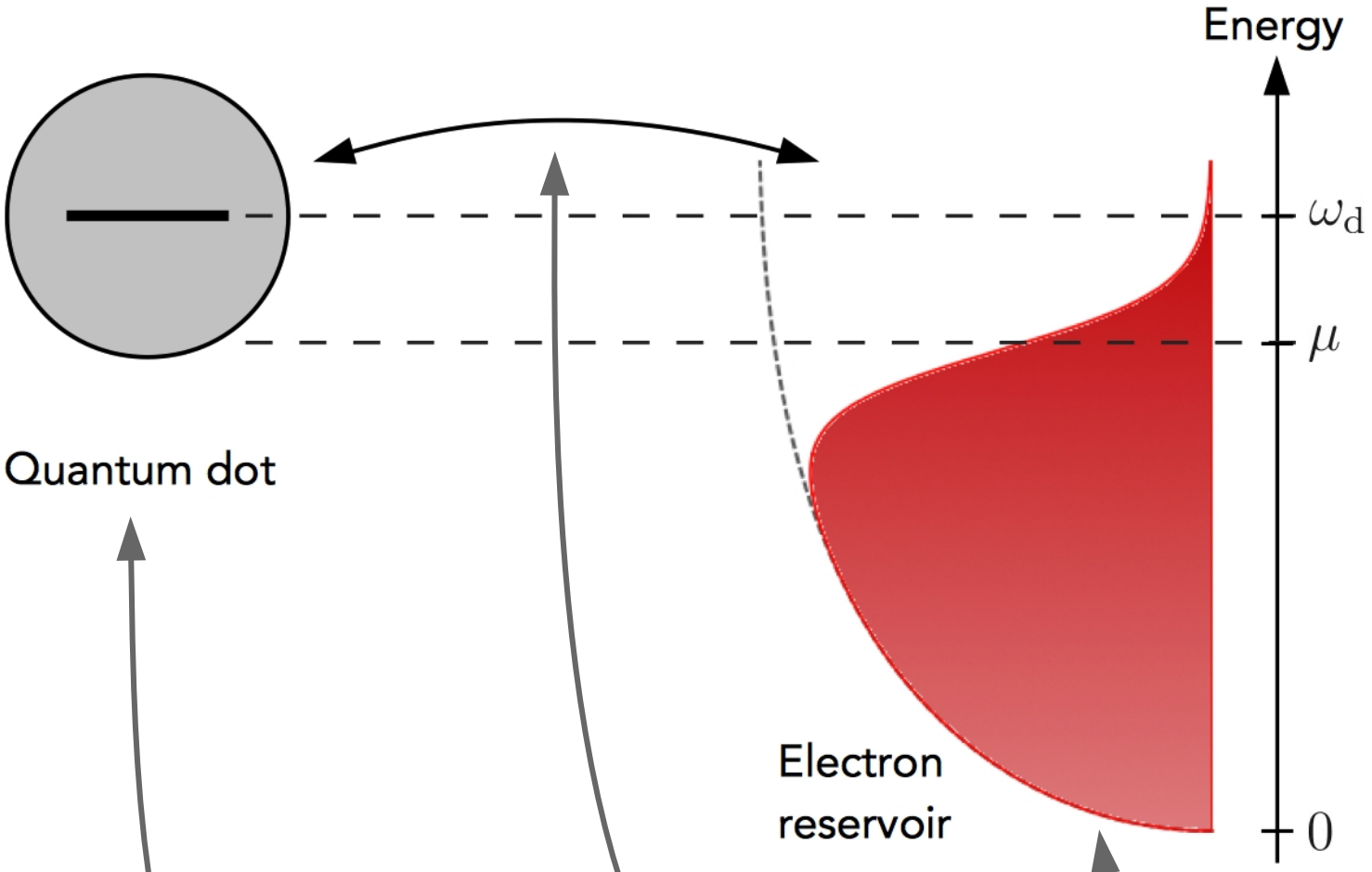
Transport properties in the Fano-Anderson model

