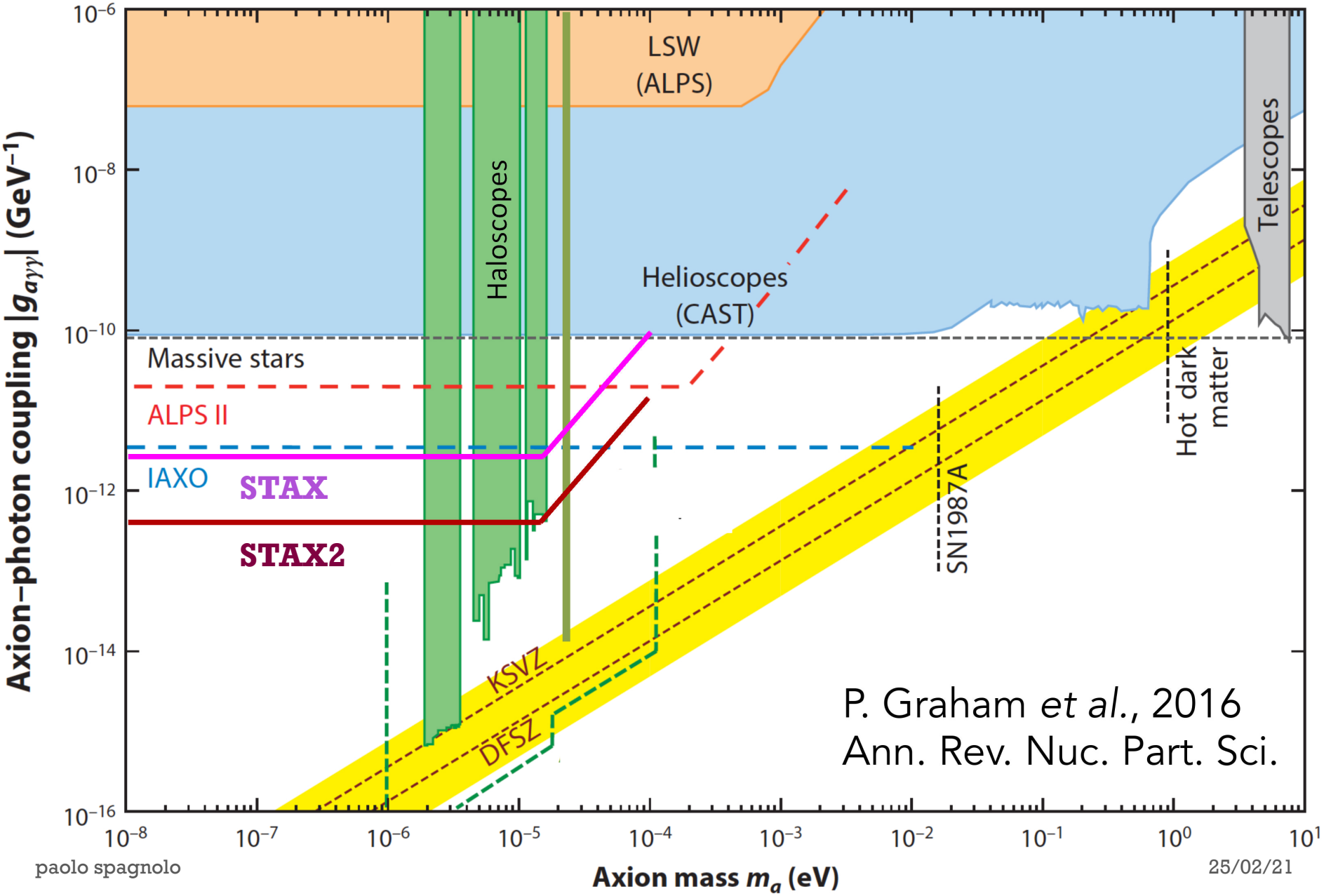
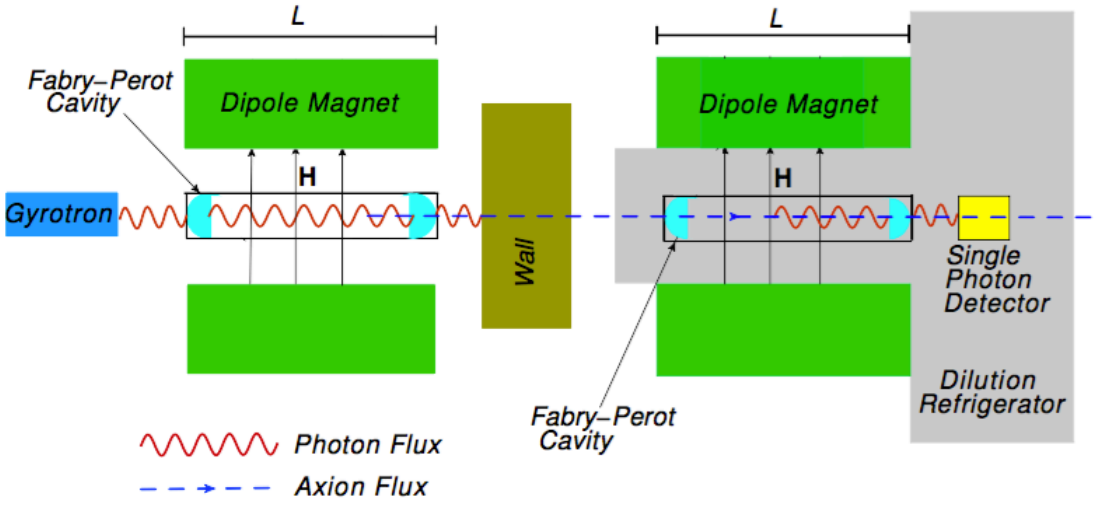
Constraints on $g_{A\gamma\gamma}$ vs. m_A



