

**מפגש התנעה לקראת מאגד פיתוח טכנולוגיות
בתחום חישה קוונטית**

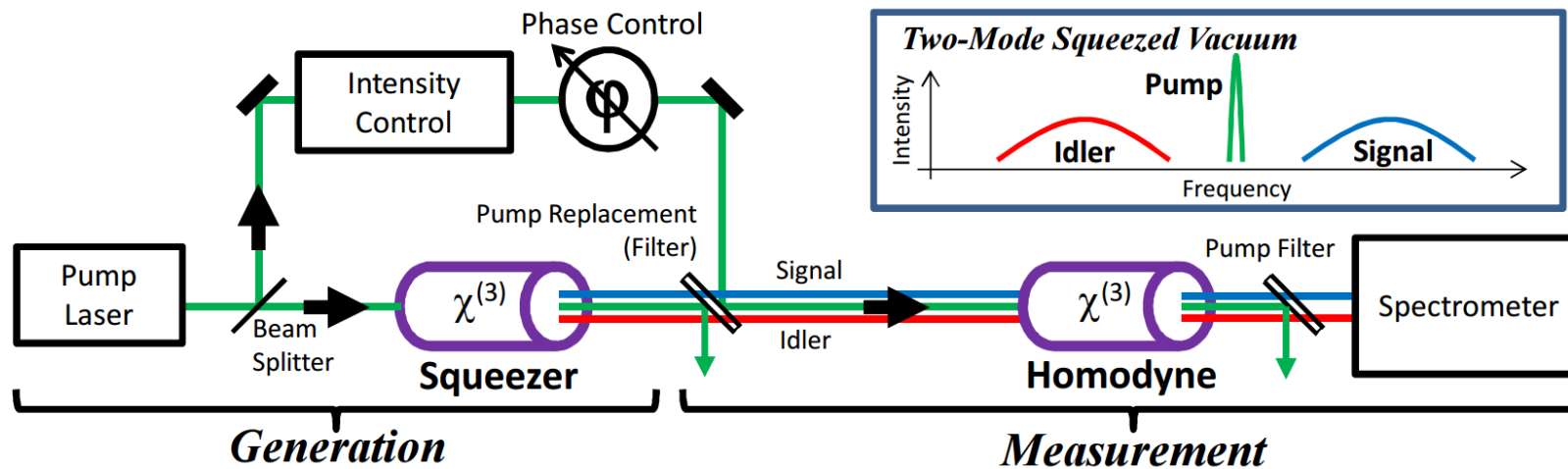
BIRAD

**ביראד חברה למחקר ופיתוח בע"מ
אוניברסיטת בר-אילן**

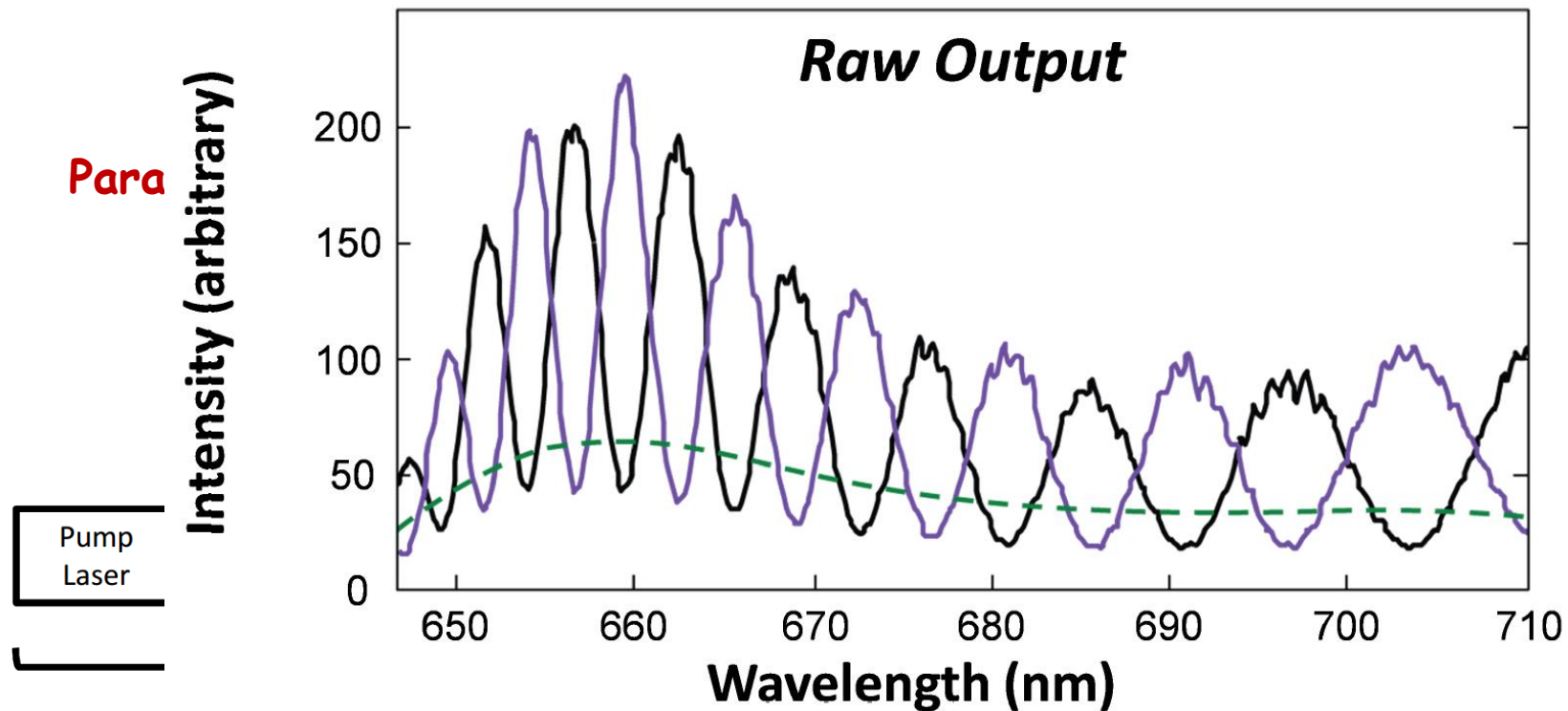


Pe'er & Rosenbluh: Robust, Loss Resilient, sub-Shot Noise Sensing with Nonlinear Interference

Parametric amplification as a homodyne measurement



Pe'er & Rosenbluh: Robust, Loss Resilient, sub-Shot Noise Sensing with Nonlinear Interference



Up to ~ 1.7 dB squeezing
over the entire 55THz bandwidth!

Where we can fit in...

Contribution

- Sub shot-noise spectroscopy (linear and Raman)
- Beyond-classical phase measurement (on top of existing shot-noise limit)
- Loss resilient, Ultra broadband

Collaboration

- Clock development
- Super-sensitive chemical sensing
- Any interferometric sensing application...

Quantum Engineering Laboratory

Dr. Asaf Albo, BIU

Utilizing symmetry protected point defect states in semiconductors for quantum memory and single photon detection applications.

PHYSICAL REVIEW B 85, 115307 (2012)

Electronic bound states in the continuum above (Ga,In)(As,N)/(Al,Ga)As quantum wells