Étienne Jussiau and **Robert S. Whitney**

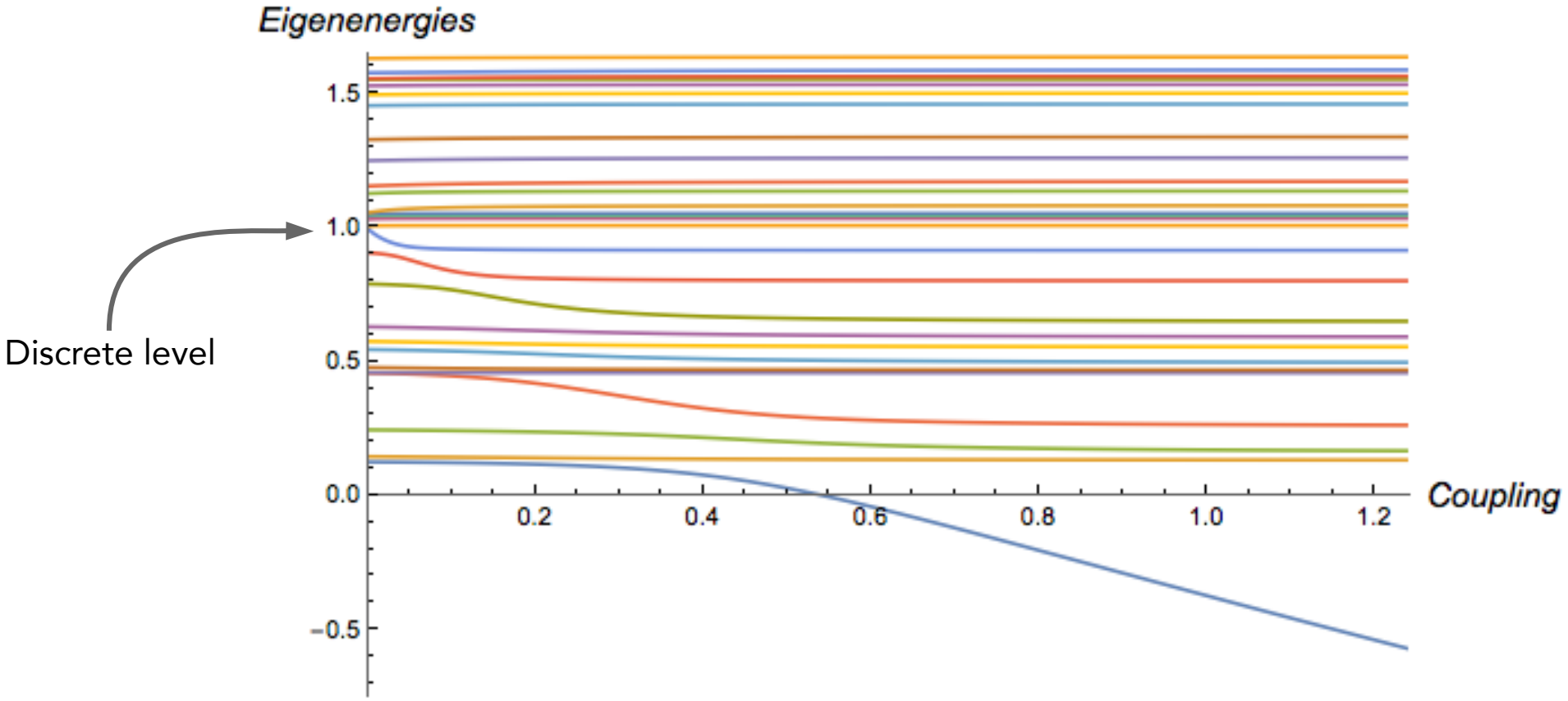
The Fano-Anderson model



$$\hat{H} = \omega_d \hat{d}^\dagger \hat{d} + \sum_\lambda \left(g_\lambda \hat{d}^\dagger \hat{a}_\lambda + g_\lambda^* \hat{a}_\lambda^\dagger \hat{d} \right) + \sum_\lambda \Omega_\lambda \hat{a}_\lambda^\dagger \hat{a}_\lambda$$

- U. Fano. Physical Review, 124(6), 1866, 1961

Preliminary results



- Weak coupling: ground state in the continuum
- Strong coupling: ground state out of the continuum
  → Infinite lifetime
  → No effect on transport?

- A. G. Kofman, G. Kurizki and B. Sherman. Journal of Modern Optics, 41(2), 353-384, 1994
- D. M. Basko. Physical Review Letters, 118(1), 016805, 2017