STAX Experiment



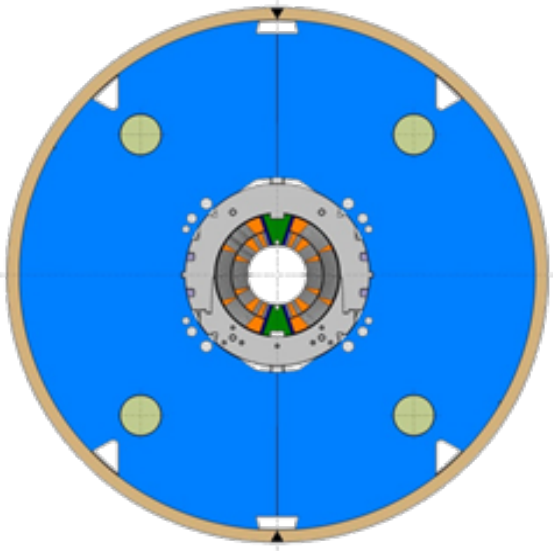
- Magnetic field: $H = 11$ T, $L = 1.5$ m
- Source: gyrotron; $P \approx 100$ kW, $\Phi_\gamma = 10^{27}$ s^{-1}, $\varepsilon_\gamma = 120$ μeV ($\nu \approx 30$ GHz)
- Fabry-Perot cavity: finesse $Q \approx 10^4$

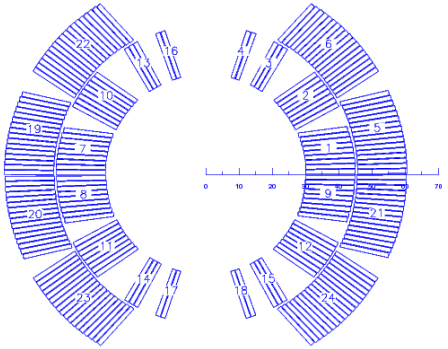
- Sub-THz single-photon detection based on TES technology, $\eta \approx 1$
- Possible second FP cavity behind the wall to enhance axion-photon conversion rate

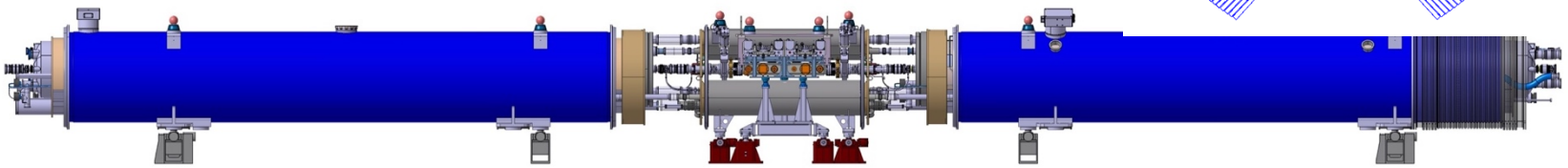
P. Sikivie, D.B. Tanner and K. Van Bibber, Phys. Rev. Lett. 98, 172002 (2007)

