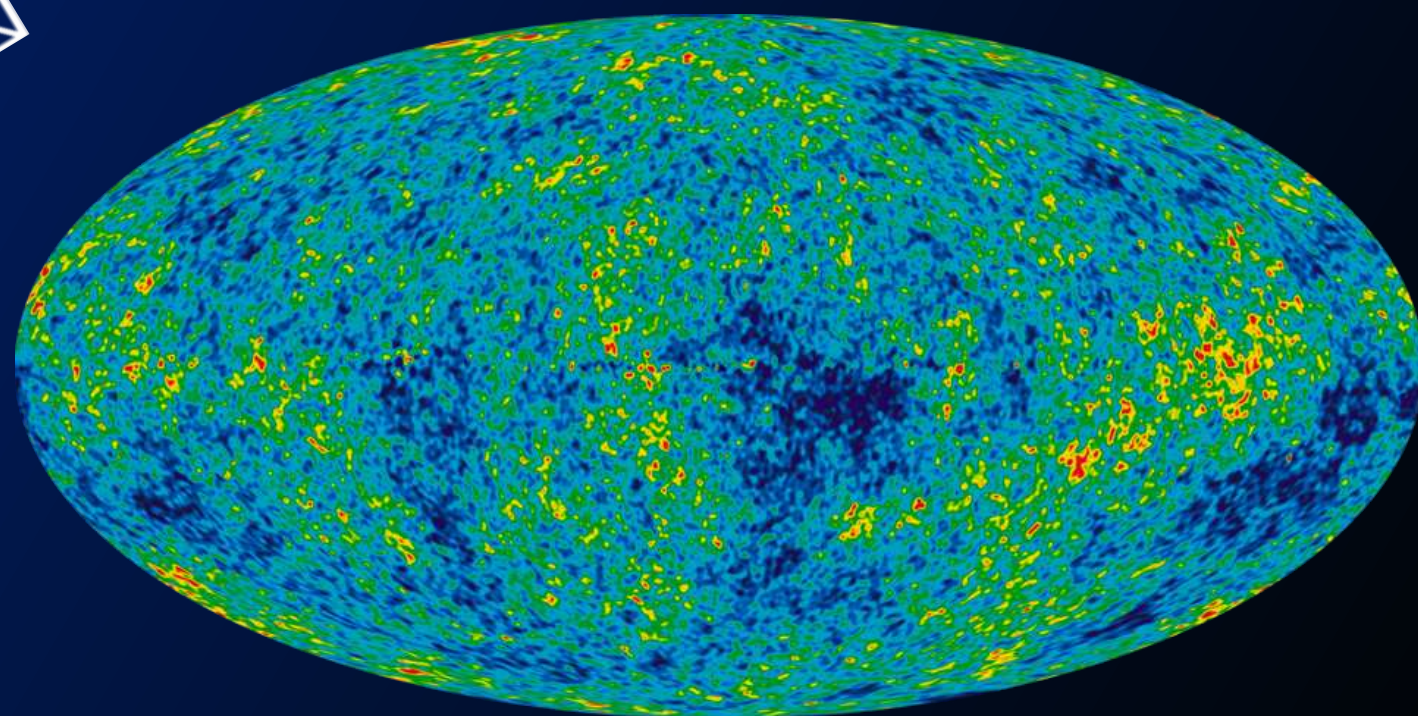


Detecting Faint Signals with TRANSITION EDGE SENSORS (TES)

