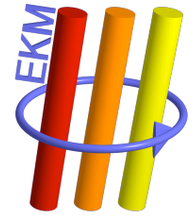


Using Interfaces and the Mesoscopic Structure of Superconductors to Boost T_c beyond the Present Limits

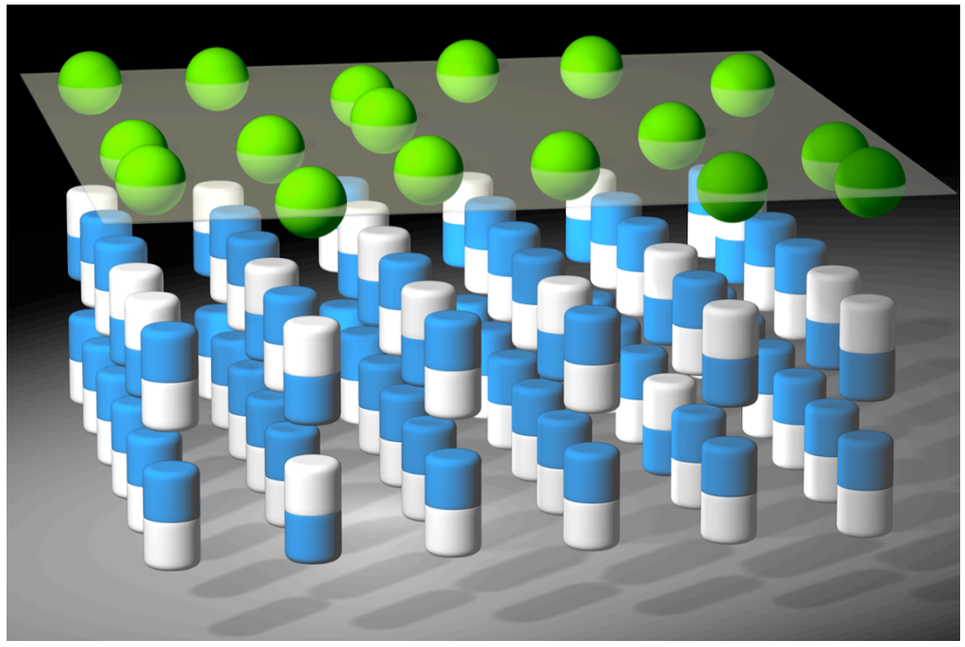
Jochen Mannhart

Center for Electronic Correlations and Magnetism

University of Augsburg

Santa Barbara, June 22, 2009

Using Interfaces to Enhance T_c



1) spatially separate

➢ exchange bosons (electronic coupling?)

from flow of carriers

➢ exchange bosons from doping (such as HTS)

➢ pair interaction from phase stabilization

2) create novel electronic phases

➢ correlation parameters at interfaces different from those of bulk

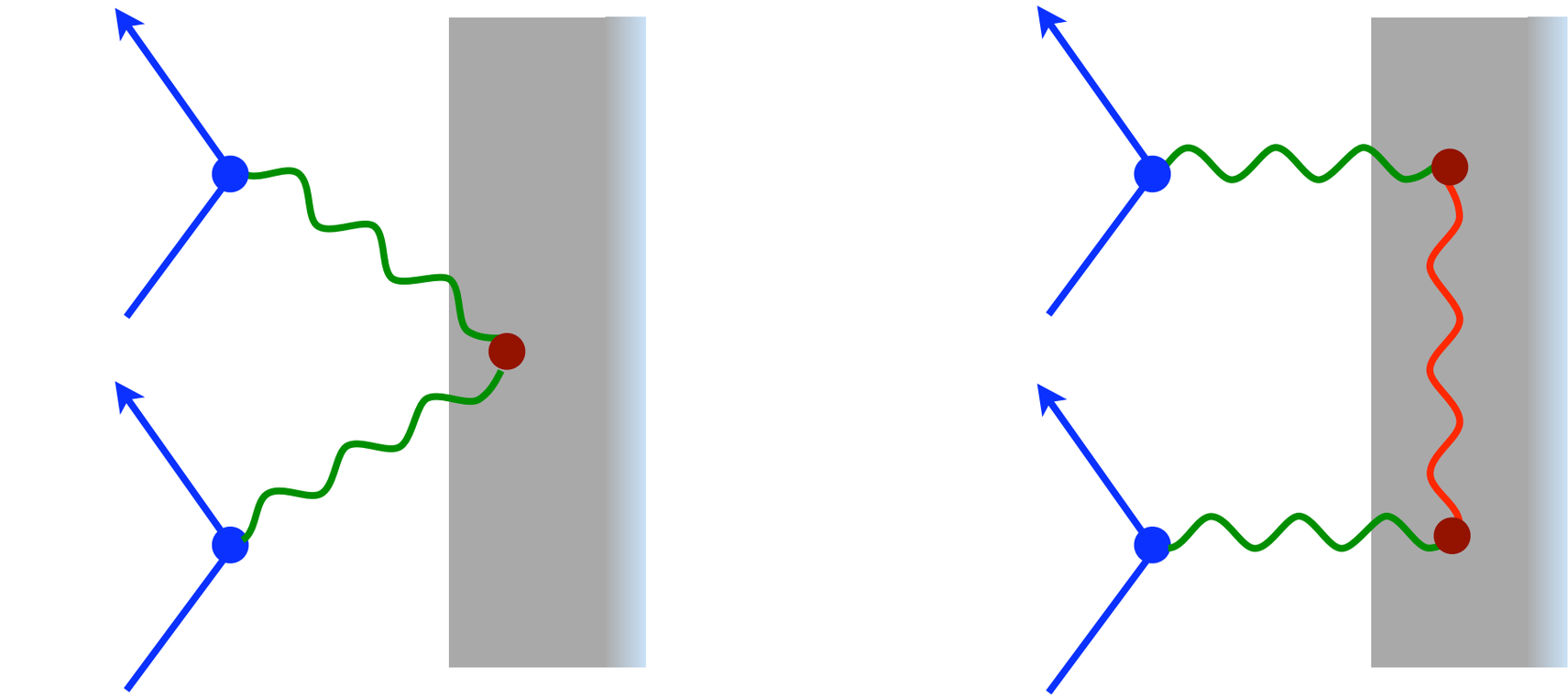
3) optimize band-structure, optimize doping

