

Qubit

Next Year Activity

C Gatti

YEAR	Month		Year 1				Year 2				Year 3				
			T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	
WP1 - Design (Fi)	T1.1	Design		D1.1	D1.2	D1.3									
	T1.3	JPA					D1.4								
	T1.4	Simulation													
WP2 - Fabrication (TIFPA)	T2.1	Components			D2.1										
	T2.2	2D Transmon					D2.2				D2.4				
	T2.3	JPA						D2.3							
	T2.4	3D Transmon										D2.5			
	T2.5	Two qubits device											D2.6		
WP3 - Control (MiB)	T3.1	Software						D3.1							
	T3.2	Firmware													
	T3.3	Test							D3.2						
WP4 - Experiment (LNF)	T4.1	Components				D4.1									
	T4.2	2D Transmon					D4.2					D4.4			
	T4.3	3D Transmon											D4.6		
	T4.4	Qubit readout								D4.3					
	T4.5	Two qubits device													D4.7
WP5 - Management (LNF)	T5.1	Collaboration Meetings													

Deliverables

Components

Transmon + resonator

Transmon +2 resonators

JPA

3D Transmon

2 Qubits device

Qubit Control

14:30 → 14:40 **Next Year plan**

Speaker: Claudio Gatti (Istituto Nazionale di Fisica Nucleare)

14:45 → 15:05 **3D Qubit Fabrication at CNR**

Speaker: Francesco Mattioli

15:10 → 15:30 **Qick on ZCU208**

Speakers: Enrico Calore (Istituto Nazionale di Fisica Nucleare), Matteo Mario Beretta (Istituto Nazionale di Fisica Nucleare)

15:35 → 15:55 **Controllo di qubit attraverso le schede RFSoc**

Speaker: Rodolfo Carbone

16:00 → 16:20 **Resonators and next fabrication at FBK ¶**

Speaker: Paolo Falferi (Istituto Nazionale di Fisica Nucleare)

16:25 → 16:45 **Qubit fabrication at NIST**

Speaker: Danilo Labranca (Istituto Nazionale di Fisica Nucleare)

16:50 → 17:10 **Setup 300mK a Pisa e progetto portacampioni**

Speaker: Claudio Puglia

17:15 → 17:35 **Qubit a IQM**

Speaker: Roberto Moretti (Istituto Nazionale di Fisica Nucleare)