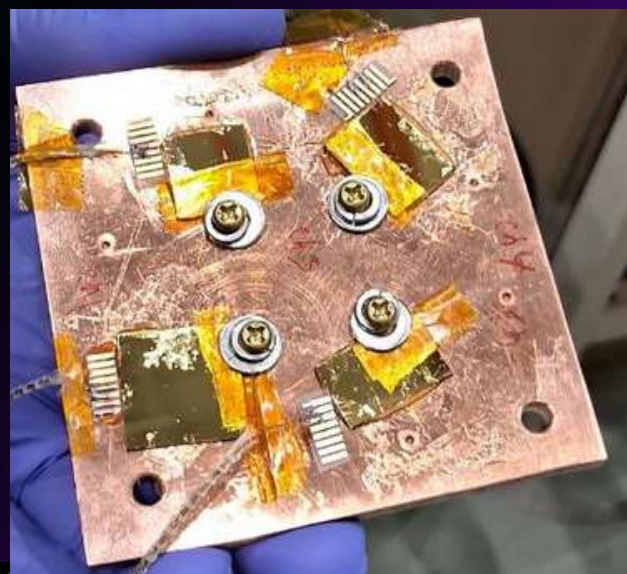
S O K E N D A I



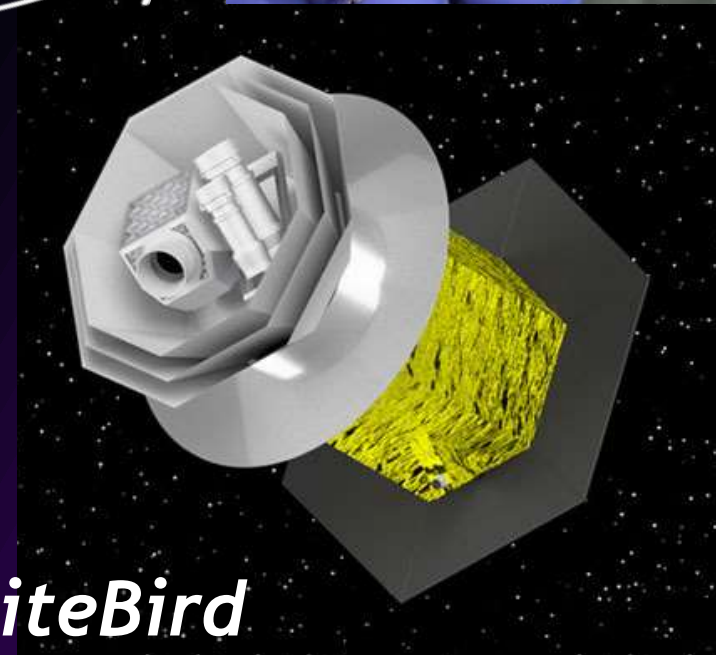
$0.0006 \text{ eV}, 2.7 \text{ K}$



TES

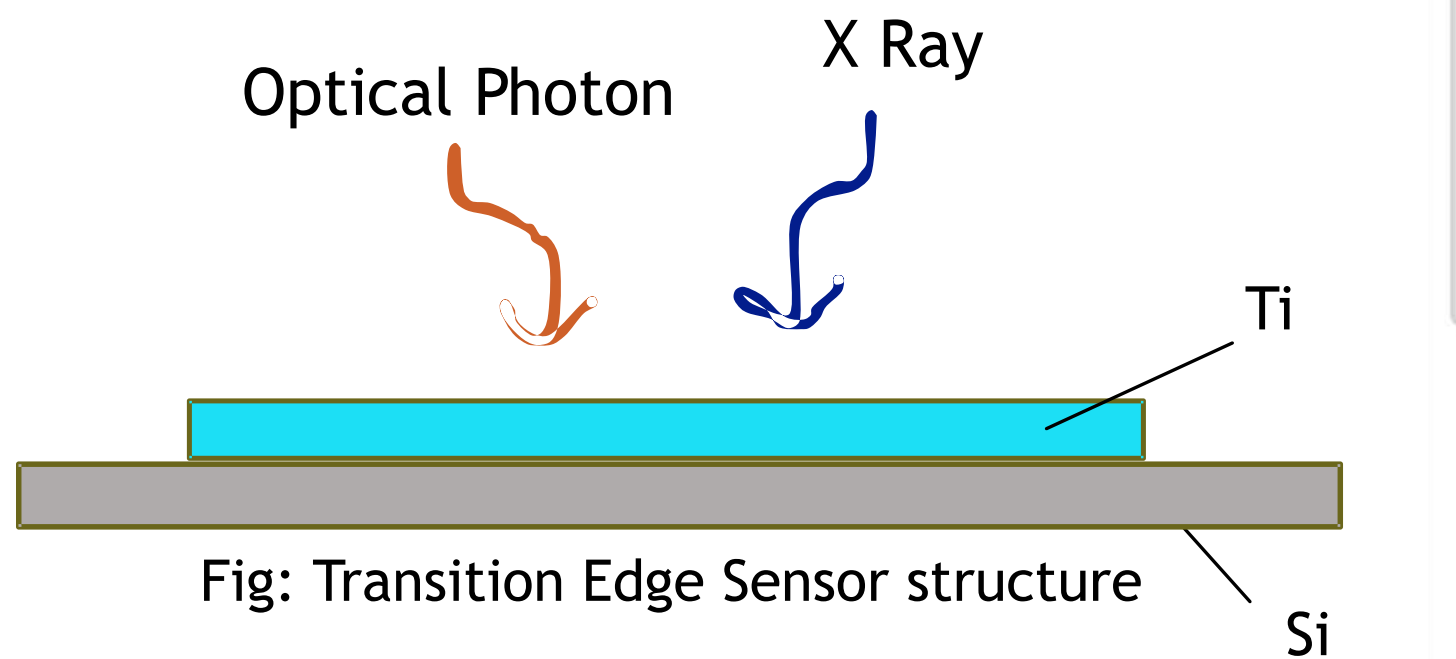


