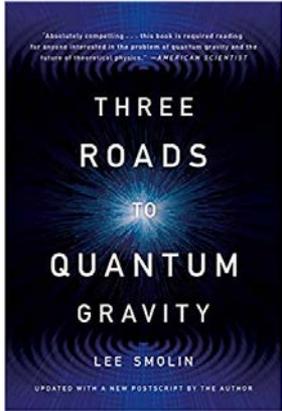


Three Roads to Electron-Localized-Spin Nonequilibrium Many-Body Systems in Spintronics

quantum electrons + classical spins governed by Landau-Lifshitz-Gilbert (LLG) equation



PHYSICAL REVIEW APPLIED 10, 054038 (2018)
Editors' Suggestion

Spin and Charge Pumping by a Steady or Pulse-Current-Driven Magnetic Domain Wall: A Self-Consistent Multiscale Time-Dependent Quantum-Classical Hybrid Approach

Marko D. Petrović,¹ Bogdan S. Popescu,² Utkarsh Bajpai,² Petr Plecháč,¹ and Branislav K. Nikolić^{2,*†}

PHYSICAL REVIEW B 99, 134409 (2019)

Time-retarded damping and magnetic inertia in the Landau-Lifshitz-Gilbert equation self-consistently coupled to electronic time-dependent nonequilibrium Green functions

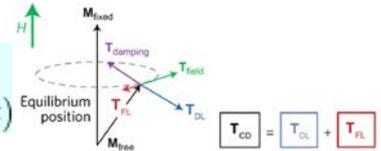
Utkarsh Bajpai and Branislav K. Nikolić^{*}

$$\frac{d\mathbf{M}_i}{dt} = -\gamma \mathbf{M}_i \times \mathbf{B}_i^{\text{eff}} + \lambda_i \mathbf{m}_i \times \frac{d\mathbf{m}_i}{dt} + \frac{\gamma}{\mu M} \mathbf{T}_i$$

LLG equation is applicable if:

$$S \rightarrow \infty, \hbar \rightarrow 0 (S \times \hbar \rightarrow 1)$$

$$|S_1\rangle(t) \otimes |S_2\rangle(t) \otimes \dots \otimes |S_N\rangle(t)$$



PHYSICAL REVIEW B 104, 214401 (2021)

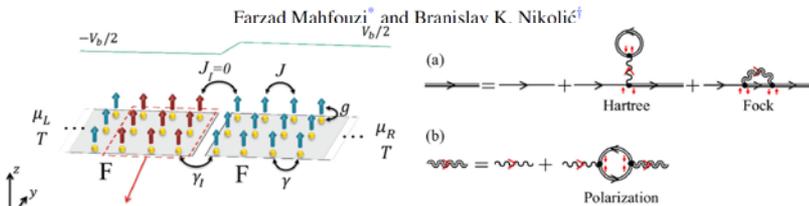
When can localized spins interacting with conduction electrons in ferro- or antiferromagnets be described classically via the Landau-Lifshitz equation: Transition from quantum many-body entangled to quantum-classical nonequilibrium states

Priyanka Mondal, Abhin Suresh, and Branislav K. Nikolić^{*}

quantum electrons + quantum localized spins mapped to bosons

PHYSICAL REVIEW B 90, 045115 (2014)

Signatures of electron-magnon interaction in charge and spin currents through magnetic tunnel junctions: A nonequilibrium many-body perturbation theory approach



PHYSICAL REVIEW B 104, 184425 (2021)

Quantum many-body states and Green's functions of nonequilibrium electron-magnon systems: Localized spin operators versus their mapping to Holstein-Primakoff bosons

Utkarsh Bajpai^{1,2}, Abhin Suresh,¹ and Branislav K. Nikolić^{1,*†}

quantum electrons + quantum localized spins

PHYSICAL REVIEW X 11, 021062 (2021)

Spintronics Meets Density Matrix Renormalization Group: Quantum Spin-Torque-Driven Nonclassical Magnetization Reversal and Dynamical Buildup of Long-Range Entanglement

Marko D. Petrović¹, Priyanka Mondal,¹ Adrian E. Feiguin², Petr Plecháč³, and Branislav K. Nikolić^{1,*†}

PHYSICAL REVIEW LETTERS 126, 197202 (2021)

Quantum Spin Torque Driven Transmutation of an Antiferromagnetic Mott Insulator

Marko D. Petrović¹, Priyanka Mondal,¹ Adrian E. Feiguin², and Branislav K. Nikolić^{1,*†}

$$\left(\frac{2N}{N_e}\right) 2^{N_{\text{FM}}} \Rightarrow |\Psi\rangle = \sum_{\{s\}} A[s_1]_{\alpha_1} A[s_2]_{\alpha_1, \alpha_2} \dots A[s_{N-1}]_{\alpha_{N-1}, \alpha_N} A[s_N]_{\alpha_N} |s_1 \dots s_N\rangle$$

$$e^{-i\hat{H}\delta t/\hbar} \approx e^{-i\hat{H}_1\delta t/2\hbar} \dots e^{-i\hat{H}_{N-1}\delta t/2\hbar} \times e^{-i\hat{H}_{N-1}\delta t/2\hbar} \dots e^{-i\hat{H}_1\delta t/2\hbar}$$