🕒 20m ✎ ▼

🕒 20m ✎ ▼

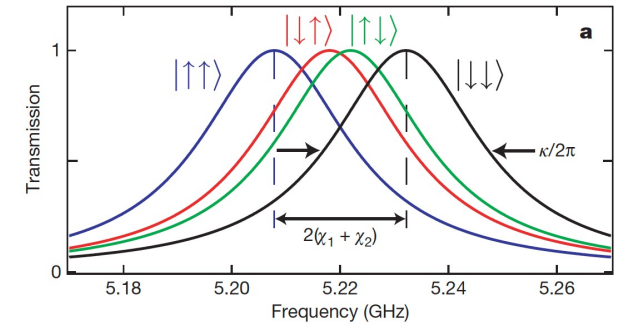
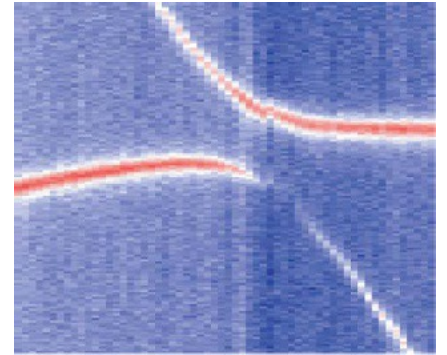
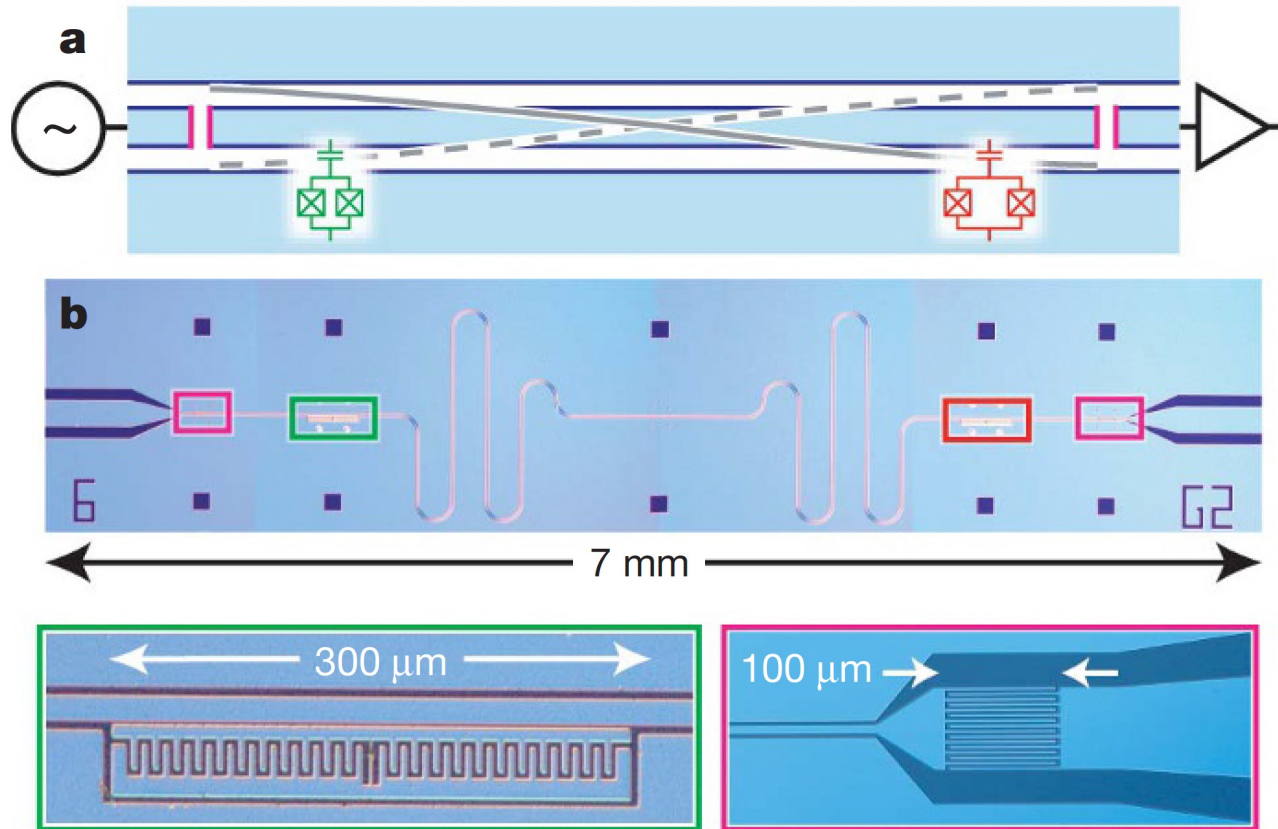