LiteBird



Srijeeta Barua, *Under the guidance of:* Prof. Akamatsu, Dr. Fujino & Igarashi San (QUP)

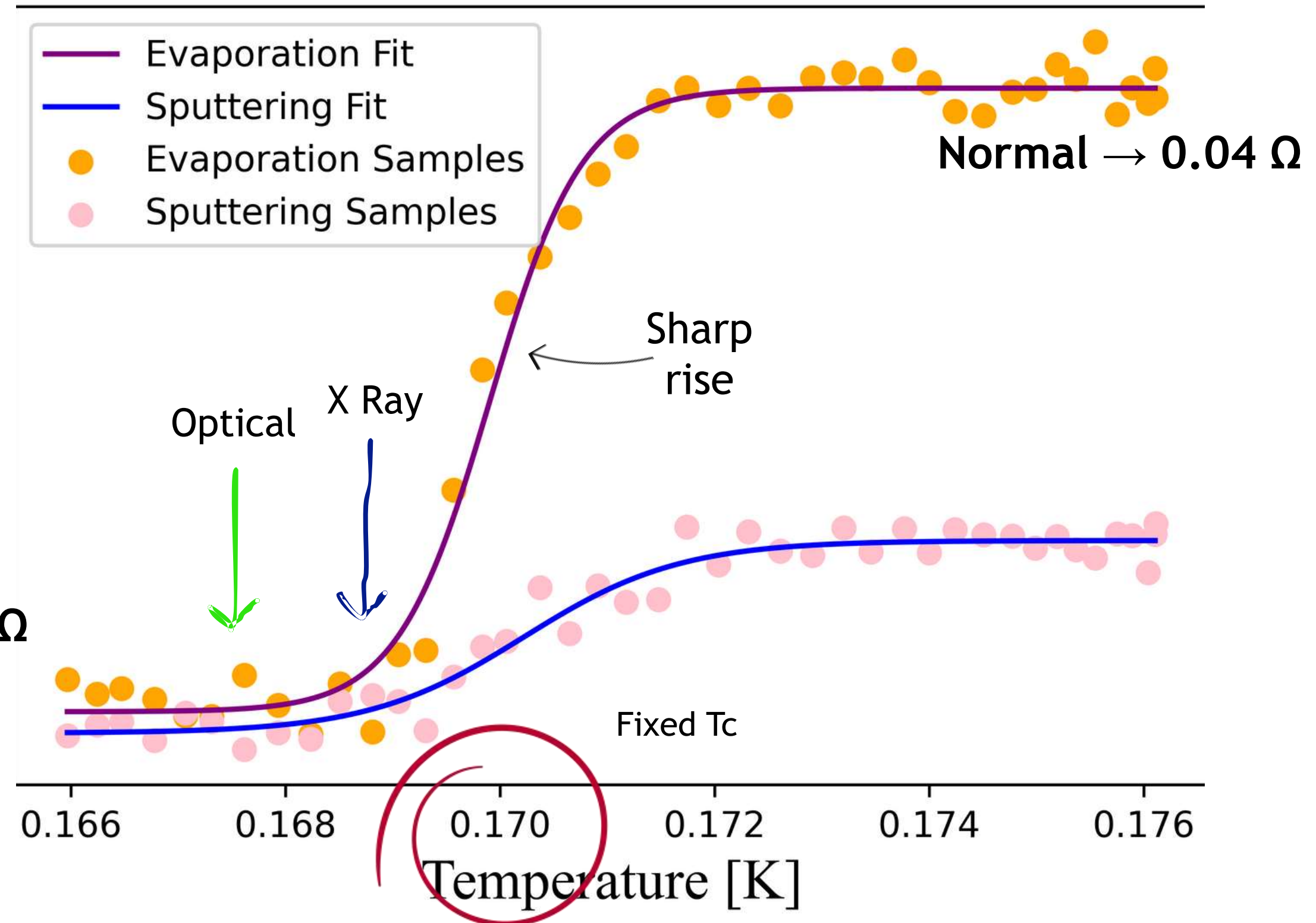
VERY SENSITIVE TEMPERATURE SENSORS!



