cultural context.
- Gender is **socially constructed** and is used for social organisation: it is a social, psychological and cultural state of being.

- Objects, spaces, behaviours and social, legal and economic roles acquire gendered meanings through **performative actions**.
- **Performative Theory** describes gender as the product of culturally specific rituals and practices which are maintained over time.
- It is generally inappropriate to apply contemporary labels to the past.
- As an historical category, **queerness** requires (re)thinking how gender and sexuality vary over time, space and culture.
- **Queerness** may be historically understood as sustained expressions of gender and sexuality which are **subversive with respect to their historical context**.
- **Data** are therefore **limited to observable expressions of subversion**.



346 NEWTON TO FATIO DE DUILLIER(1)

10 OCTOBER 1689

From the original in the possession of Mrs Balfour, Drogheda, Ireland

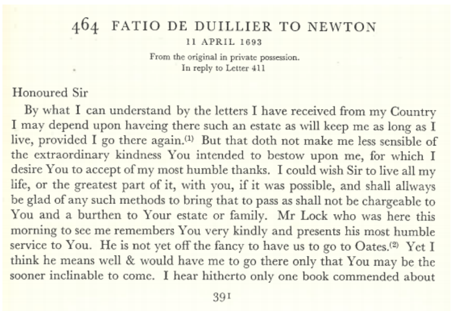
Sr

I am extreamly glad that you..................(2) friend & thank you most heartily for your kindness to me in designing to bring me acquainted wth him. I intend to be in London ye next week & should be very glad to be in ye same lodgings wth you. I will bring my books & your letters(3) wth me. Mr Boyle has divers times offered to communicate & correspond wth me in these matters but I ever declined it because of his..................(2) & conversing wth all sorts of people & being in my opinion too open & too desirous of fame. Pray let me know by a line or two whether you can have lodgings for us both in ye same house at present or whether you would have me take some other lodgings for a time till..................(2) I am

Yours most affectionately

to serve you

Is Newton



464 FATIO DE DUILLIER TO NEWTON

11 APRIL 1693

From the original in private possession.
In reply to Letter 411

Honoured Sir

By what I can understand by the letters I have received from my Country I may depend upon haveing there such an estate as will keep me as long as I live, provided I go there again.(1) But that doth not make me less sensible of the extraordinary kindness You intended to bestow upon me, for which I desire You to accept of my most humble thanks. I could wish Sir to live all my life, or the greatest part of it, with you, if it was possible, and shall allways be glad of any such methods to bring that to pass as shall not be chargeable to You and a burthen to Your estate or family. Mr Lock who was here this morning to see me remembers You very kindly and presents his most humble service to You. He is not yet off the fancy to have us to go to Oates.(2) Yet I think he means well & would have me to go there only that You may be the sooner inclinable to come. I hear hitherto only one book commended about

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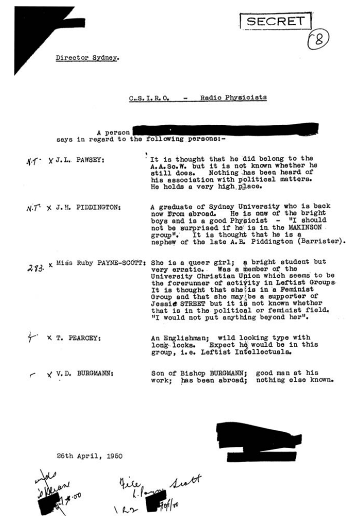
Queer Superstar: Ruby Payne-Scott (1912-1981)