11T dipole magnets

- The HL-LHC Project implies beams of larger intensity
  - Additional collimators are needed
- Two collimators to be installed on either side of interaction point 7
  - Replace a standard Main Dipole by a pair of shorter 11 T Dipoles
- 5 single aperture short models fabricated and tested by CERN TE-MSC team
  - Bore field ranging from 10 to 12 T
  - 60 mm coil aperture
  - ~1.5 m magnetic length

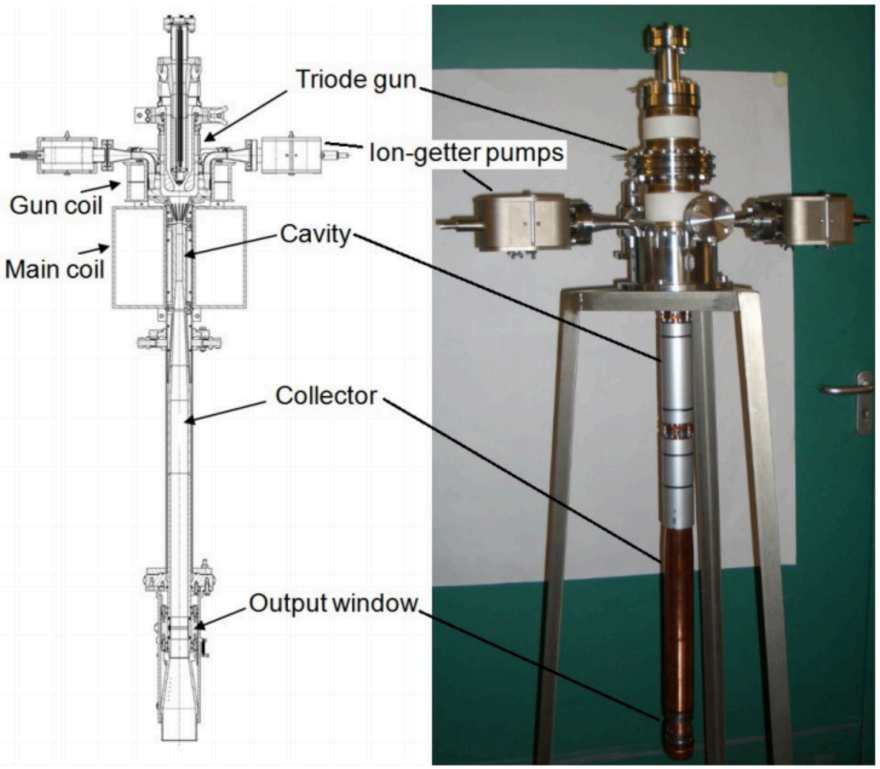






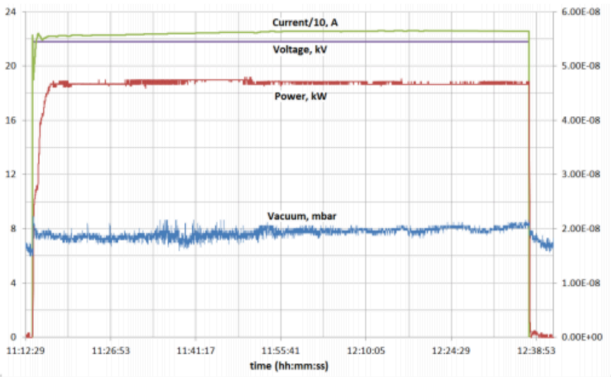
Gyrotron

28 GHz Gyrotron for Industry and Research



28 GHz, 15 kW CW, 40 % eff.

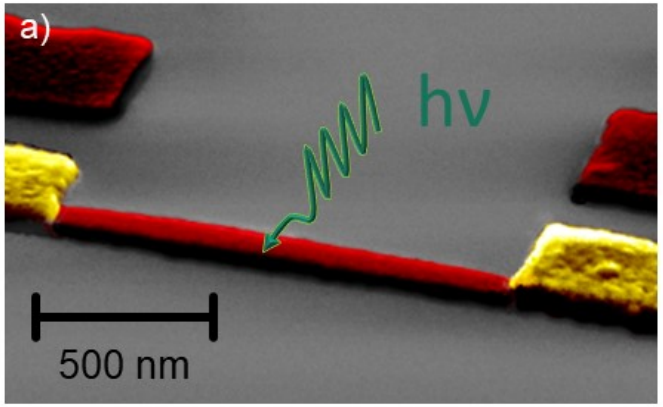
compact gyrotron system for research & industrial processes