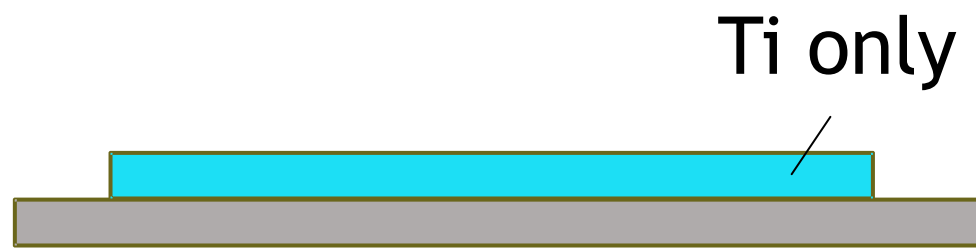
Superconductor $\rightarrow 0.001 \Omega$

- Can we tune natural T_c ?

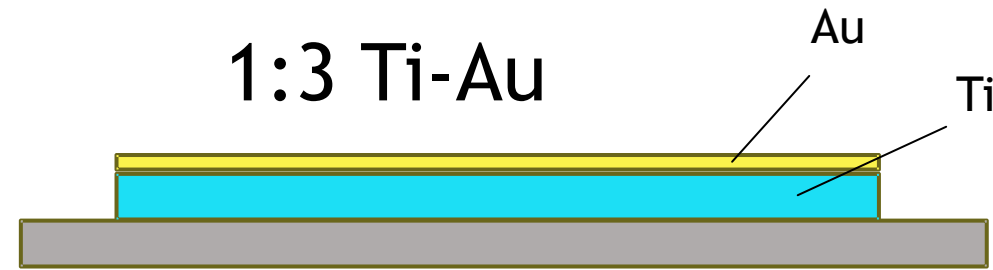
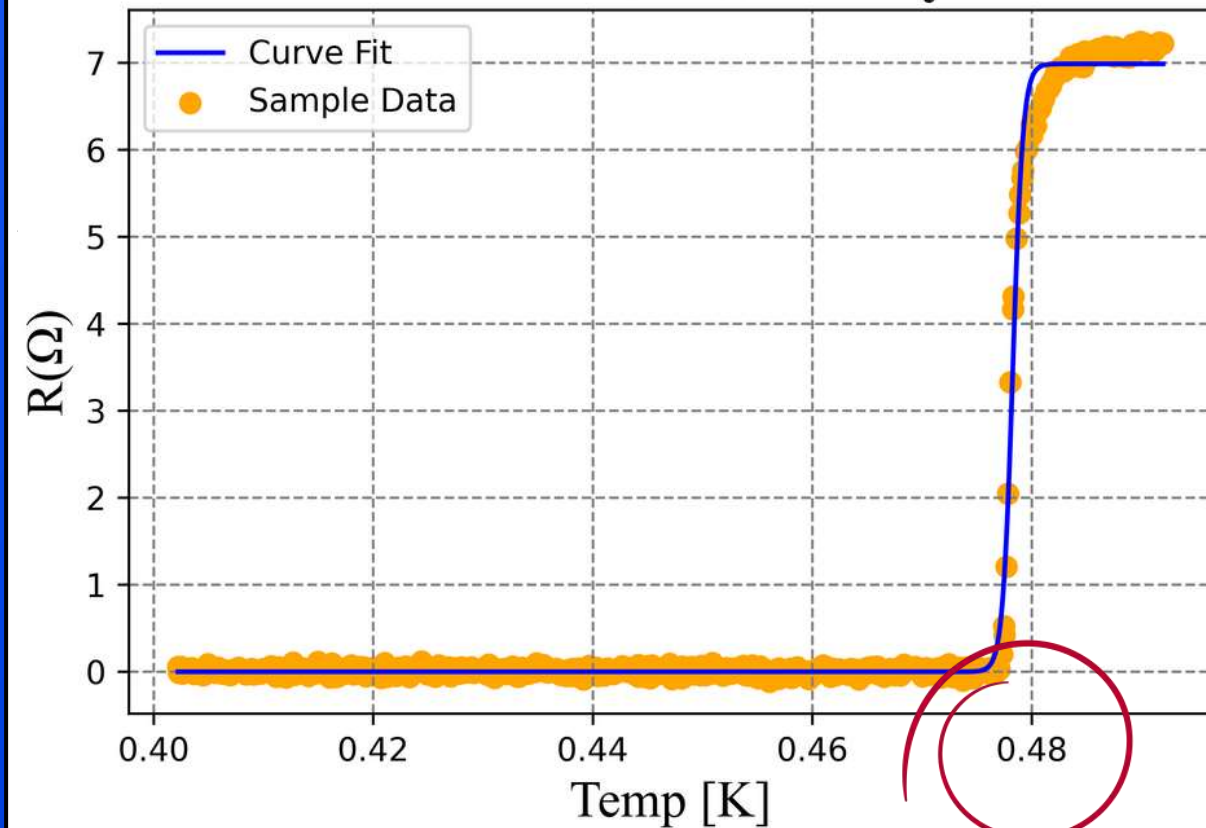
R vs T Plot Ti-Au 1:5