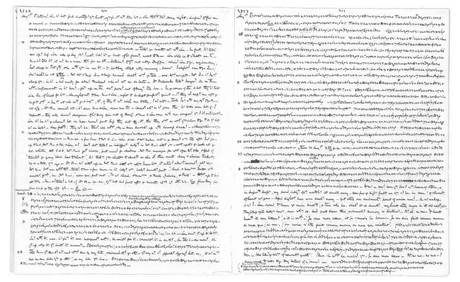
- **Ruby Payne-Scott** was a **pioneering Australian radio astronomer** who worked on solar astronomy and military radars.
- Ruby **discovered three of the five categories of solar bursts** originating in the solar corona in 1945 to 1947 and made major contributions to radio astronomy techniques.
- Her most significant contribution in this period was the **development of the aperture synthesis technique** with her collaborators.
- Martin Ryle and Antony Hewish shared the **1974 Nobel prize**, **awarded for Jocelyn Bell's discovery of Pulsars which used the method pioneered by Ruby** and her collaborators.
- She was married in 1944 and concealed it until 1950, knowing she would be **forced to resign** if discovered.
- Her marriage was discovered in 1950, she was demoted and, in **1951**, **she resigned**. She was pregnant and had miscarried a few years previously.

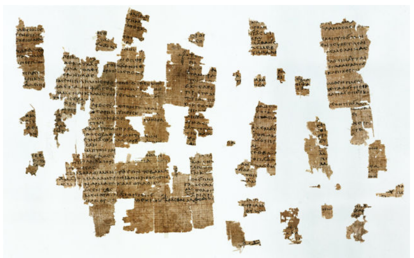


- **Ruby eschewed gendered conventions**: when women were expected to wear skirts to work, Ruby wearing shorts replied: "**Well, this is absurd.**"
- At a meeting discussing men being allowed to smoke and women not, **Ruby attended smoking a cigarette**.
- Some of Ruby's colleagues called her **"Red Ruby"** for her socialist, feminist and radical politics.
- A secret CSIRO memorandum described Ruby as "**queer girl**; a bright student but erratic ... **I would not put anything past her**".

Gaps in the Record

- The data available on historical queer people are **sparse**.
- Major sources of evidence for queerness are **police and court documents** as well as **newspapers and journals**.
- These focus on male homosexuality since it was **explicitly illegal** and **publicly scandalous**.
- **Private writings** furnish some data on **female homosexuality**, but are difficult to access.
- **Scientists** tended to be **historically wealthy and privileged**, leaving more records.





Modern Context

- **Recognising queer contributions** to the history of science is essential to the belonging of the queer community today.
- **Posthumous recognition** helps to **correct the historical injustice** and erasure of queer scientists.
- Research must be respectful of historical self-identification and of ethical considerations around such information.
- **Queerness in science is far more common today** owing to the public funding of science and more universal and accessible education.
- Even with limited data, it is clear that **queer people made important contributions to science** from the beginning.

QueersInScience and Collaborations

QueersInScience is a community-based organisation building community and support for queer/LGBTQIA+ people in STEMM in Australia. If you are interested in our **seminars and advocacy** work contact queersinscienceau@gmail.com. QiS received grant funding from the **Theo Murphy (Australia) Initiative administered by the Australian Academy of Science**.

ALGA 1978 Australian Lesbian & Gay Archives

QUEERS IN SCIENCE

Special Mention #1

Menai Lamers James

The Hyper-Kamiokande Outer Detector

The Hyper-Kamiokande Outer Detector

Menai Lamers James

On behalf of the Hyper-Kamiokande Collaboration

m.lamersjames@lancaster.ac.uk

Supervisors: Prof Helen O'Keeffe, Dr Federico Nova, Dr Anna Holin

Science and Technology Facilities Council

Lancaster University

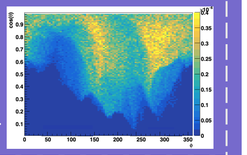
Hyper-K

The Hyper-Kamiokande Detector

- Next generation **large-scale water Cherenkov experiment** with a broad physics programme.
- Two concentric detectors: the inner detector (ID) and outer detector (OD).
- 68 m in height and 71 m in diameter.
- ~258 kt of pure water. **Data taking from 2027.**