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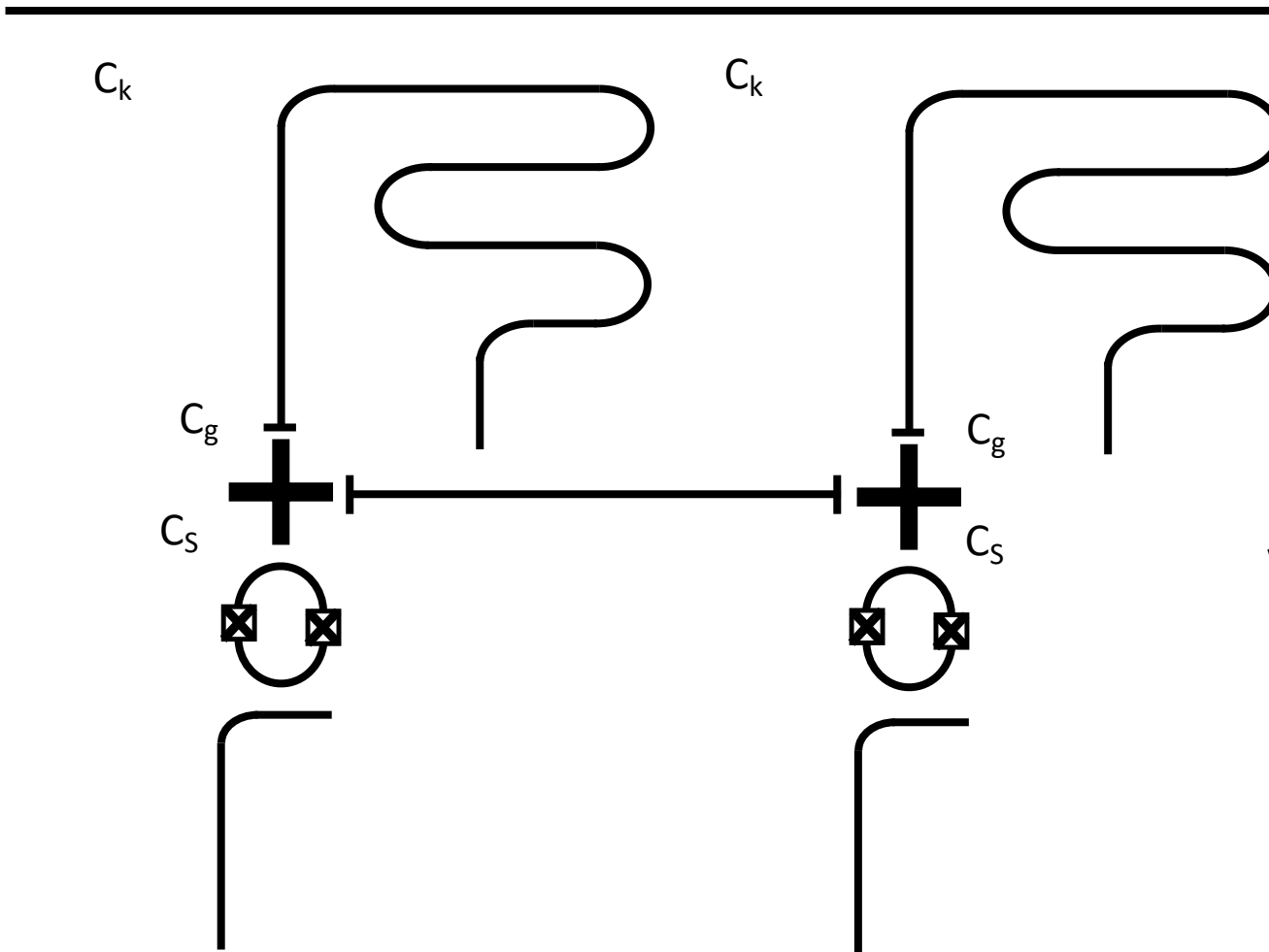
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Two (tunable) qubits gate