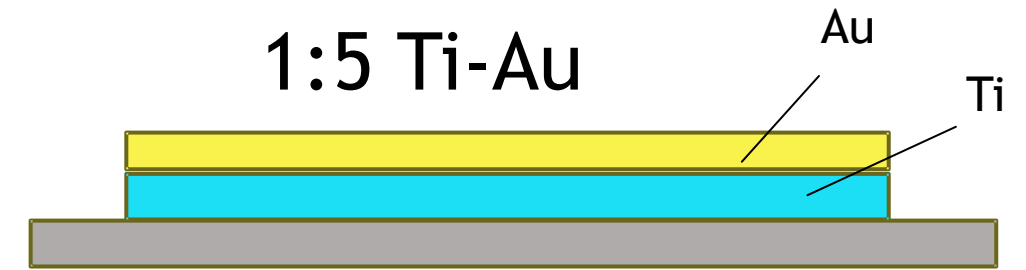
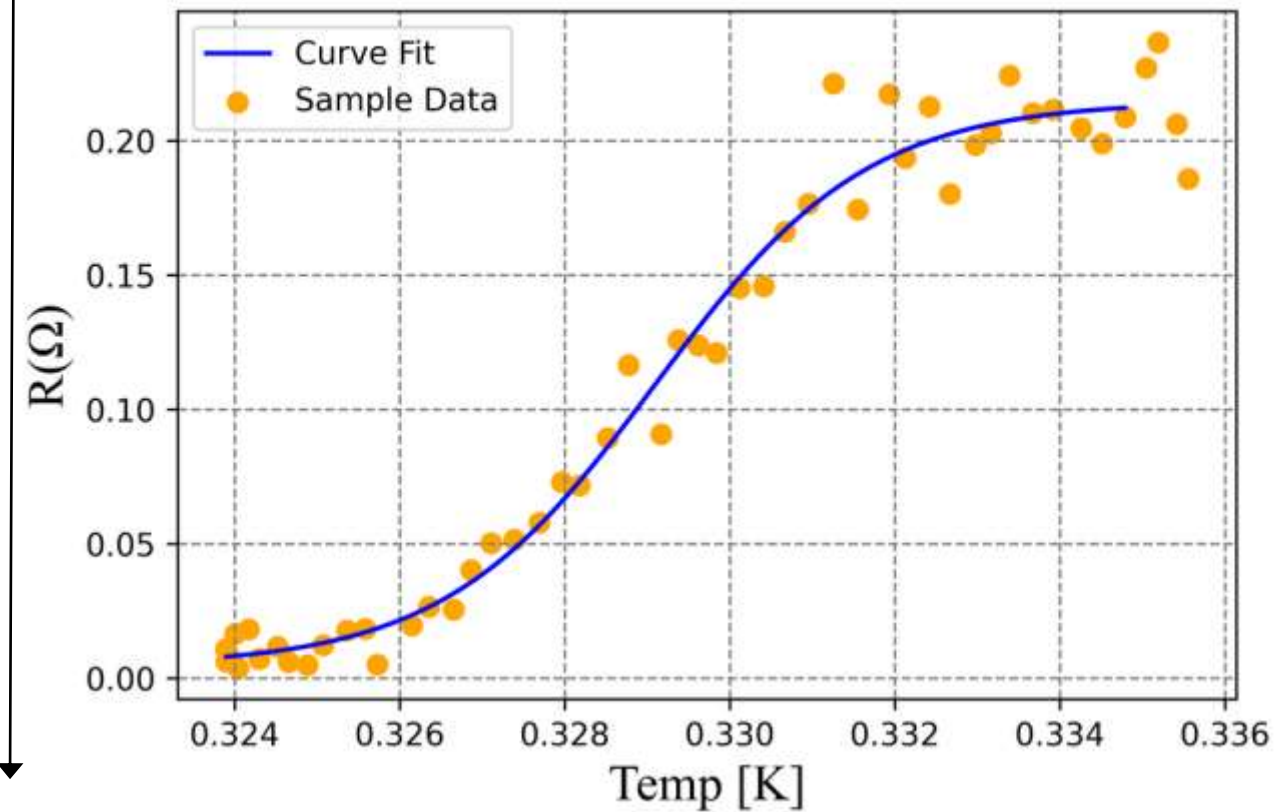
ADDING A LAYER OF GOLD!