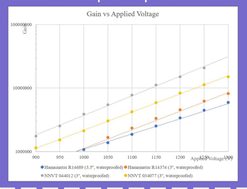
Outer Detector Purpose

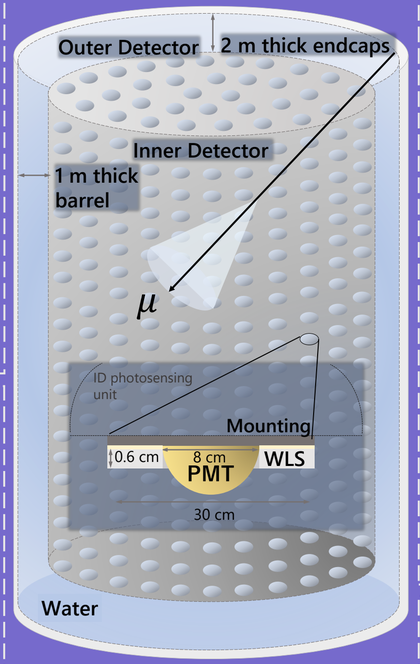
- Water in OD is passive shielding from external backgrounds.
- **Cosmic muon background rate of 45 Hz** which OD should tag.
- Plot of simulated cosmic muon flux as expected at the Hyper-Kamiokande site.
- Generated using MUSIC software.



Photomultiplier Tubes (PMTs)

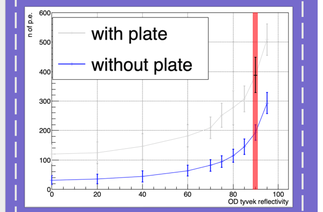
- ~7,200 OD 8 cm (3") PMTs.
- PMT gain > 3 × 10^6.
- Operating voltage between 900 V and 1300V.
- Quantum efficiency of 27%.
- Passed multiple implosion tests.





Wavelength Shifting (WLS) Plates

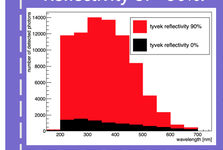
- WLS plate captures Cherenkov light from region around the PMT.
- Re-emitted light trapped within the plate is directed towards the PMT.
- **Light collection 76% higher with WLS added.**



Geometry: Square, 30 x 30 x 0.6 cm^3
PMT hole: cylindrical 78 mm diameter
Base material: PMMA
Fluors: POPOP - 50 mg/l
+ PPO - 3g/L
Cladding reflector: polymeric film

Tyvek

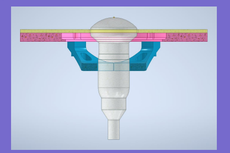
- Inner wall of OD fitted with black/white and outer wall with white highly reflective Tyvek.
- **Reflectivity of >90%.**



Light collection increases 800% with Tyvek.

Mounting

- Injection moulded PMT mounting frame with earthquake resistance.
- Sheet of Tyvek between mounting and photosensing unit to reflect photons that are not captured.

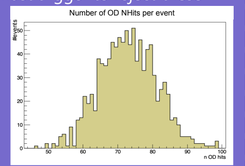


Triggering

- Light generated in outer region used to generate an OD trigger.
- OD data also saved when ID issues any trigger.
- Spallation neutrons may cause delayed signal in ID. OD must trigger to reject these events at analysis level.

Two OD triggers:

1. **Nhits trigger**: Count number of hits in entire OD in time window.
2. **Cluster trigger**: Search for small clusters of hits in space and time.



Special Mention #2

Meutia Wulansatiti

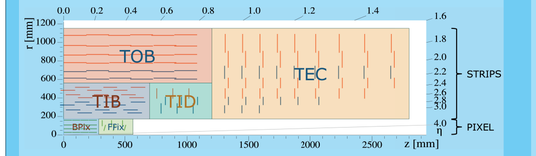
The CMS Tracker Performance in Run 3

The CMS Tracker Performance in Run 3

Meutia Wulansatiti on behalf of the CMS Collaboration

THE CMS TRACKER

- All-silicon, comprised of the **Pixel** (BPix, FPix) and the **Strips** (TIB, TID, TOB, TEC)
- Allows for **high-precision charged particle tracking**
- Essential in particle identification, heavy-flavour tagging, trigger decisions, vertex reconstructions



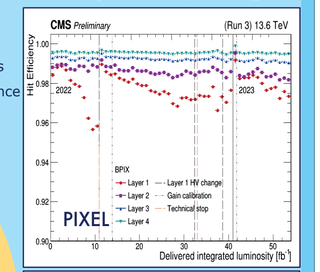
COPING WITH RADIATION

Degradation of performance due to radiation is **expected**

- Especially in BPix Layer 1, being just ~3 cm from the beam-pipe
- **Degradation visible** in hit efficiency and signal-to-noise ratio