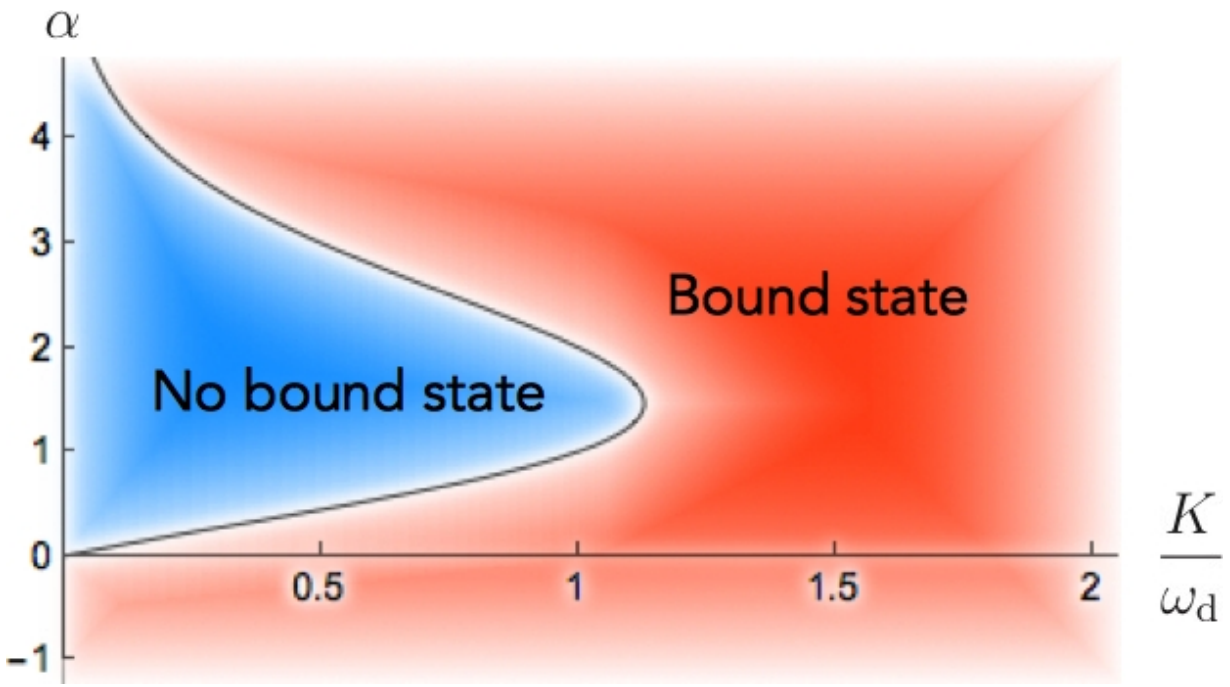
Existence of the bound state

- Specific spectral density: $J(\Omega) = K \left(\frac{\Omega}{\Omega_c} \right)^{\alpha} e^{-\frac{\Omega}{\Omega_c}}$

- The bound state exists if and only if: $K > K^*$

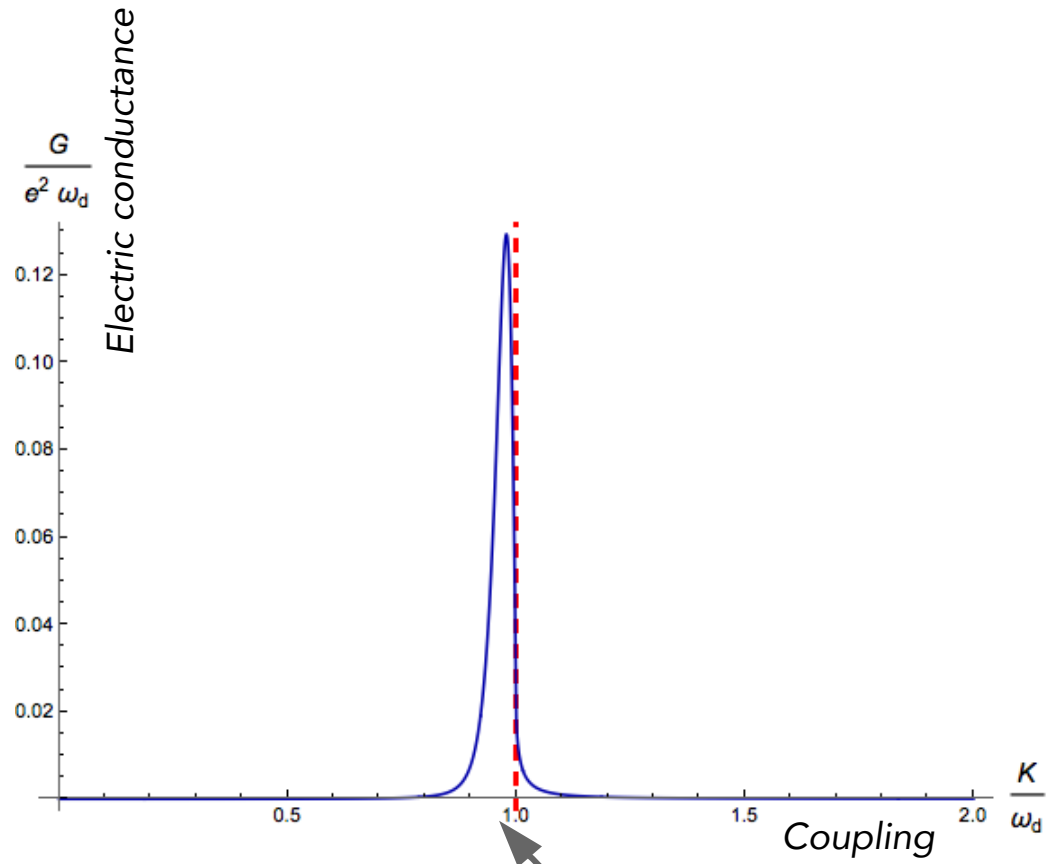
$$K^* = \begin{cases} \dfrac{\omega_d}{\Gamma(\alpha)}, & \alpha > 0 \\ 0, & -1 < \alpha \leq 0 \end{cases}$$