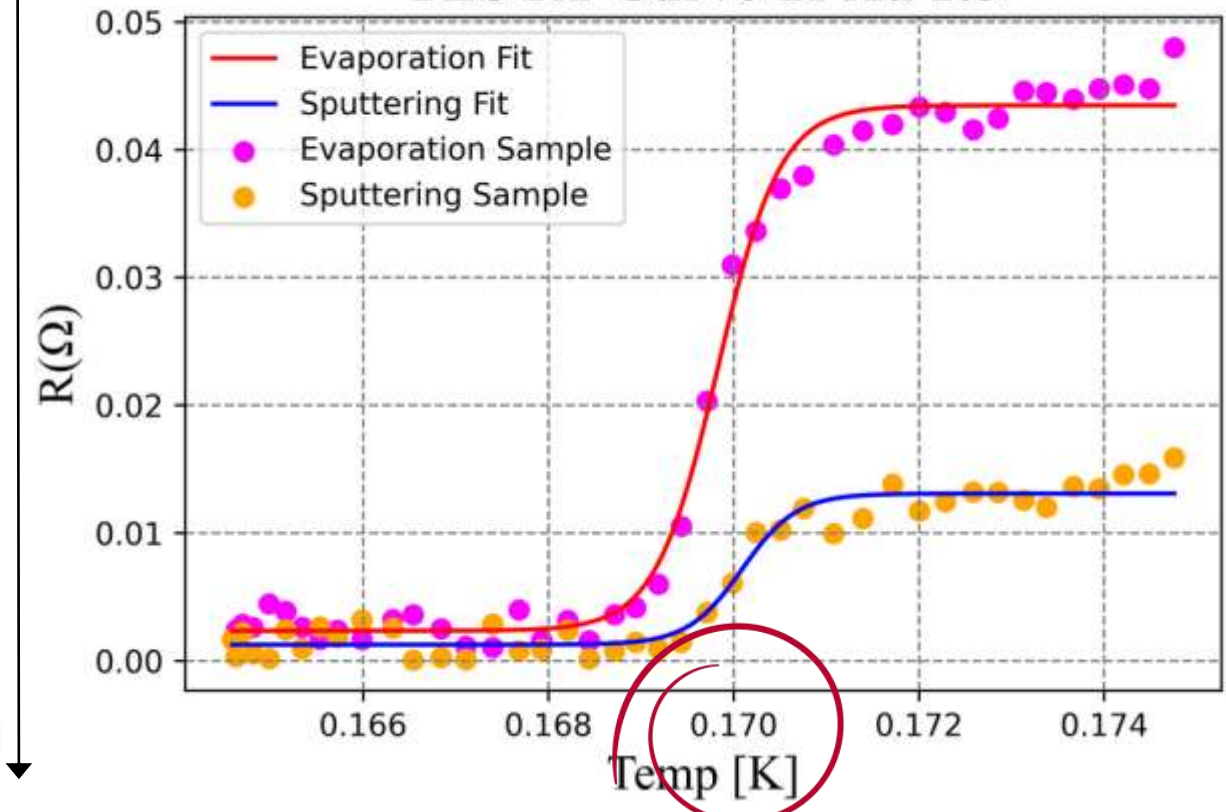
TES RT Curve Ti only



TES RT Curve Ti-Au 1:3



TES RT Curve Ti-Au 1:5



Cooper pairs leak into Au layer (Proximity Effect) → Fewer pairs → break easily at Lower T_c !