Effects of radiation are closely monitored, and measures are taken to mitigate the degradation

- Routine bias voltage scans and increase of bias voltage when needed, along with routine calibrations for Pixel
- Adjusting temperature and bias voltage of the Strips to mitigate leakage currents
- **Beneficial annealing** during no-beam periods help improve performance



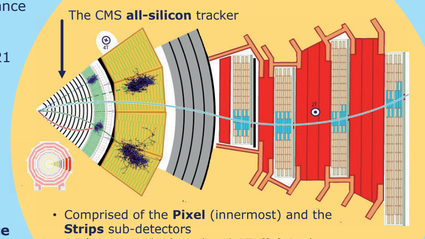
IMPROVEMENTS SINCE RUN 2

To prepare for Run 3's expected 250 fb^{-1} of integrated luminosity, upgrades and maintenance were performed to enhance the Tracker's data-taking capabilities

- **New Pixel Layer 1** installed in 2021
  - Able to be operated up to 800 V compared to 600 V during Run 2
  - Enhanced front-end ASICs to improve efficiency and increase resistance against single-event upsets [1]
- Various **upgrade and maintenance of the Strips service**
- More granular Online alignment procedure integrated in the Prompt Calibration Loop from **36 (LG-PCL) to ~5k parameters (HG-PCL)**

The innermost part of the CMS detector

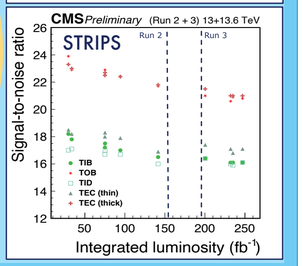
The CMS **all-silicon** tracker



- Comprised of the **Pixel** (innermost) and the **Strips** sub-detectors
- **14 layers** in the barrel and **15 disk** in the forward regions

1,856 Pixel modules and **15,148 Strips** modules

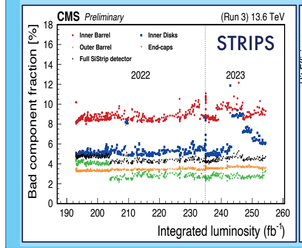
The **largest silicon tracker** in the world!

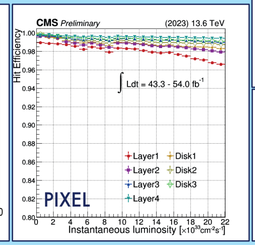


PERFORMANCE IN RUN 3

Throughout the 2022 and 2023 data-taking periods, both Pixel and Strips have been taking excellent data at high trigger rates and high pile-up conditions up to 65 PU

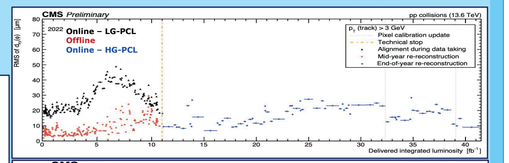
- The Tracker participated in all proton-proton data-taking runs, amounting to 42 fb^{-1} of data in 2022 and ~20 fb^{-1} in 2023 so far
- **Very high hit efficiency** with **more than 95% and 98% of active detector fraction** for Strips and Pixel respectively

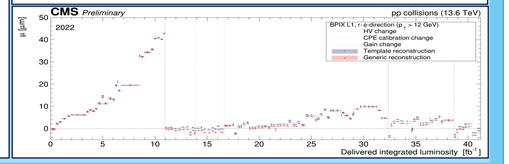




Precise measurements of the position and orientation of each silicon sensors are essential to utilize their excellent resolution in tracking charged particle trajectories

- The increasing offset of BPix hit residuals is recovered by increasing the sensor bias voltage and kept stable by the deployed HG-PCL [2]





CONCLUSIONS

Thanks to improvements made since Run 2 and continuous efforts in mitigating radiation effects, the CMS Tracker has been successfully acquiring valuable data. The CMS Tracker showed excellent tracking performance with very high hit efficiency and resolution despite the demanding conditions of Run 3, including high trigger rate and pile-up conditions.

