

Oddelení teoretické fyziky

Katedra fyziky kondenzovaných látok

RNDr. Tomáš Novotný, Ph.D.

Prof. RNDr. Bedřich Velický, CSc.

Doc. RNDr. Ilja Turek, DrSc.

Doc. RNDr. Martin Diviš, CSc.

RNDr. Karel Carva, Ph.D.

Ing. Richard Korytár, Ph.D.

RNDr. Pavel Baláž, Ph.D.

RNDr. Martin Žonda, Ph.D.

Dr. Panch Ram

Dr. Artur Slobodenyuk

Mgr. Alžběta Kadlecová

Mgr. Štěpán Marek

Topics, methods & systems

Ab initio

Atomistic spin dynamics

CuMnAs

Density functional theory

Domain wall dynamics

Dynamical mean field

GaMnAs

Gilbert damping

Graphene

Josephson junctions

Kondo effect

Magnetic tunnel junctions

Magnetism

Magnetization dynamics

Micromagnetic simulati...

Molecular magnets

Molecular wires

Monte Carlo

Multiferroics

Noise and full counting ...

Nonequilibrium Green f...

Numerical renormalizat...

Open systems

Quantum dots

Quantum Monte Carlo

Quantum transport

Semiconductors

Spin currents

Spin fluctuations

Spin transfer torque

Spin valves

Spin waves

Spin-orbit torques

Spintronics

Stochastic dynamics

Superconducting quant...

Superconductivity

Topological insulators

Transition metals

Tunnel magnetoresista...

Ultrafast demagnetization

Uranium compounds

Systems

Systems with spontaneously broken symmetry

- superconductor (gauge symmetry)
- ferromagnet (rotational symmetry)

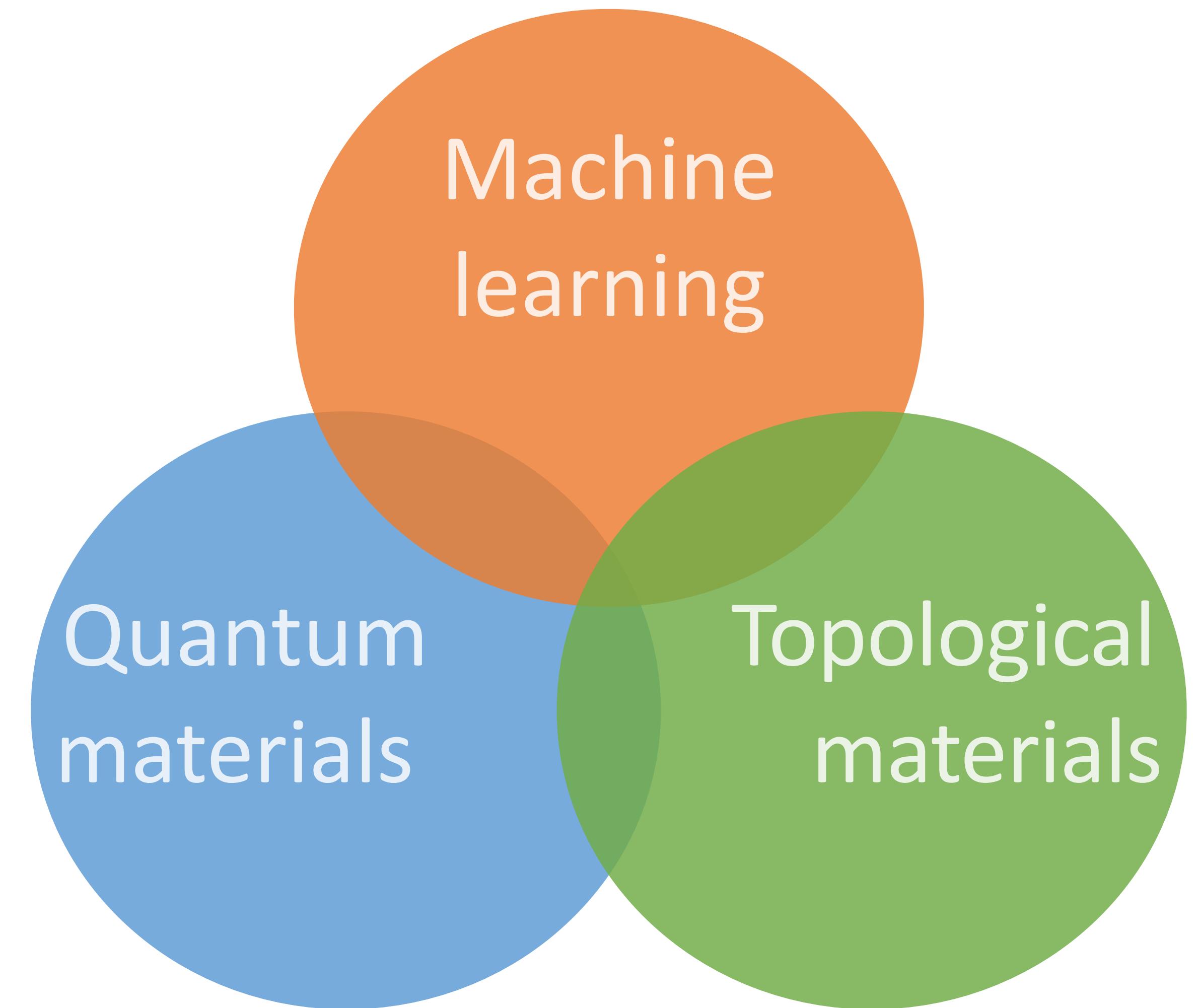
Methods

Vast range:

- classical physics
 - stochastic dynamics, molecular dynamics
- Statistical physics
- quantum many-body theory
- quantum field theory
- topology



Topics



Quantum Materials

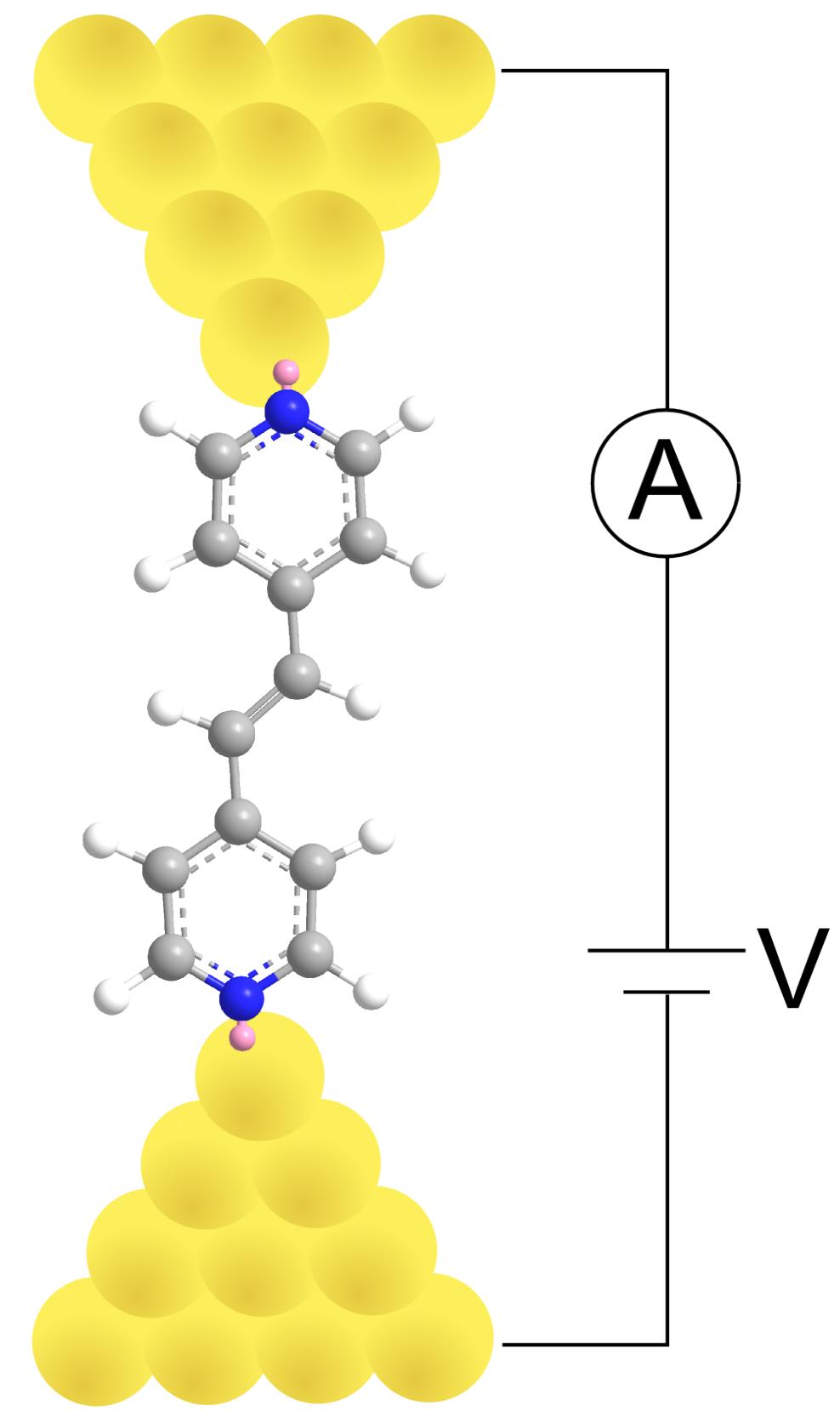
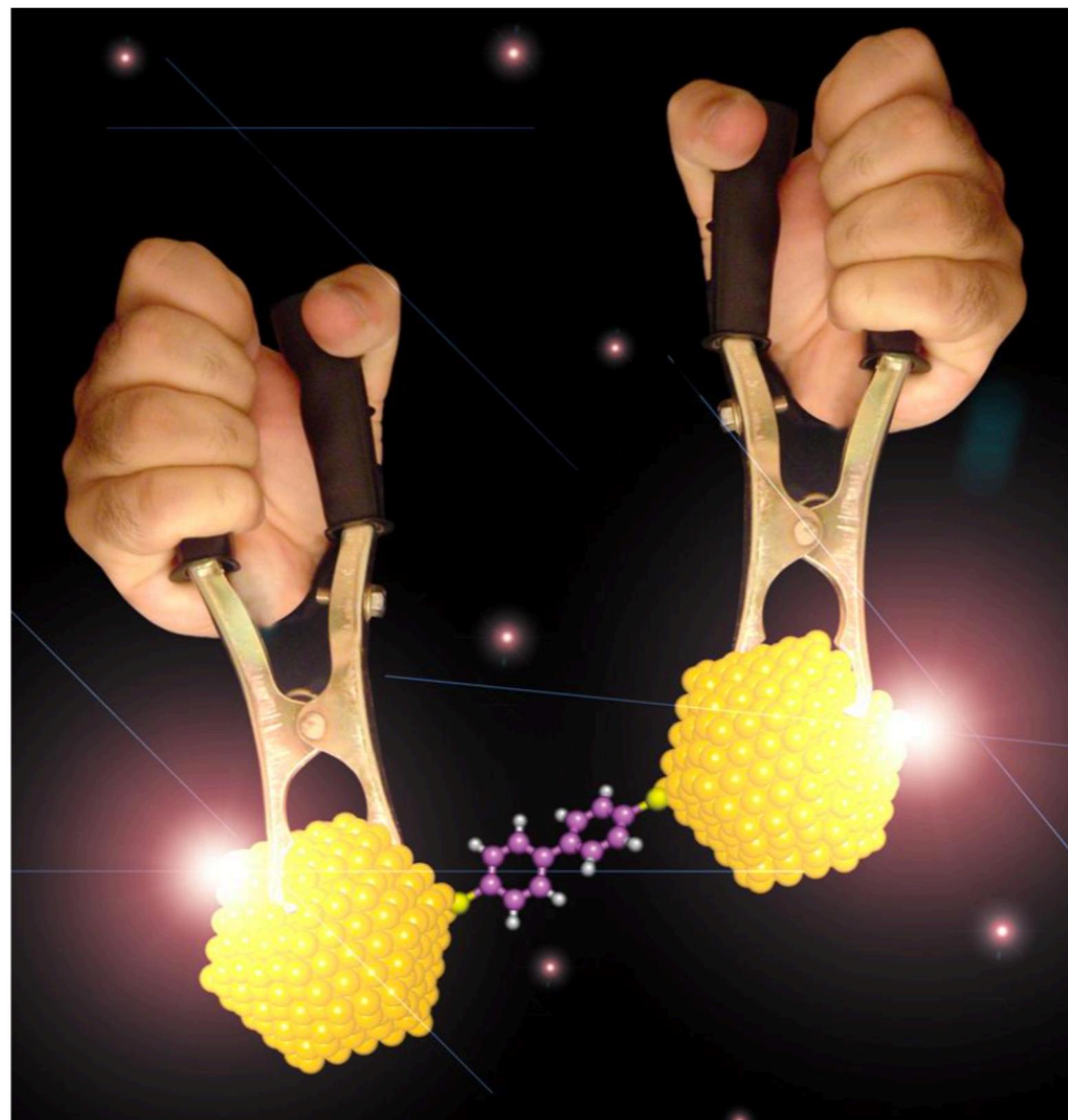
Cannot be understood by classical and elementary quantum mechanics

- Topological phases
 - (topological insulators, Weyl metals)
- Nontrivial electronic correlations
 - superconducting, magnetic
 - emergent low-energy behavior

“The physics of quantum materials”

B. Keimer & J. E. Moore, *Nature Physics*, **13**, 1045 (2017)

Quantum Materials: Molecular Electronics



F. Evers, R. Korytár, S. Tewari, J. M. van Ruitenbeek

Advances and challenges in single-molecule electron transport, Reviews of Modern Physics (2020)

Quantum Materials: Molecular Electronics

Opportunities for a theoretical physicist:

- transport of electric charge:
the conductance is fully determined by quantum effects
- transport of energy (heat)
- conversion of electric current into angular momentum
 - spin (a molecular bit)
 - mechanical rotation (molecular machine)

F. Evers, R. Korytár, S. Tewari, J. M. van Ruitenbeek

Advances and challenges in single-molecule electron transport, Reviews of Modern Physics (2020)

Quantum Materials: Molecular Electronics

Richard Korytár

- <http://ctcm.kfkl.cz>
- korytar@karlov.mff.cuni.cz