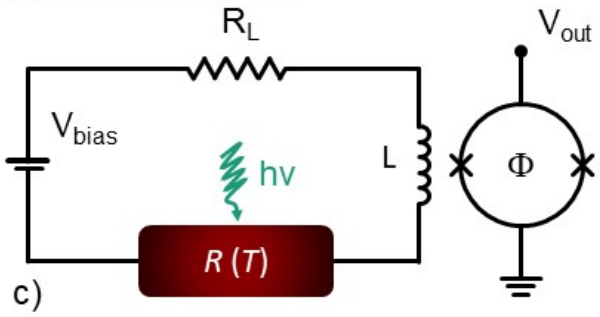
Institute for Pulsed Power and Microwave Technology (IHM)

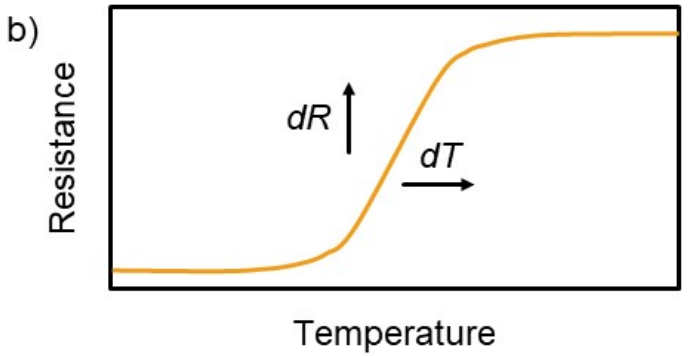
Transition Edge Sensor

TES operates within its superconducting transition. DC bias voltage applied.
When TES absorbs an incoming photon, it heats up above critical temperature Tc.
Change of resistance and current flowing in the circuit, measured by a SQUID



Active region
Lateral electrodes





Electro-thermal parameter $\alpha = \frac{T}{R}\frac{dR}{dT}$

R - resistance of active region
T - temperature of active region

Energy resolution: $\Delta E \cong 2.35\sqrt{2k_B T^2 \frac{C}{\alpha}}$
k_B - Boltzmann constant
Heat capacity: $C = \gamma V_{Active} T$
γ - Sommerfeld coefficient
V_{Active} - active region volume

d)