ENVIRONMENT – DILUTION REFRIGERATOR

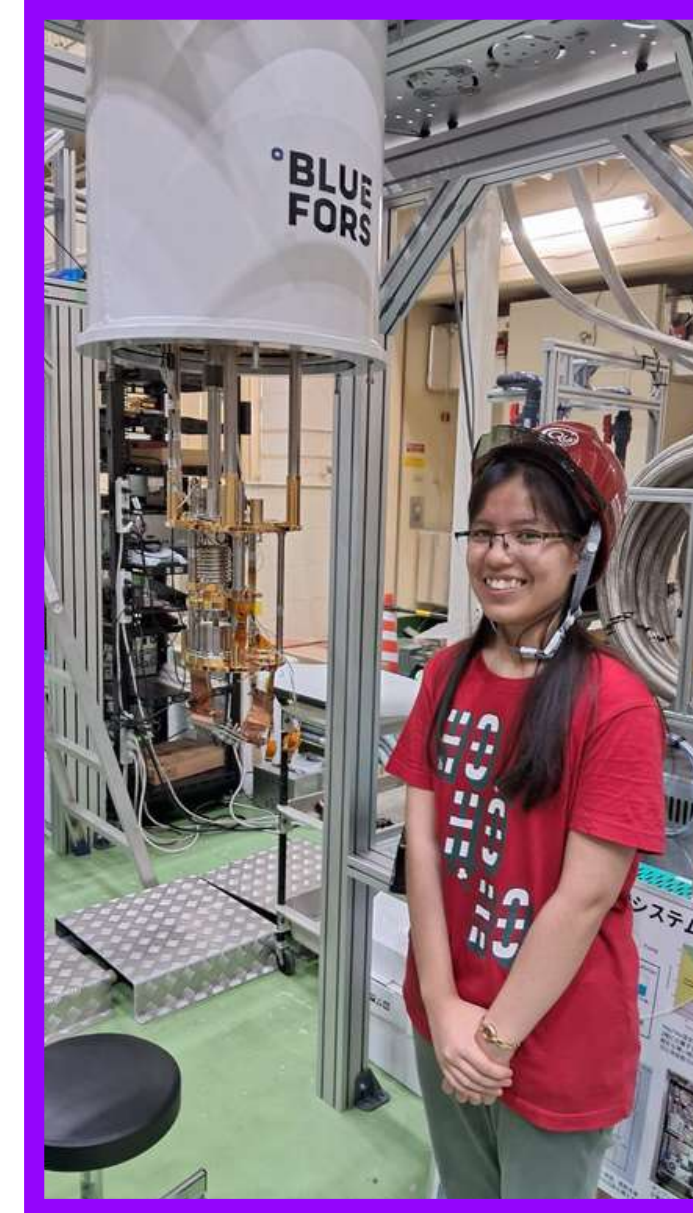
“0.170 K” achieved by mixing He3 & He4 - endothermic



(a)



(b)



(c)



(d)

Fig: Experimental setup (a) Control Unit (b) Closed Cooler (c) Open Cooler (d) Mixing Chamber Flange (coldest) with RuOx Temperature Sensor

RESULTS AND CONCLUSION

Table: Summary of Fabrication Methods and Performance

Method	Ratio of Ti/Au	Critical Temp (Tc) mK	Peak α
Evaporation	Ti only	$478.28 \pm 1.3 \times 10^{-5}$	873.2
Sputtering	1:3	$329.1 \pm 13 \times 10^{-5}$	190.8
Evaporation	1:5	$169.83 \pm 3.1 \times 10^{-5}$	314.0
Sputtering	1:5	$170.09 \pm 7.5 \times 10^{-5}$	303.9

- Sample Tc -> SRON and ISAS/JAXA
- Faint signals = Superconducting TES + Gold

REFERENCES:

- Cabrera, B. (2008). Introduction to tes physics. *Journal of Low Temperature Physics*, 151(1), 82-93.
- Yagi, Y., Hayashi, T., Tanaka, K., Miyagawa, R., Ota, R., Yamasaki, N. Y., ... & Homma, T. (2023). Fabrication of a 64-pixel tes microcalorimeter array.