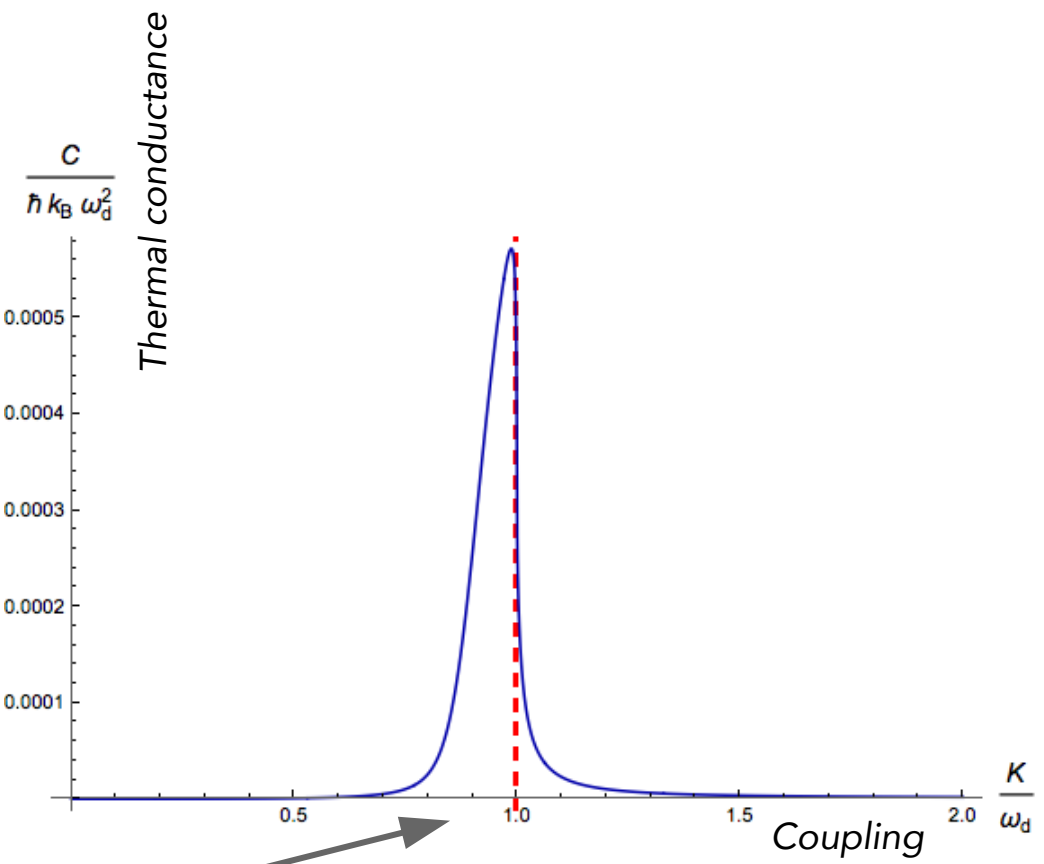
- "Phase" diagram:



Conductances

- Landauer-Buttiker formalism → everything follows from the transmission





Peak just before the transition
→ Link to the diverging derivative

$\Omega_c = 10\omega_d,\ \alpha = 1$

$T = 0.01\dfrac{\omega_d}{k_B},\ \mu = 0.001\omega_d,\ \Delta T = 0.001\dfrac{\omega_d}{k_B},\ \Delta\mu = -0.0001\omega_d$

Thank you for your attention!