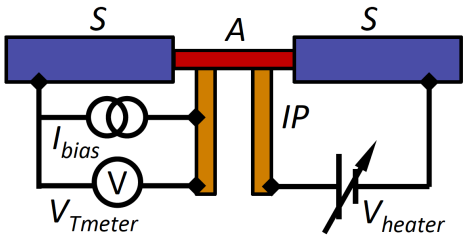
TES Nanowire

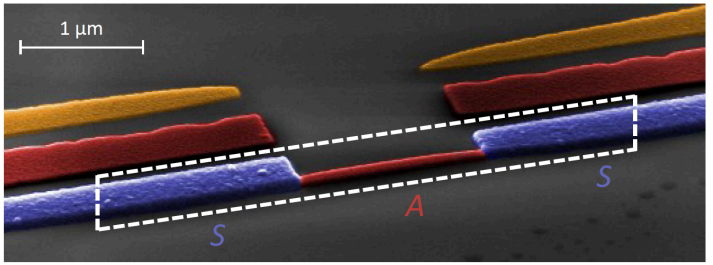
F. Paolucci et al arXiv:2007.08320

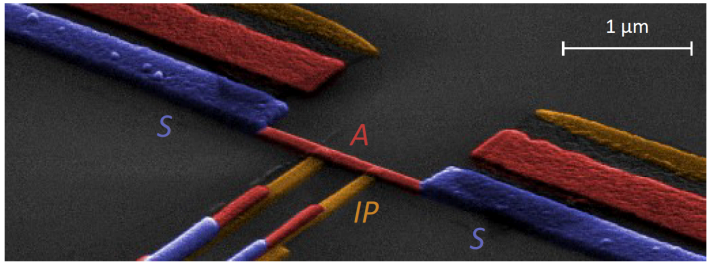
A (Red) TiAu

B (Blue) Al electrode

IP (Yellow) Al-O tunnel probe

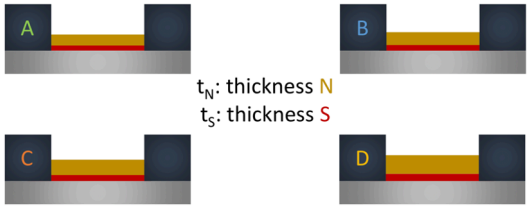




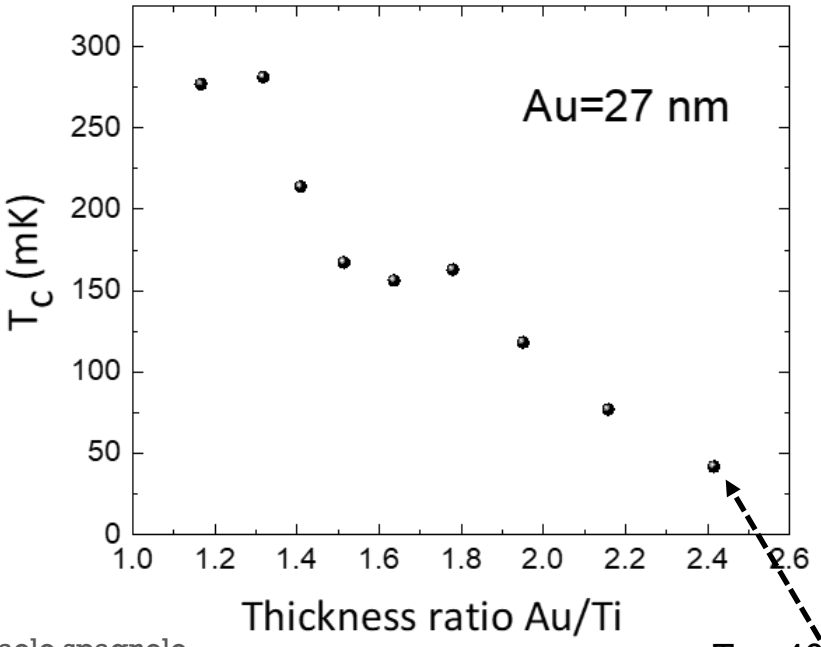


T_C suppression by vertical inverse proximity effect

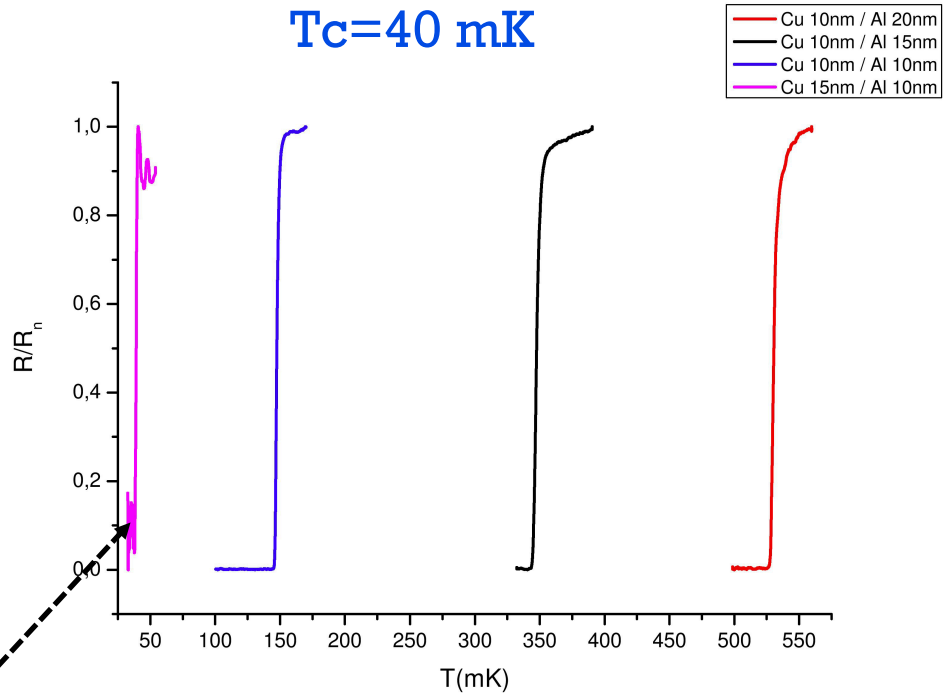
Superconductivity Of Metals And Alloys, Advanced Books Classics (Westview Press, 1999)



Bilayer Ti(11 nm) Au(27 nm)



Tc=40 mK



T_C= 40 mK