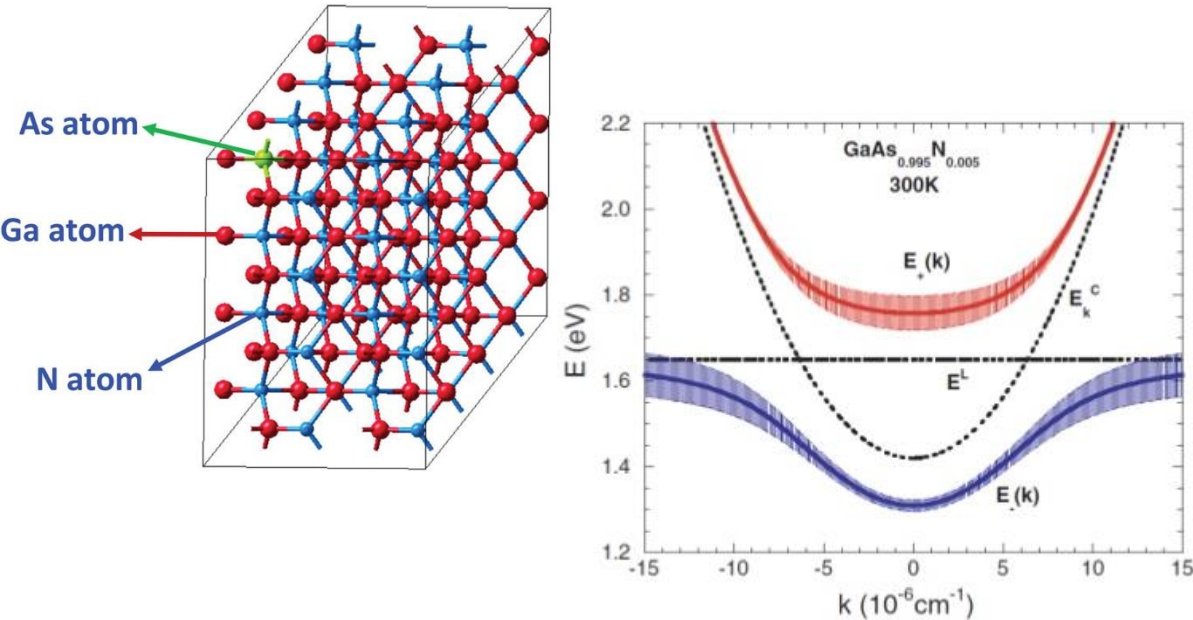
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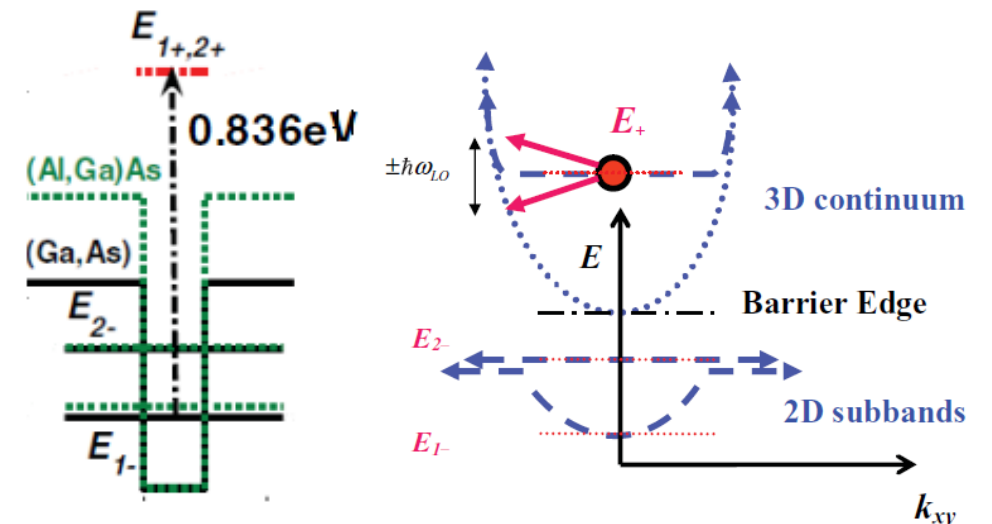
Using intersubband photocurrent spectroscopy, we have demonstrated that a bound state in the continuum exists above (Ga,In)(As,N)/(Al,Ga)As quantum wells. The photocurrent spectrum and responsivity show that the excited-state energies lie far above the potential barrier of the quantum well, and the bound nature of the states was confirmed from the long lifetime of the excited carriers and a small coupling with the surrounding continuum. Applying optical phonon scattering theory, we have demonstrated that the relaxation process is governed by scattering from localized nitrogen states to the three-dimensional continuum.



Perturbation theory applied to the nitrogen localized state and the host extended states gives:

$$\begin{vmatrix} E - E_C & V \\ V & E - E_N \end{vmatrix} = 0 \Rightarrow E_{\pm} = \frac{1}{2} \left(E_N + E_C \pm \sqrt{(E_N - E_C)^2 + 4V^2} \right)$$

Shan et al, PRL 1999.