4) reduce Coulomb-repulsion

5) break inversion symmetry, create E-fields

6) stabilize superconducting phase, suppress adverse phase transitions

Spatial Separation of Carriers and Pairing Interaction



layer with mobile carriers

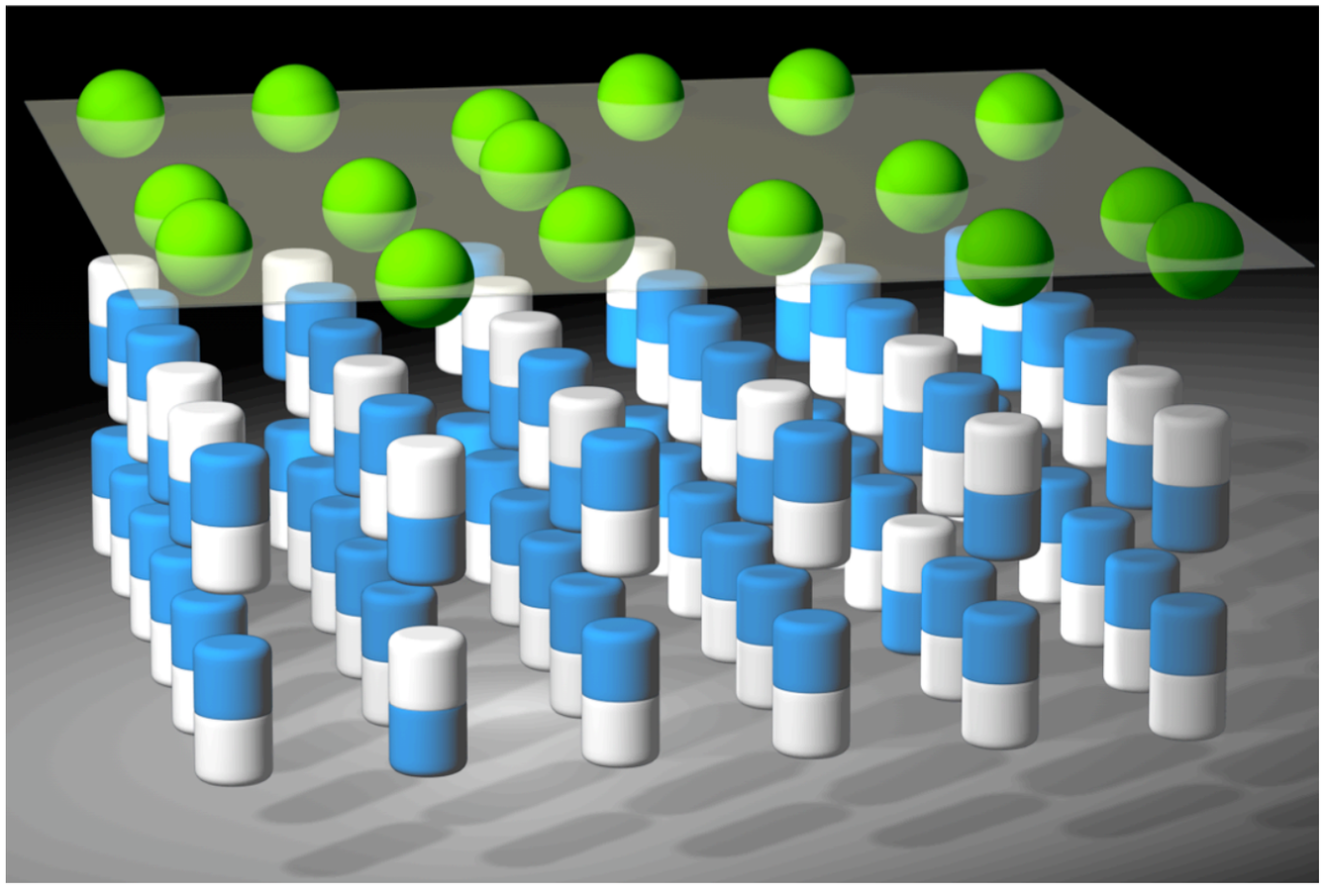
pairing layer

Spatial Separation of Carriers and Pairing Interaction

Model System:

mobile charge carriers at the interface,

pairing by virtual polarizations of the adjacent layer



mobile electrons

(TiO_2)

polarizable dipoles

($SrTiO_3$)

V. Koerting *et al.*, PRB **71**, 104510 (2005)

Challenges for Theory

Modelling of electronic systems at interfaces, including

- ➢ electronic correlations
- ➢ full relaxation
- ➢ large supercells

with predictive power