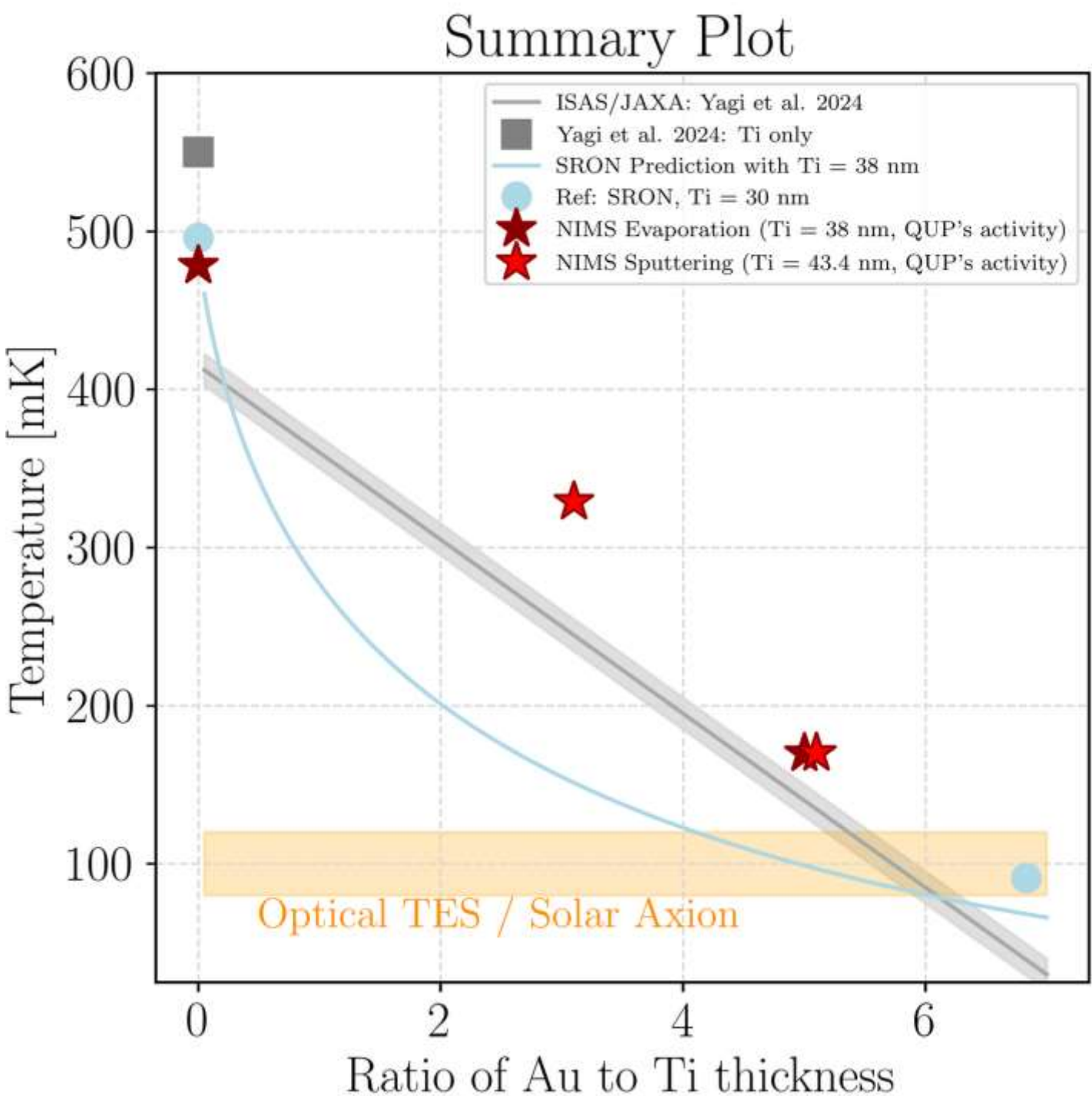


Fig: Summary plot comparing QUP's measurements with existing references

ARIGATOGOZAIMASU for this amazing experience!



A person is silhouetted against a vibrant, colorful nebula in a starry night sky. The nebula displays a gradient of colors from deep orange and yellow at the bottom to bright pink and purple at the top. The person stands on a dark, rocky outcrop, looking up at the celestial display. The background is filled with numerous stars of varying brightness.

THANK YOU
FOR YOUR PATIENT AUDIENCE!

FOR FURTHER QUESTIONS : srijeeta.barua@stu.adamasuniversity.ac.in