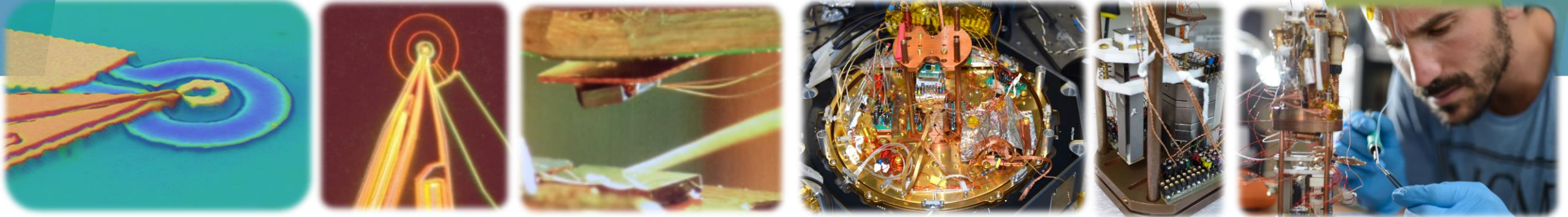
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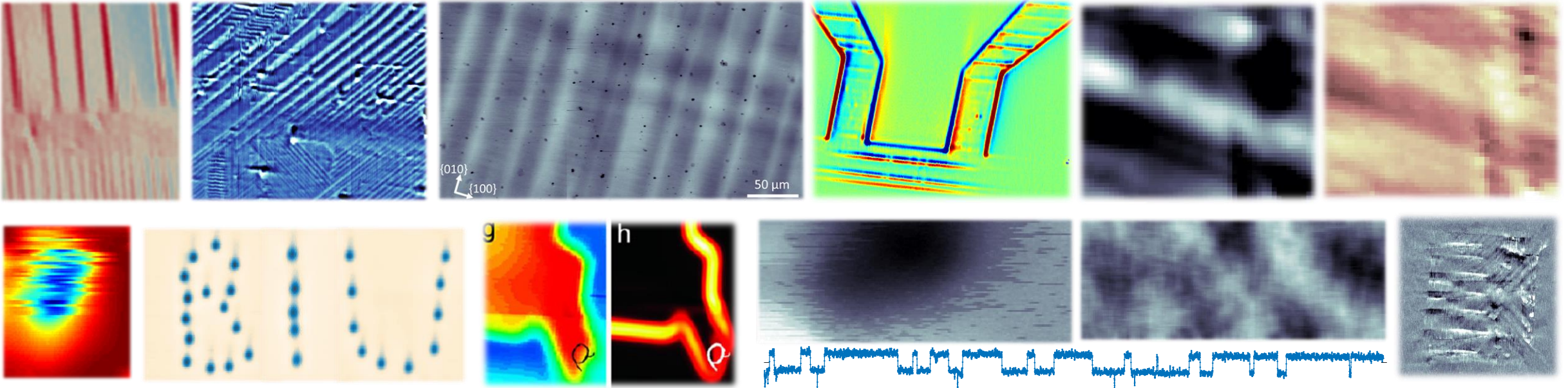


Scanning SQUID. A highly sensitive magnetic flux imaging technique



Emergent states at interfaces

Mapping tiny currents and supercurrents



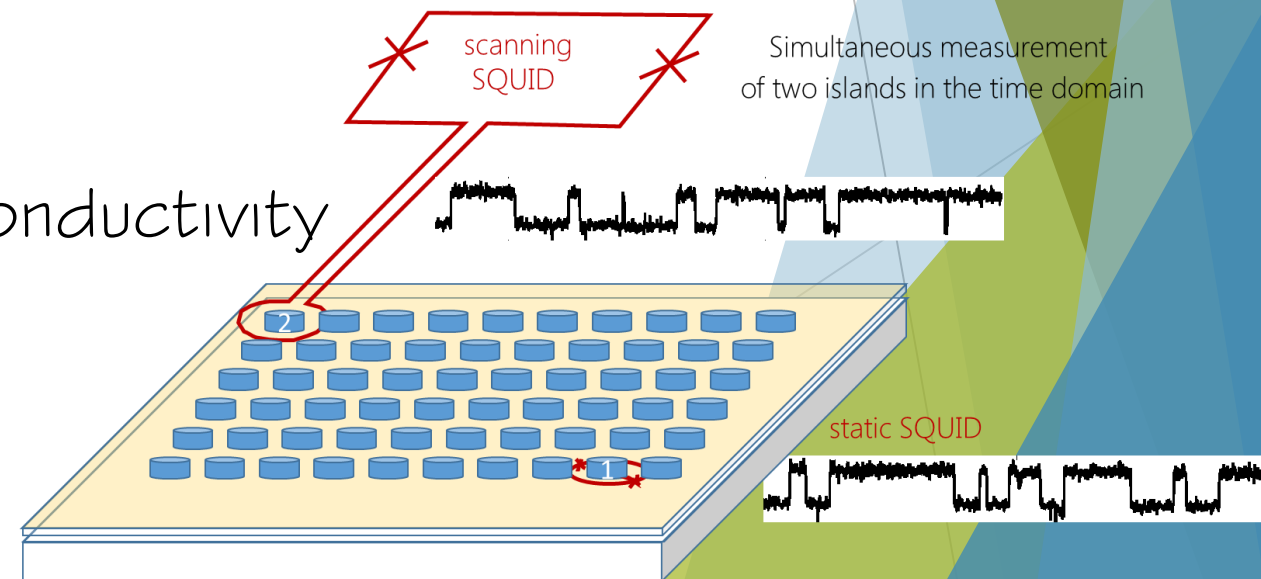
Detection and manipulation of nano-magnets

Sensing quantum behavior

Quantum entanglement mediated by a controllable medium

Where we can fit in

- Solid state approach to quantum sensing
- Quantum entanglement in a many qubits system
- Detect communication between two distant qubits
- Super sensitive spatial maps of magnetism, current flow, superconductivity and quantum behavior



FOR MORE INFORMATION :

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THANK YOU !