<https://doi.org/10.1038/nature06184>



2 qubits gate



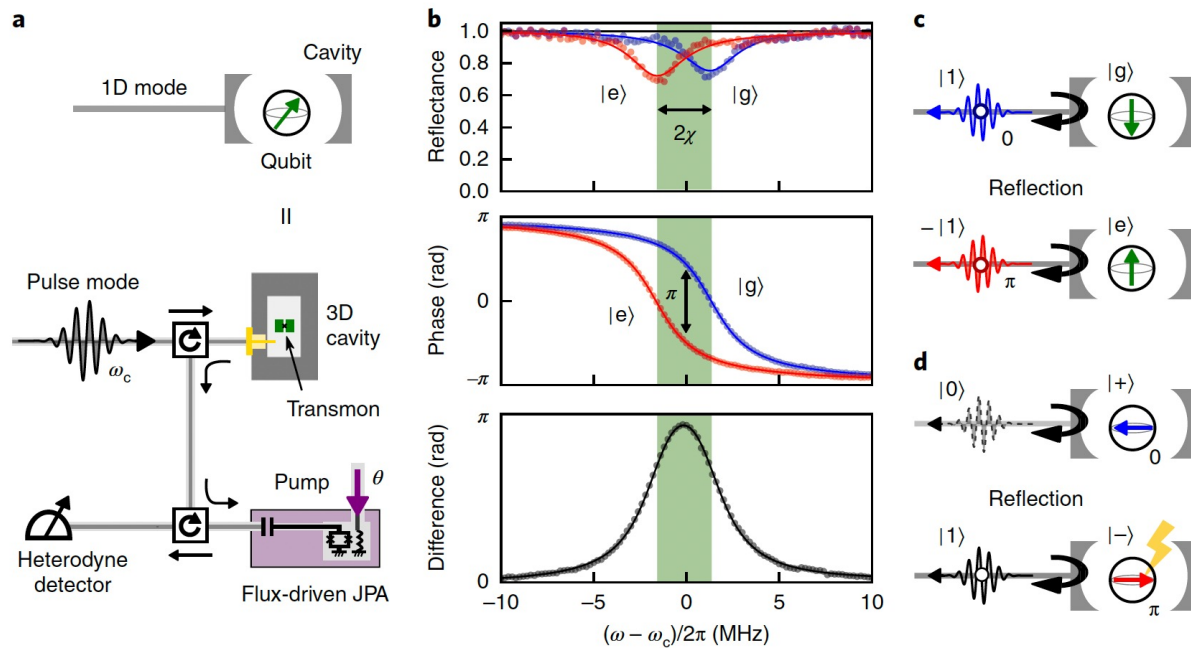
Virtual qubit-qubit interaction

PHYSICAL REVIEW A 75, 032329 2007

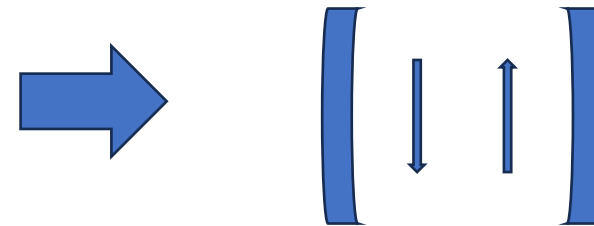
$$\frac{g_1 g_2 (\Delta_1 + \Delta_2)}{2\Delta_1 \Delta_2}$$

Two-qubits photon-detector

Nature Phys **14**, 546–549 (2018)



Can be extended to two qubits

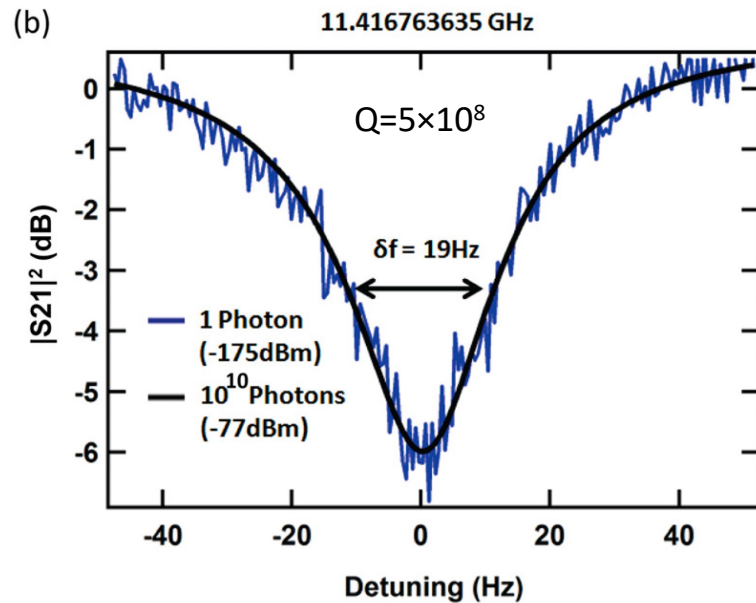


Dark Counts rate:

$$\nu_{DC} \approx \frac{p^2}{T_2} \sim 1 - 10 \text{ Hz}$$

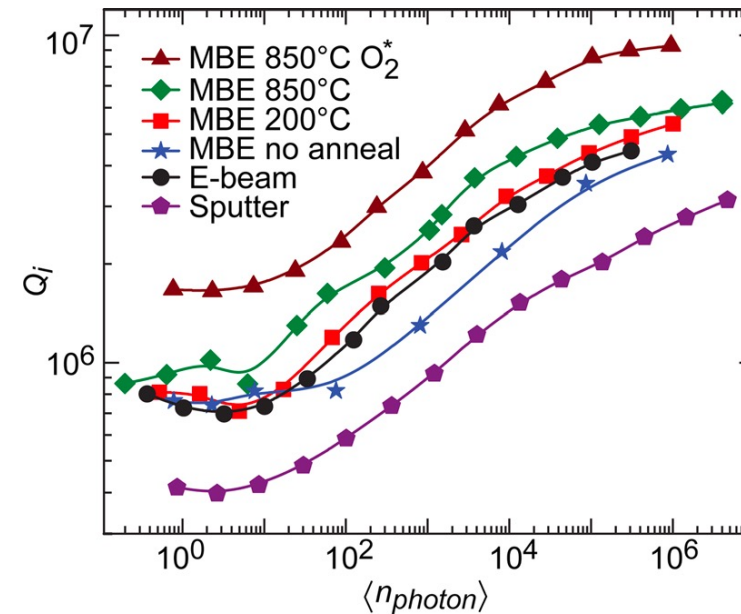
“D vs 3D Photon Counter: Q_0 vs n_{photon}

3D Al cavity



Appl. Phys. Lett. 102, 192604 (2013)

2D Al resonator



Appl. Phys. Lett. 100, 113510 (2012)