References:
[1] JINST-17-C09017
[2] CMS-DP-2022-067

Plots taken from:
CMS Tacker Detector Performance Results (Public)

LP2023@Melbourne, 17 July 2023 Contact: meutia.wulansatiti@cern.ch

LP23 Best Poster

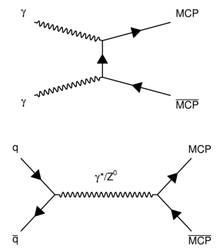
Emily Filmer

Searches for BSM physics using challenging long-lived signatures with the ATLAS detector

Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector

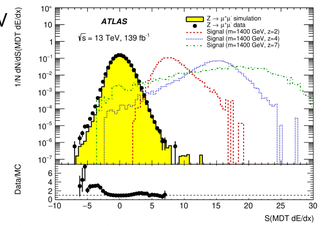
Challenging and long-lived signatures are well motivated by Beyond Standard Model physics but require specifically targeted searches

Multi-Charged Particles



- 139 fb^{-1} of *pp* collision data at √s = 13 TeV
- Anomalously high ionisation
- Long-lived spin-½ particles
- Mass range of 500 to 2000 GeV
- Electric charges from $|q| = 2e$ to $|q| = 7e$
- Drell-Yan (L) and Photon Fusion (R) production modes
- Muon-like signature
- Data-driven background

↑ Full Result ↑



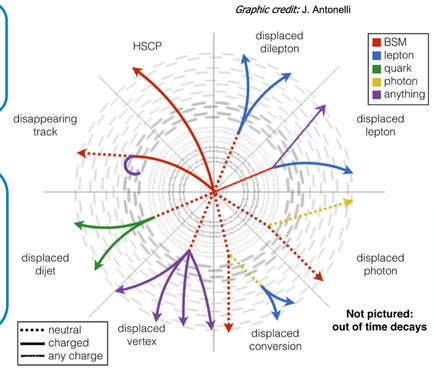
No evidence of multi-charged particles is observed. Obtained lower mass vs charge limit.

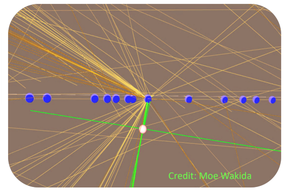
The ATLAS Detector in the transverse plane, perpendicular to proton-proton collisions, showing signatures of long-lived particles.

A particle is LONG-LIVED if it decays an observable distance from the interaction point

A signature is CHALLENGING if it has elements such as non-elementary charge, large ionisation, or out of time effects.

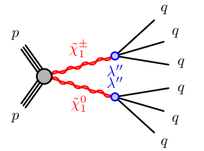
Graphic credit: J. Antonelli





This ATLAS Detector event display shows a number of primary vertices along the proton-proton interaction point (blue) and a displaced vertex emanating from a long-lived particle (pink).
Hits in the semiconductor tracker are orange while the tracks associated with the displaced vertex are green.

Displaced Vertices + Jets

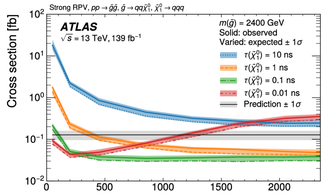


Reinterpretation material available!

- 139 fb^{-1} of *pp* collision data at √s = 13 TeV
- EWK (L) and Strong (R) R-Parity Violating models
- Long-Lived particle with multi-track decay gives rise to a Displaced Vertex
- Multiple energetic jets increases sensitivity to various BSM topologies
- Fully data-driven background

↑ Full Result ↑

No excess beyond the Standard Model was found. New limits set.



Emily Filmer
on behalf of the
ATLAS Collaboration
Lepton Photon 2023

LP23 PEOPLE'S CHOICE AWARD:

Eliot Jane Walton, "A History of Queer Contributions to Physics"

LP23 SPECIAL MENTION:

Muti Wulansatiti, "The CMS Tracker Performance in Run3"

Menai Lamers James, "Design of the Hyper-Kamiokande Outer Detector"

LP23 BEST POSTER:

Emily Filmer, "Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector"