



Optical spectroscopy

Leonardo Degiorgi, Laboratorium für Festkörperphysik,
Department of Physics, ETH Zürich, Switzerland

History

PHYSICAL REVIEW B

SOLID STATE

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1 JANUARY 1970

Optical Properties of Substitutional H- and Li-Atom Impurities in Solid Argon and Neon*

RAJ K. BHARGAVA[†] AND D. L. DEXTER[‡]

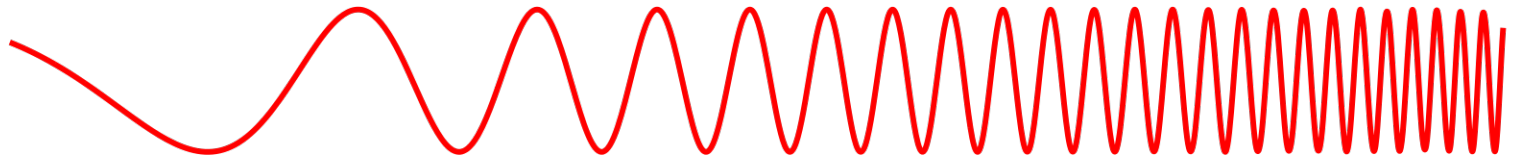
Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627

(Received 22 July 1969)

A tight-binding formalism is presented for the calculation of the excitation energies and oscillator strengths for low-lying excitations, and of the ground-state polarizabilities, of substitutional impurities in rare-gas solids. The formalism is applied to hydrogen- and lithium-atom impurities in solid neon and in solid argon at 0°K, and numerical results are presented.

The Electromagnetic Spectrum

Penetrates Earth's Atmosphere?



Radiation Type
Wavelength (m)

Radio

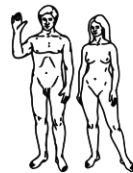
10^3



Buildings

Microwave

10^{-2}



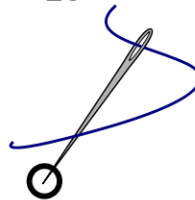
Humans

Infrared

10^{-5}



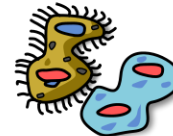
Butterflies



Needle Point

Visible

0.5×10^{-6}



Protozoans

Ultraviolet

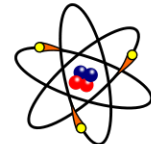
10^{-8}



Molecules

X-ray

10^{-10}



Atoms

Gamma ray

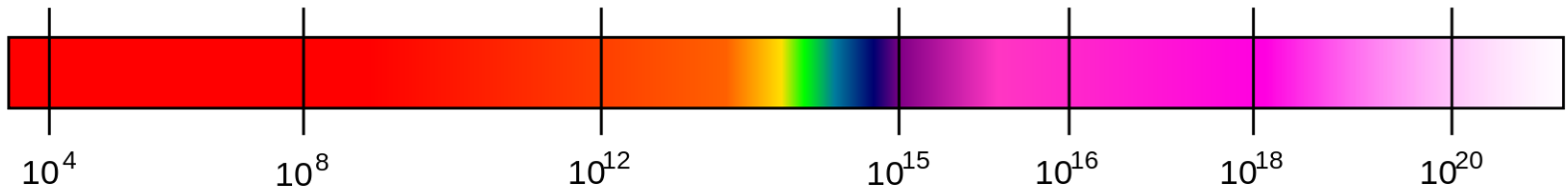
10^{-12}



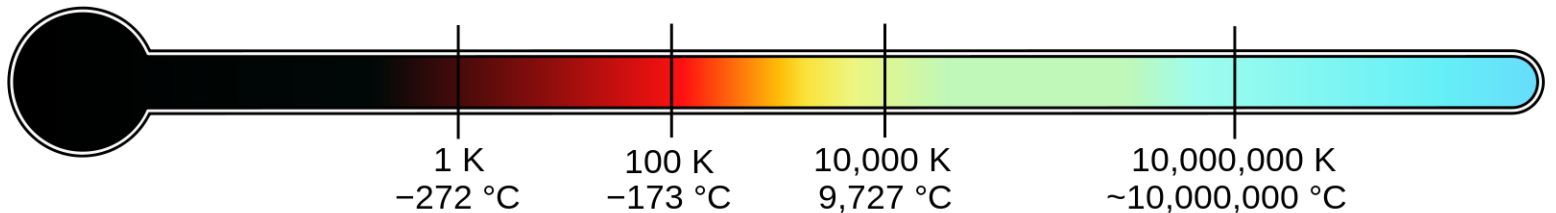
Atomic Nuclei

Approximate Scale
of Wavelength

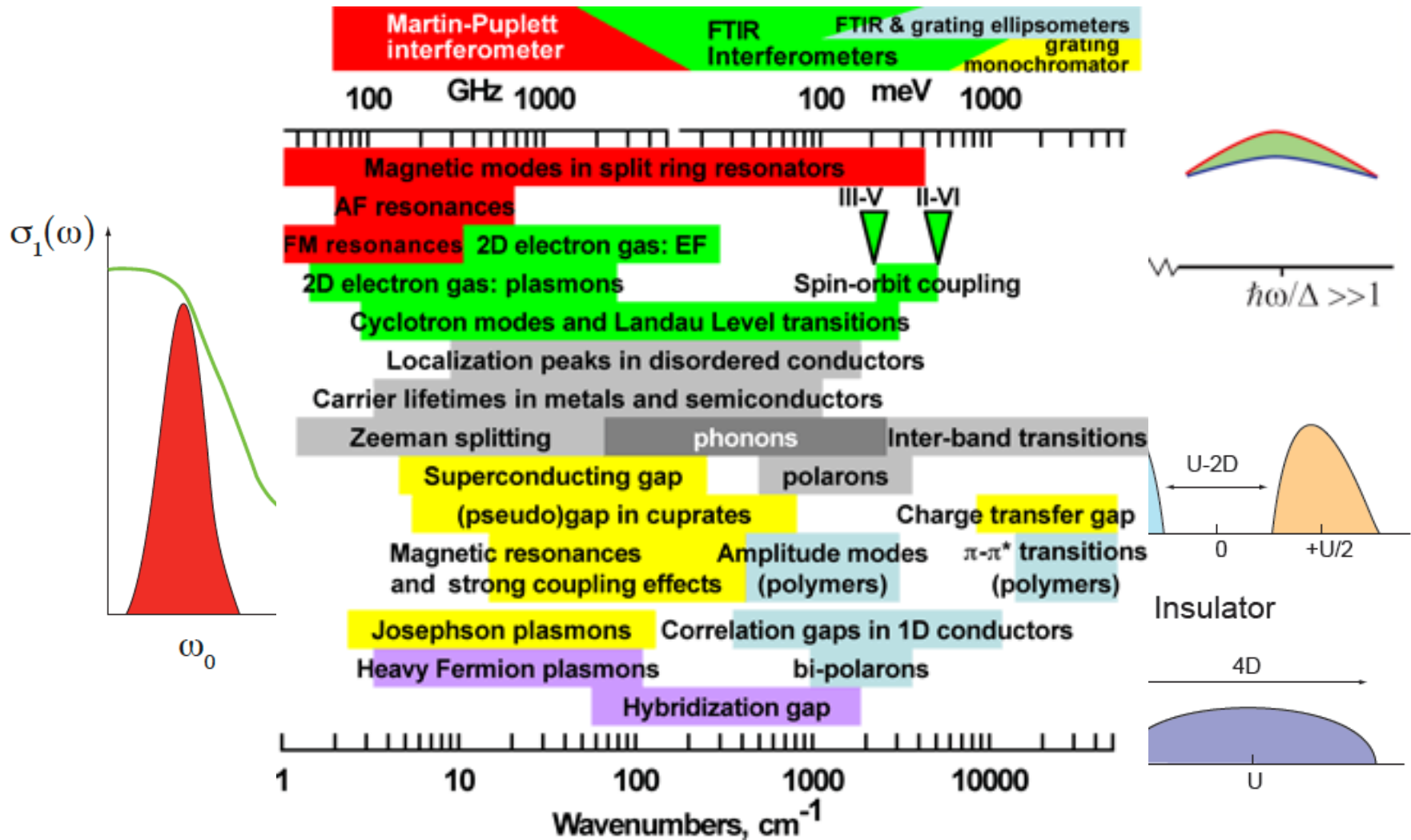
Frequency (Hz)



Temperature of
objects at which
this radiation is the
most intense
wavelength emitted

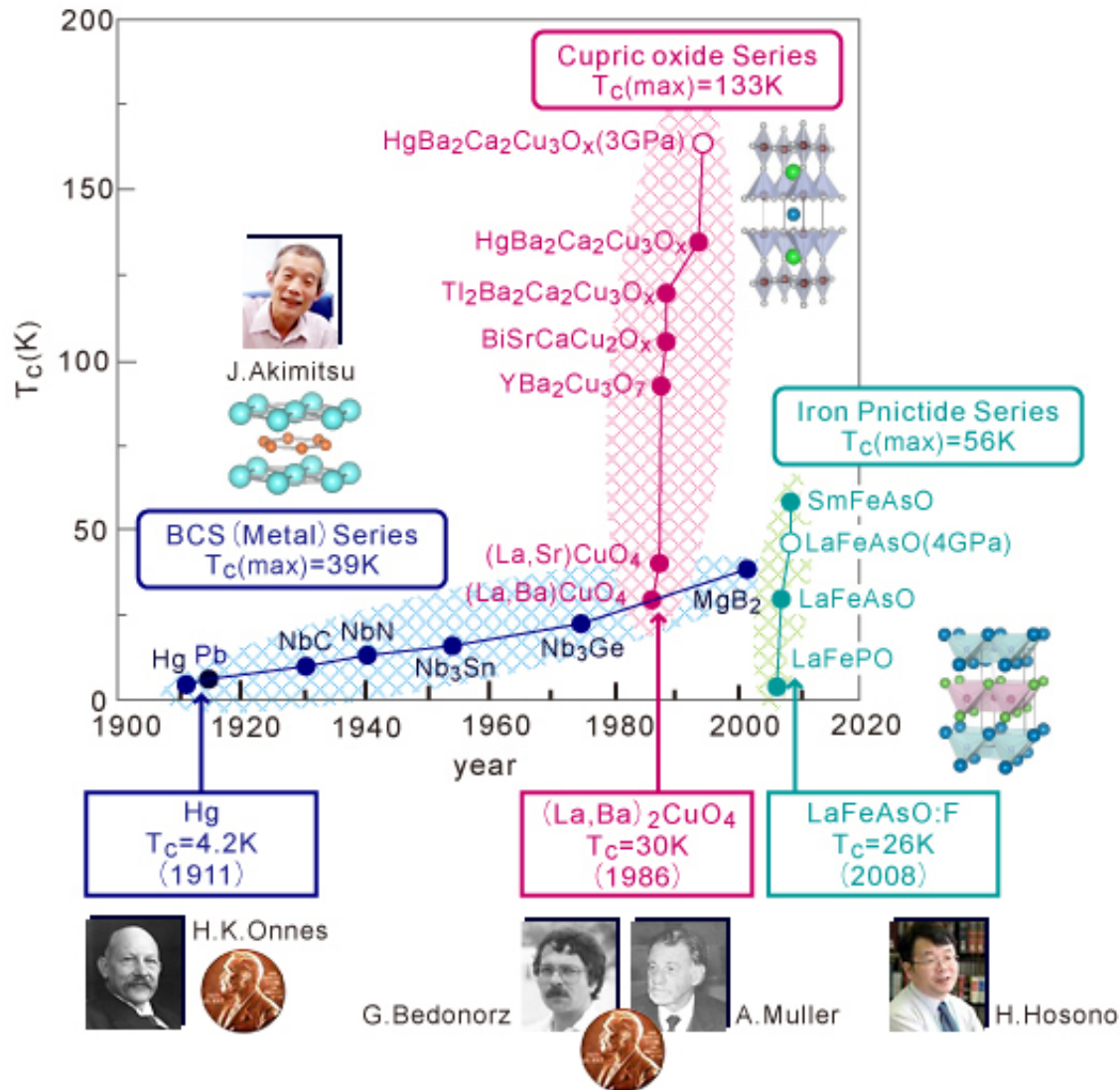


Energy Scales in Condensed Matter

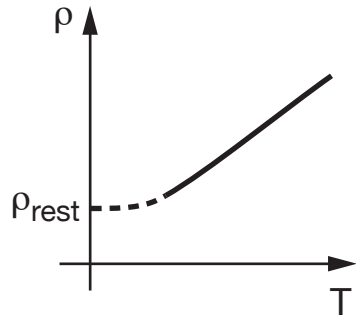




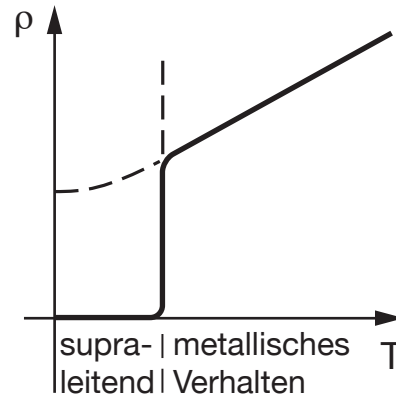
Superconductivity



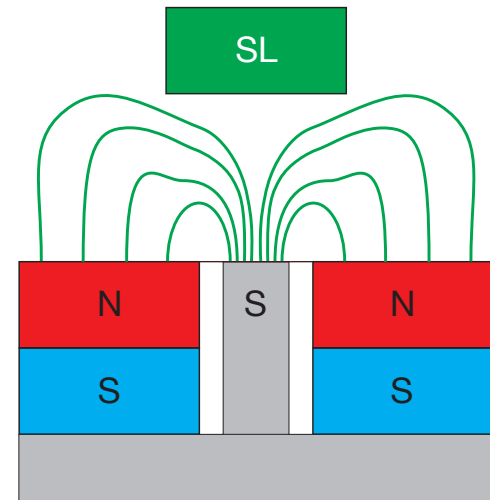
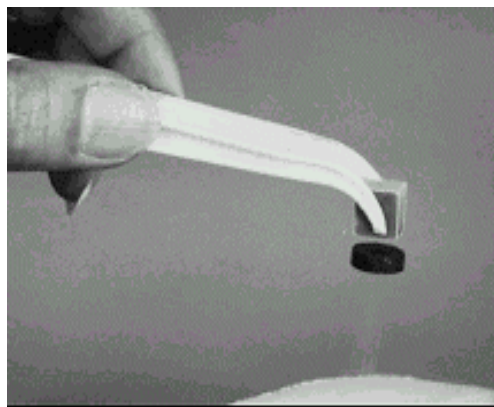
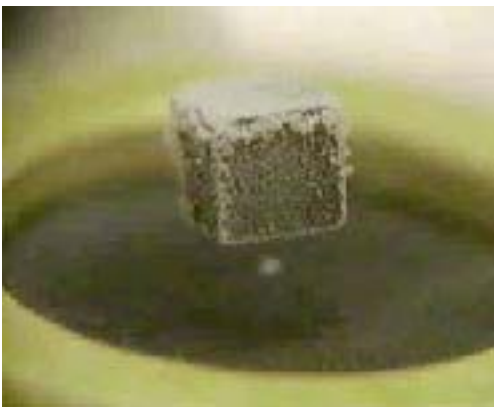
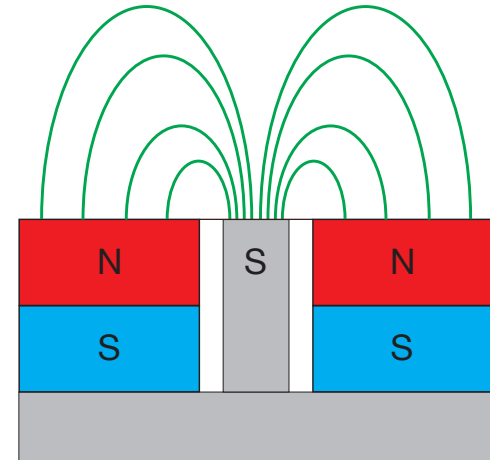
Superconductivity: a few Facts



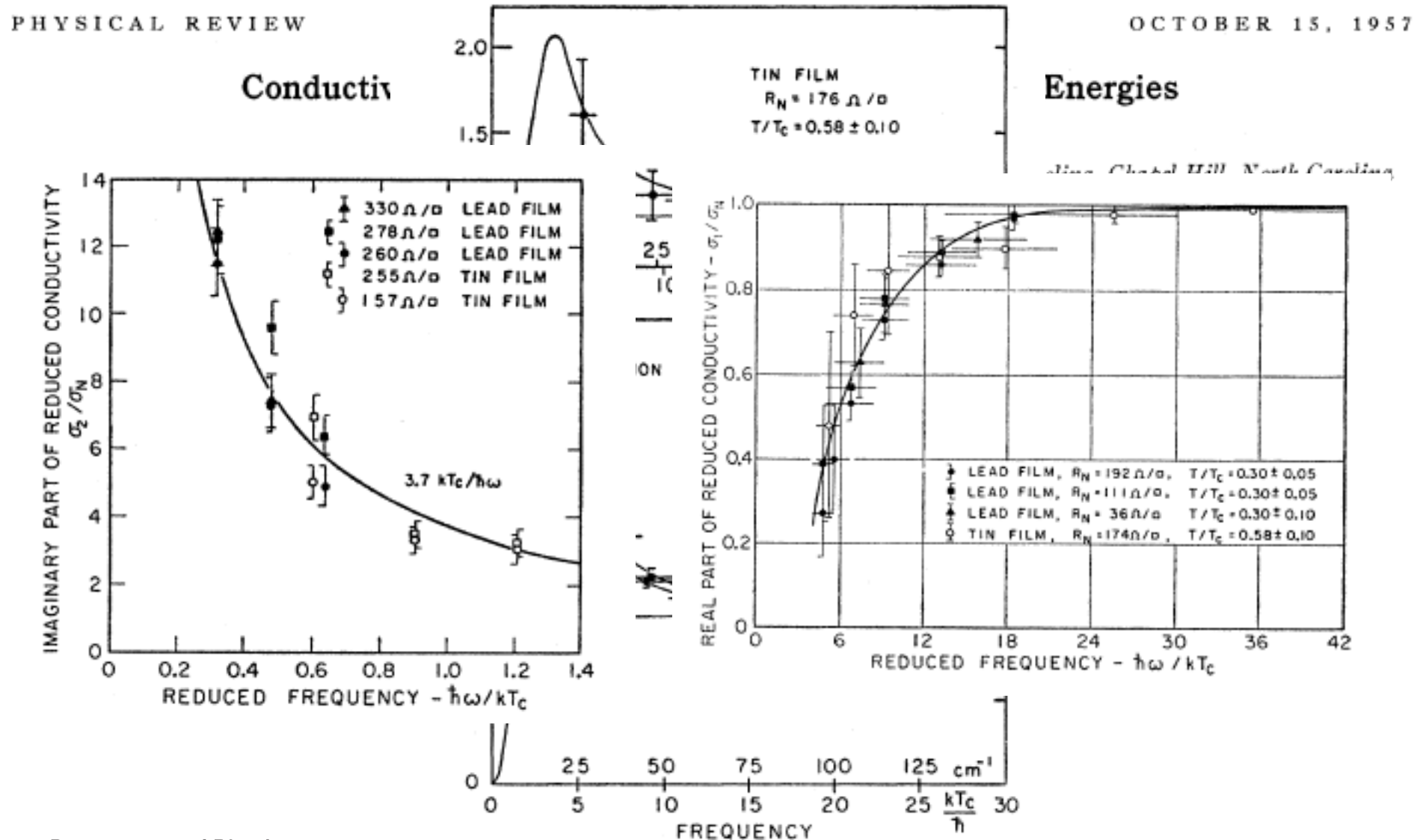
(a)



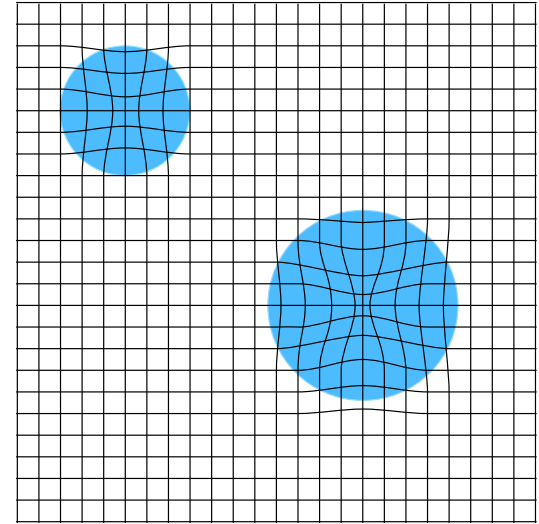
(b)



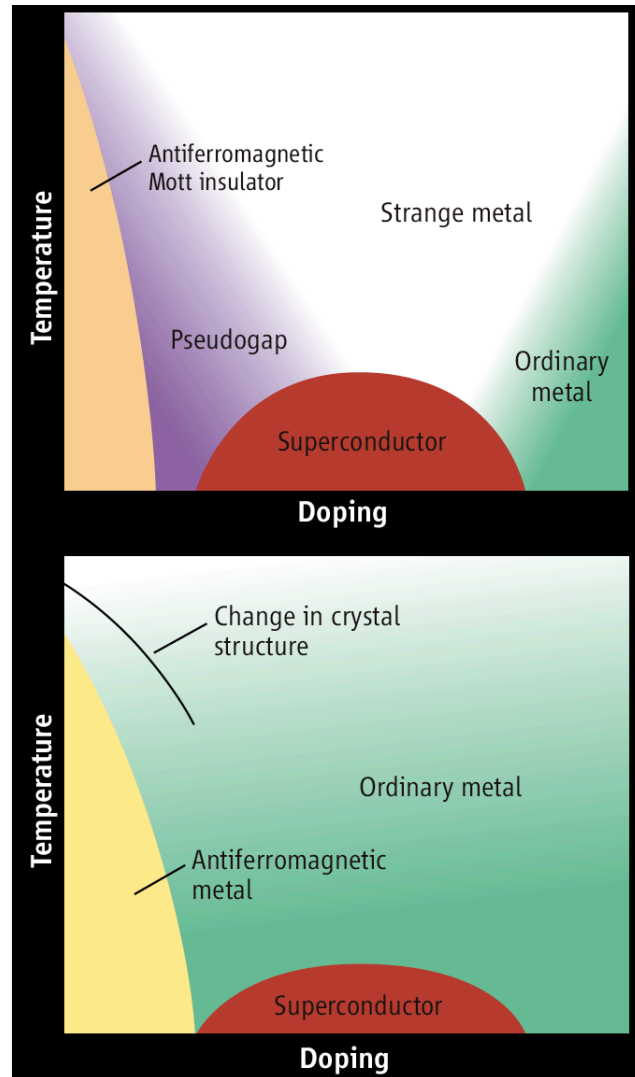
Discovery of the Superconducting Gap



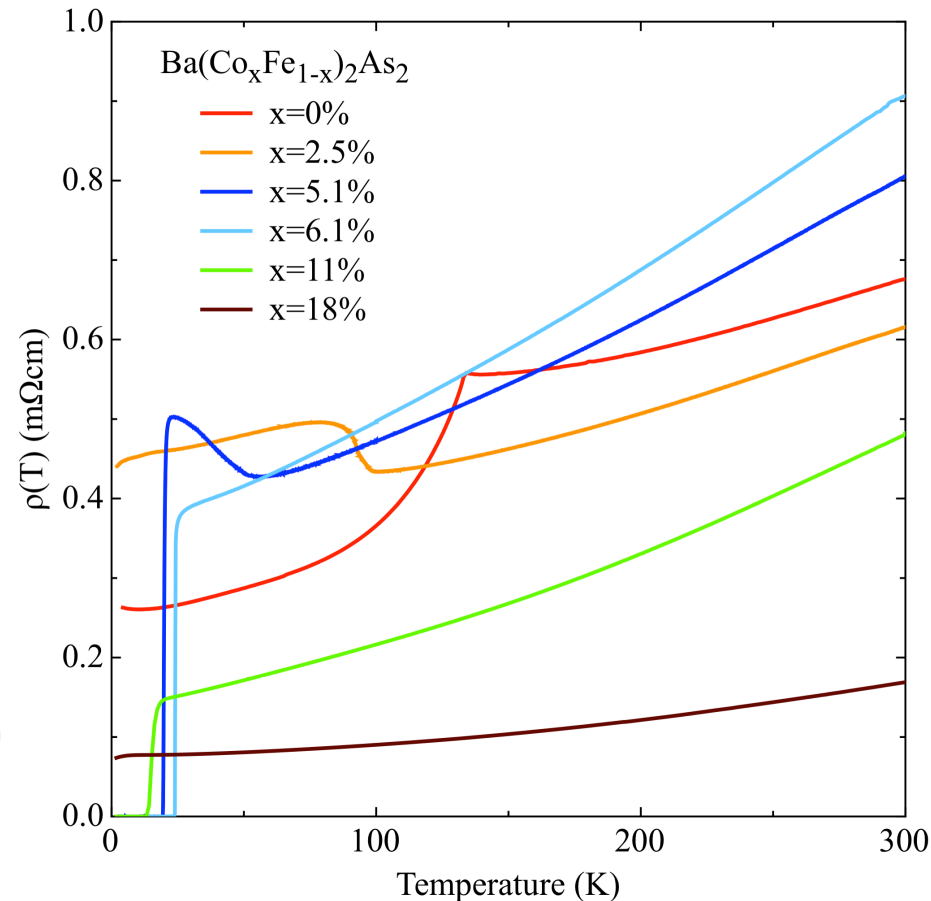
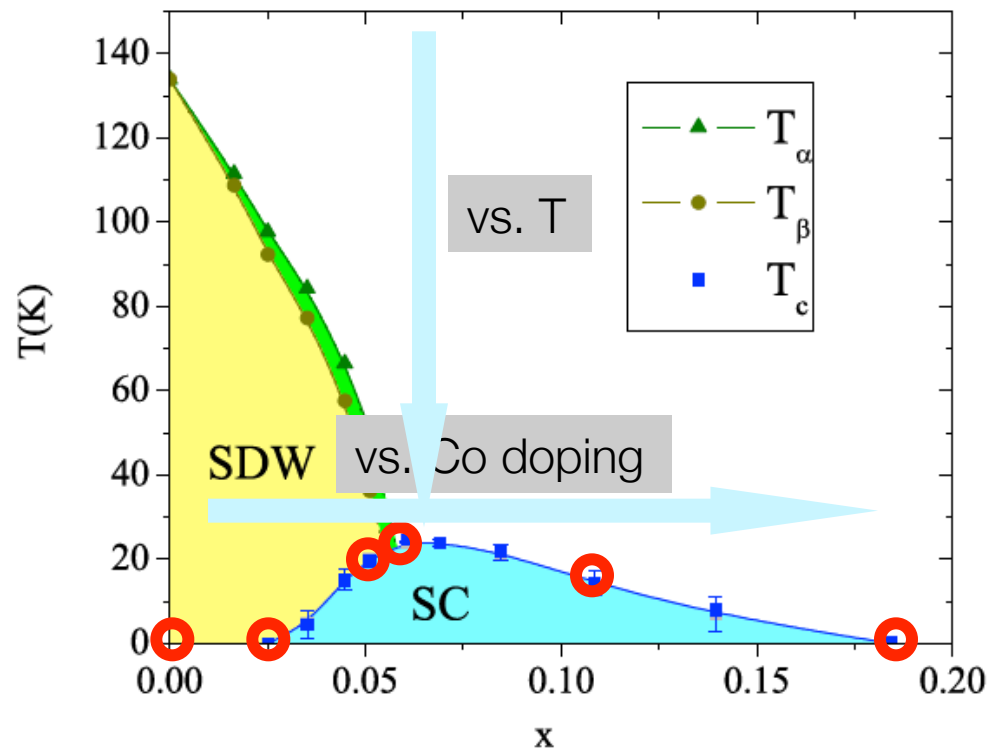
The BCS Theory of Superconductivity



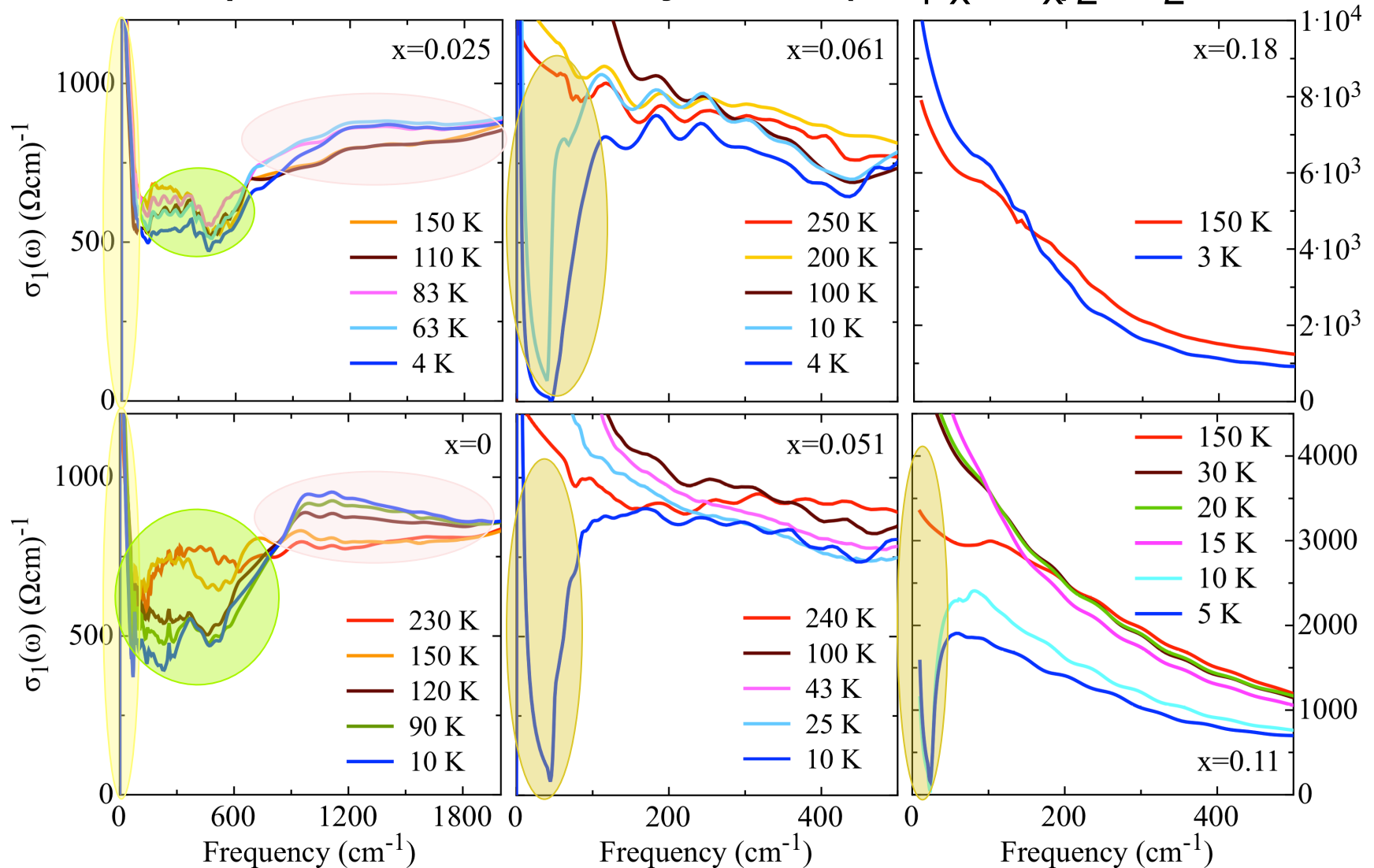
Iron-based versus Cuprate Superconductors



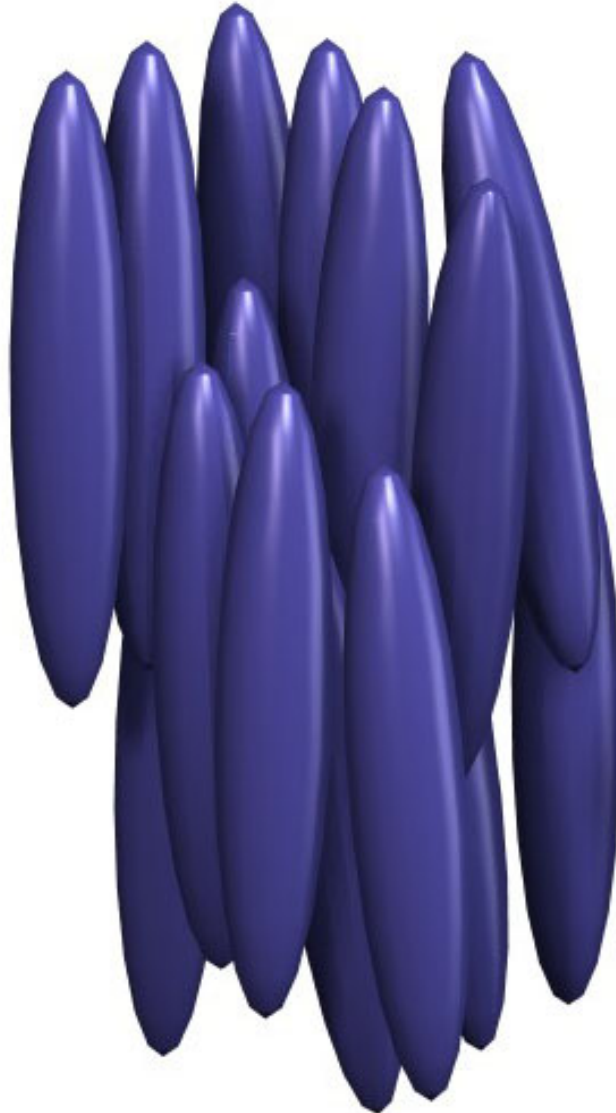
Phase Diagram and DC Transport Properties in $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$



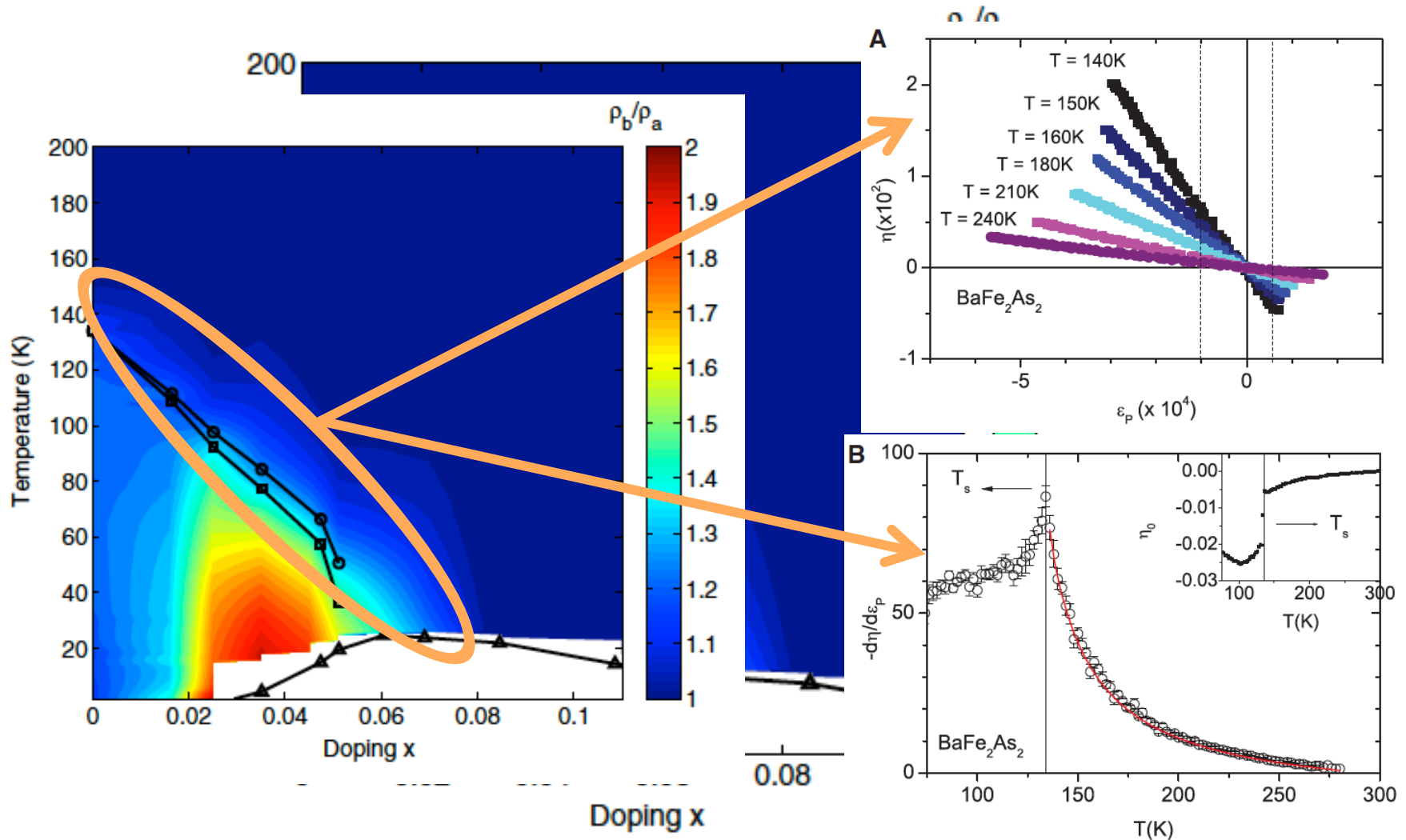
Optical Conductivity of $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$



Nematic Phase

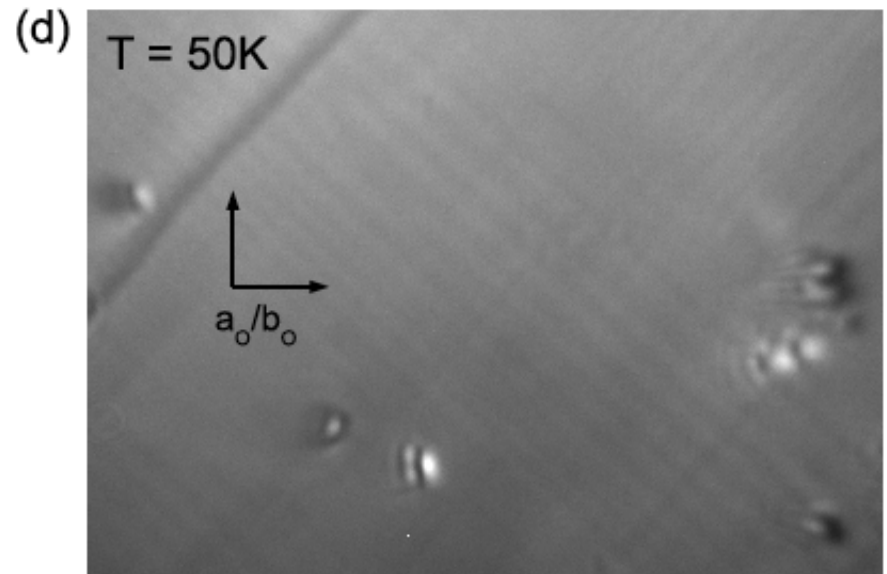
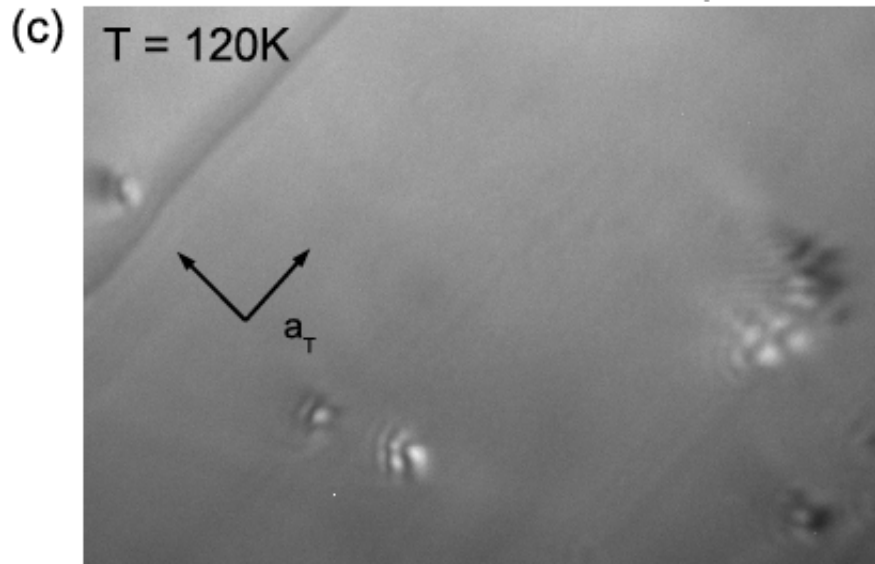
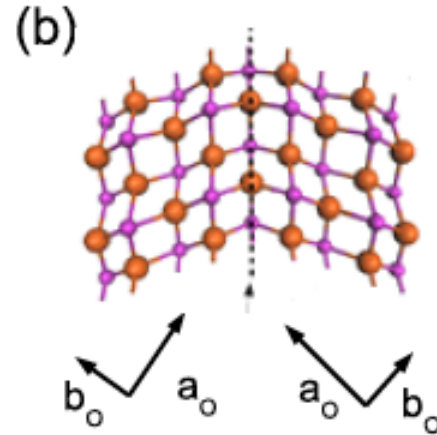
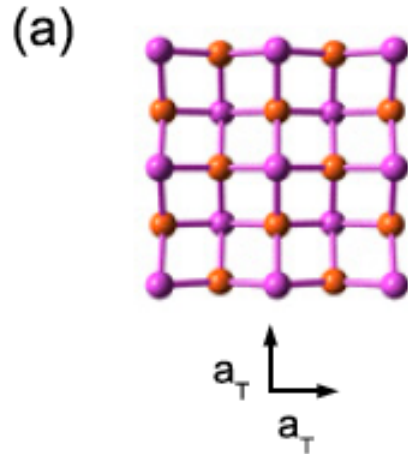


DC Transport Anisotropy in Iron-Pnictides

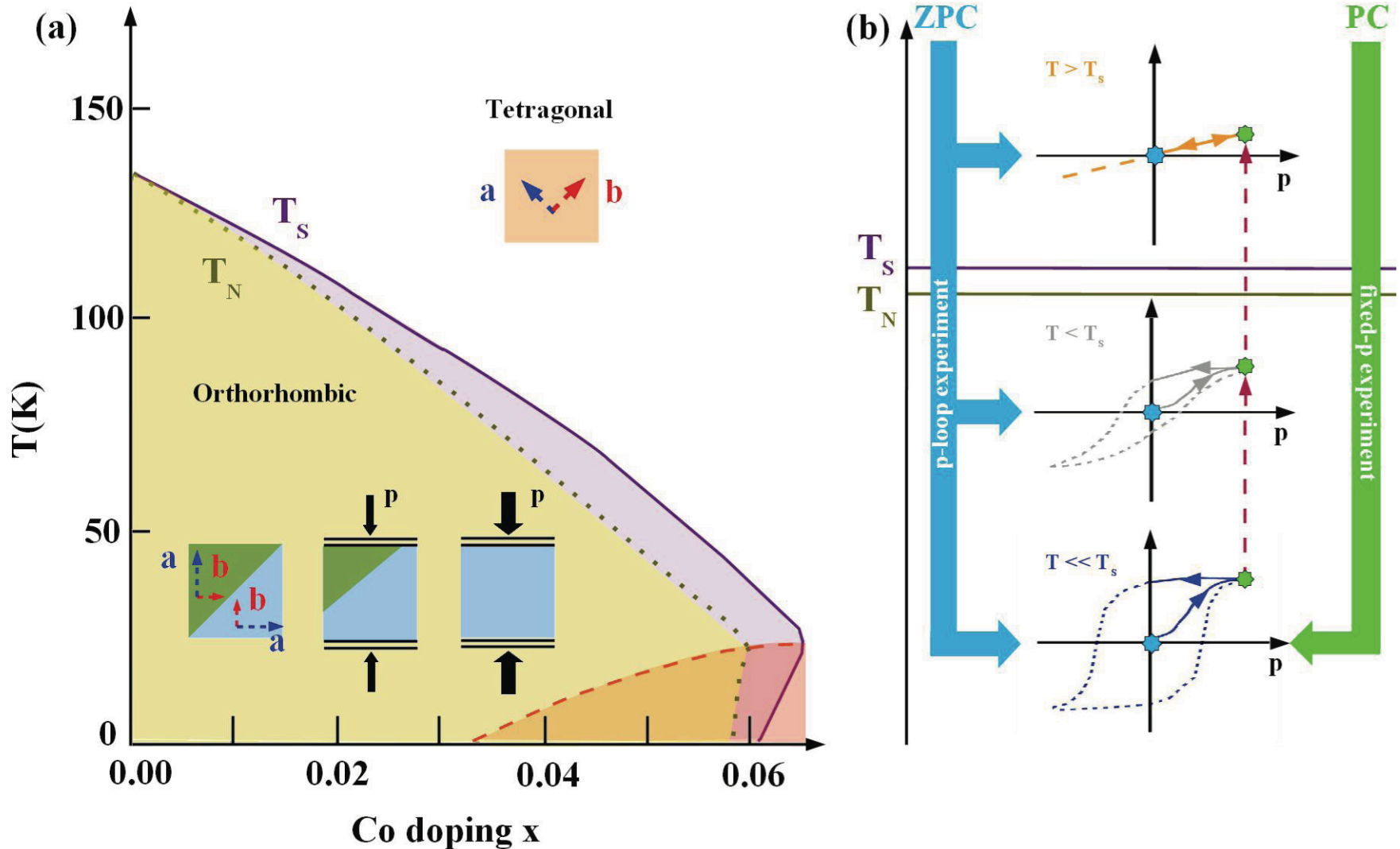


Chu et al., Science **329**, 824 (2010) and
Science **337**, 710 (2012)

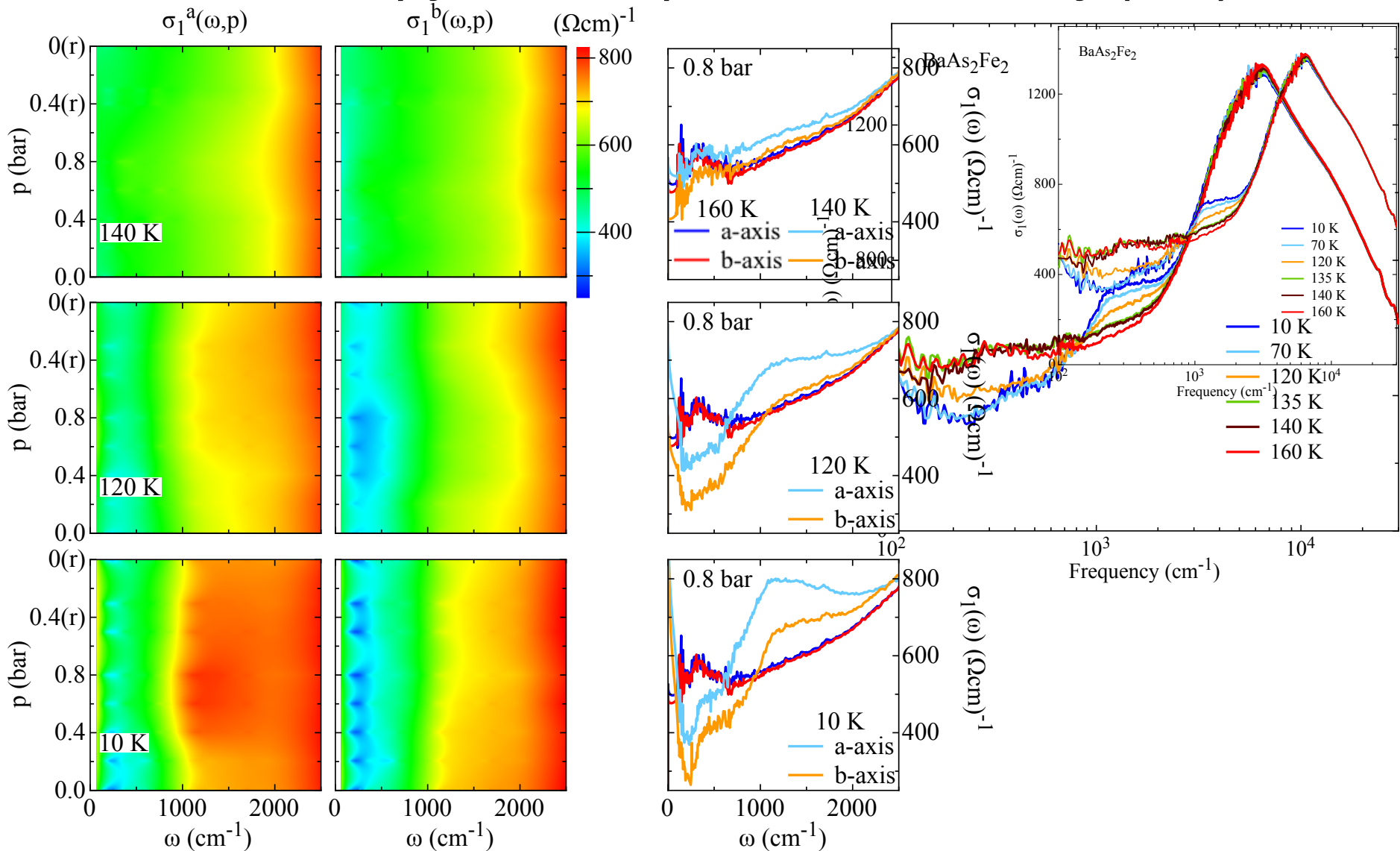
Twin Formation in Underdoped Fe-Arsenide Superconductors



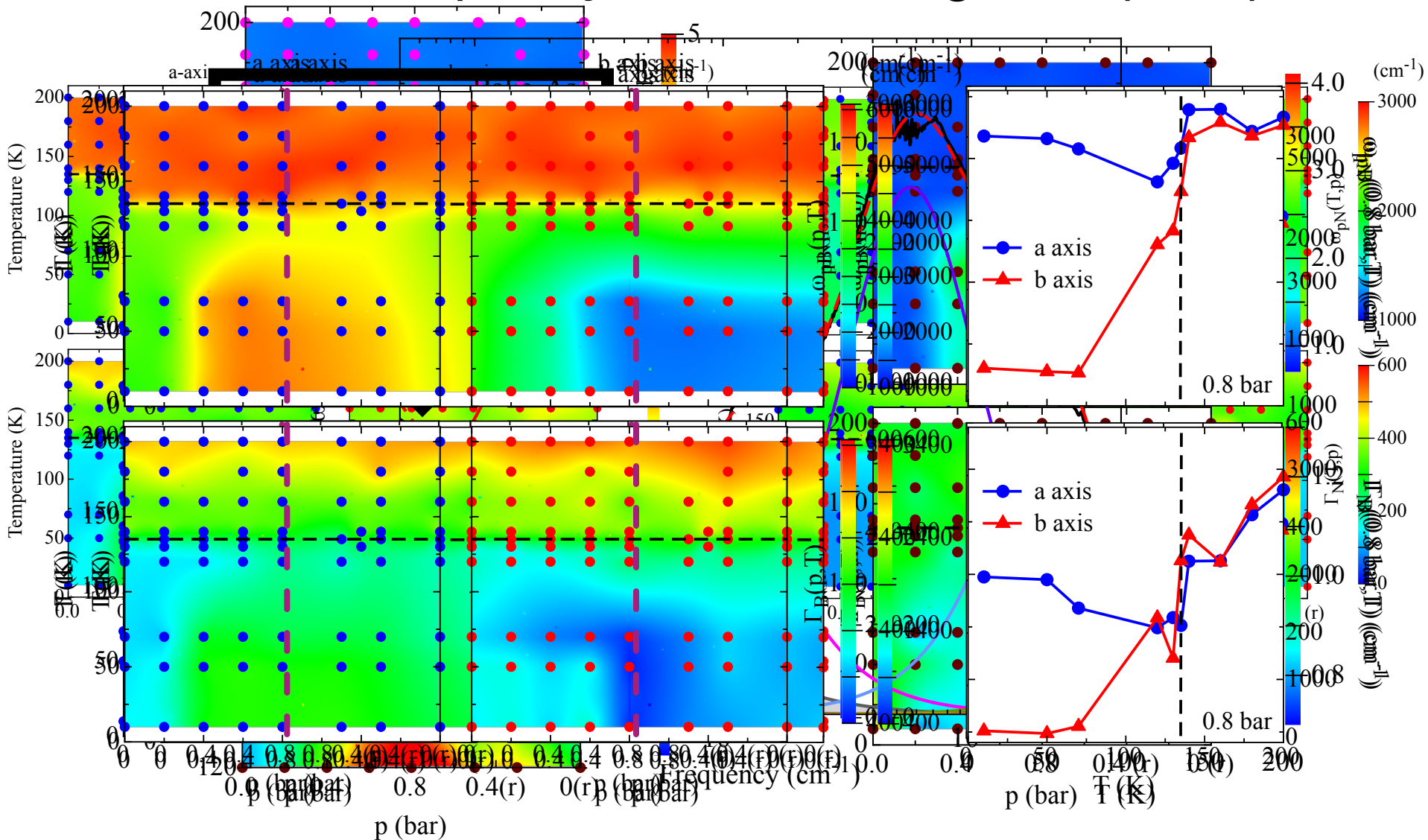
Ferroelastic Tetragonal-to-Orthorhombic Transition



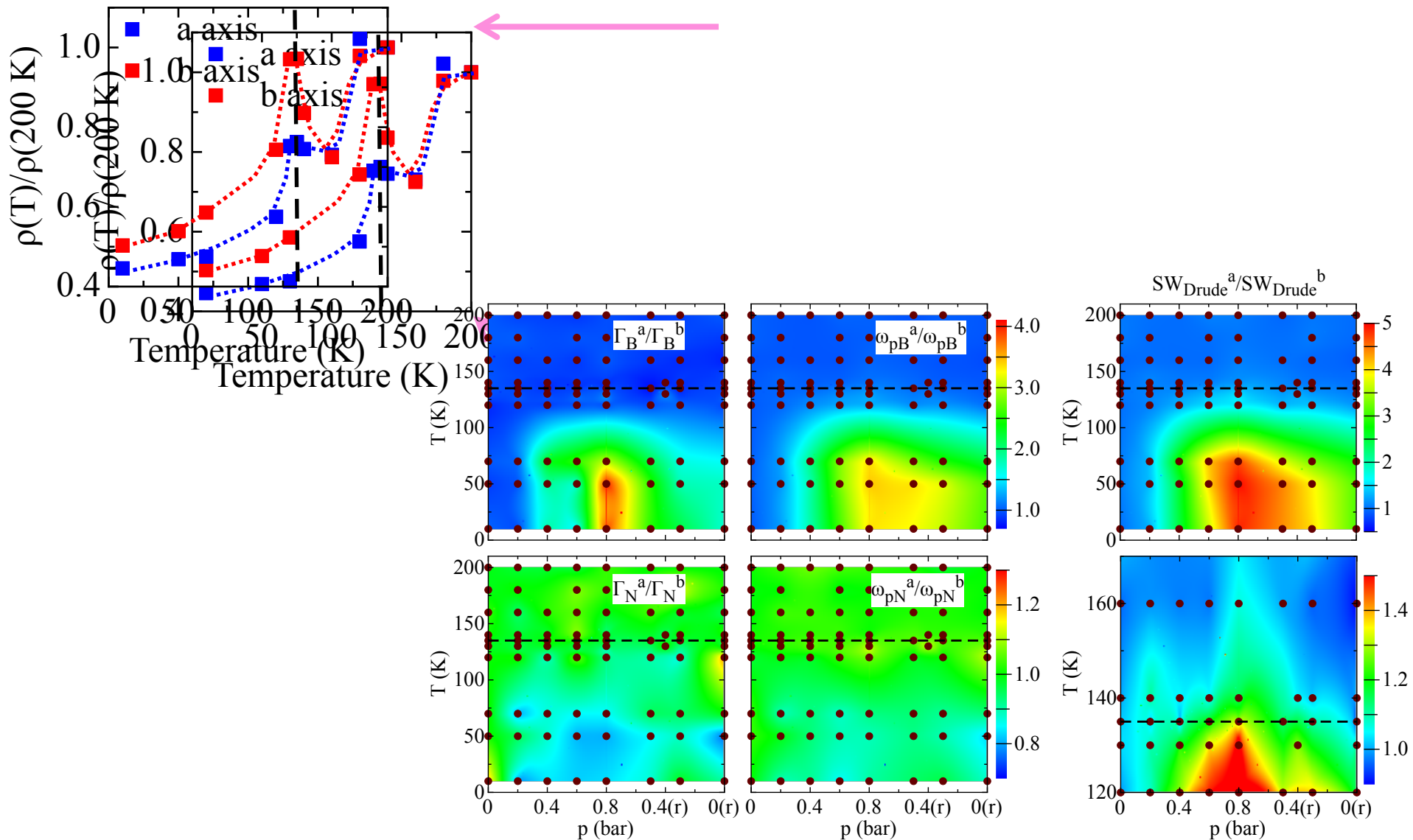
Anisotropy of the Optical Conductivity ($x=0$)



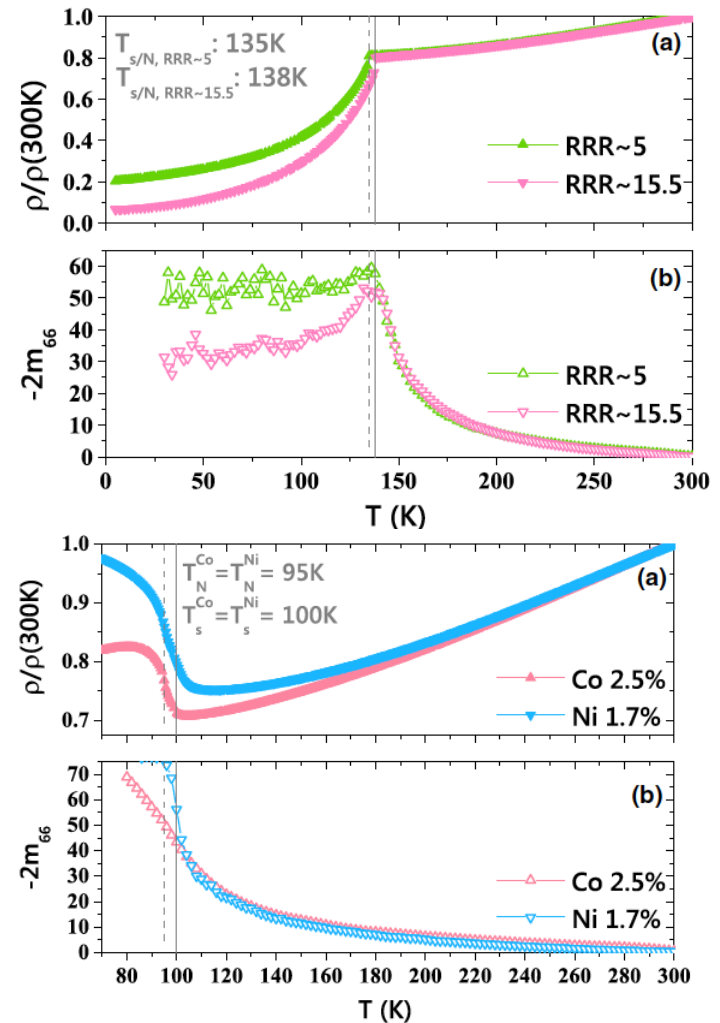
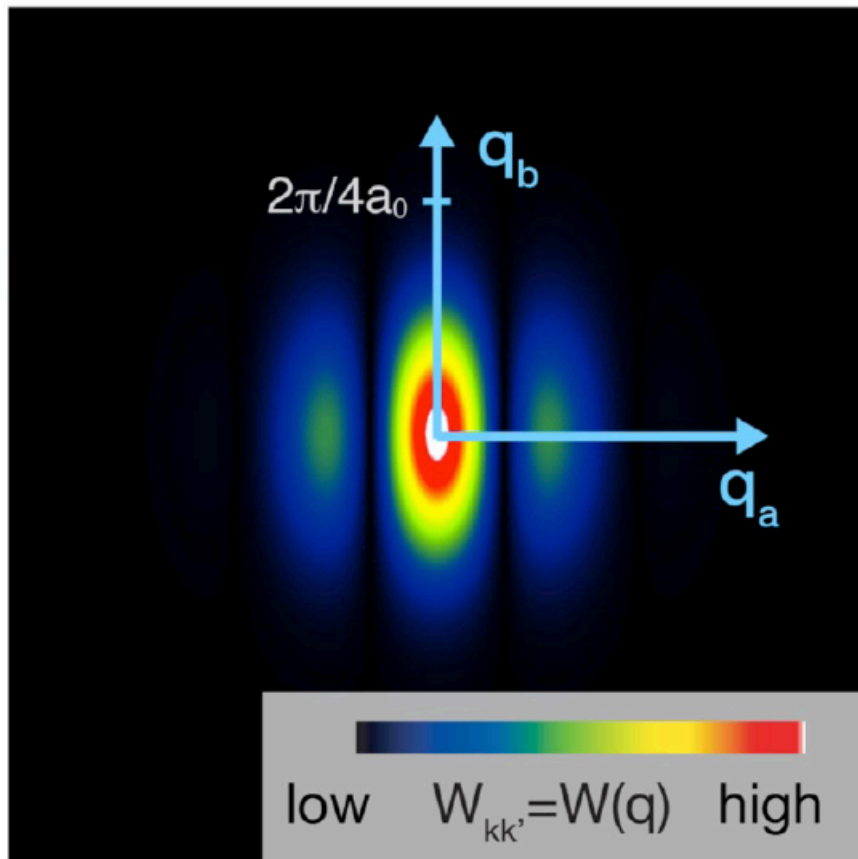
Plasma Frequency and Scattering Rate ($x = 0$)



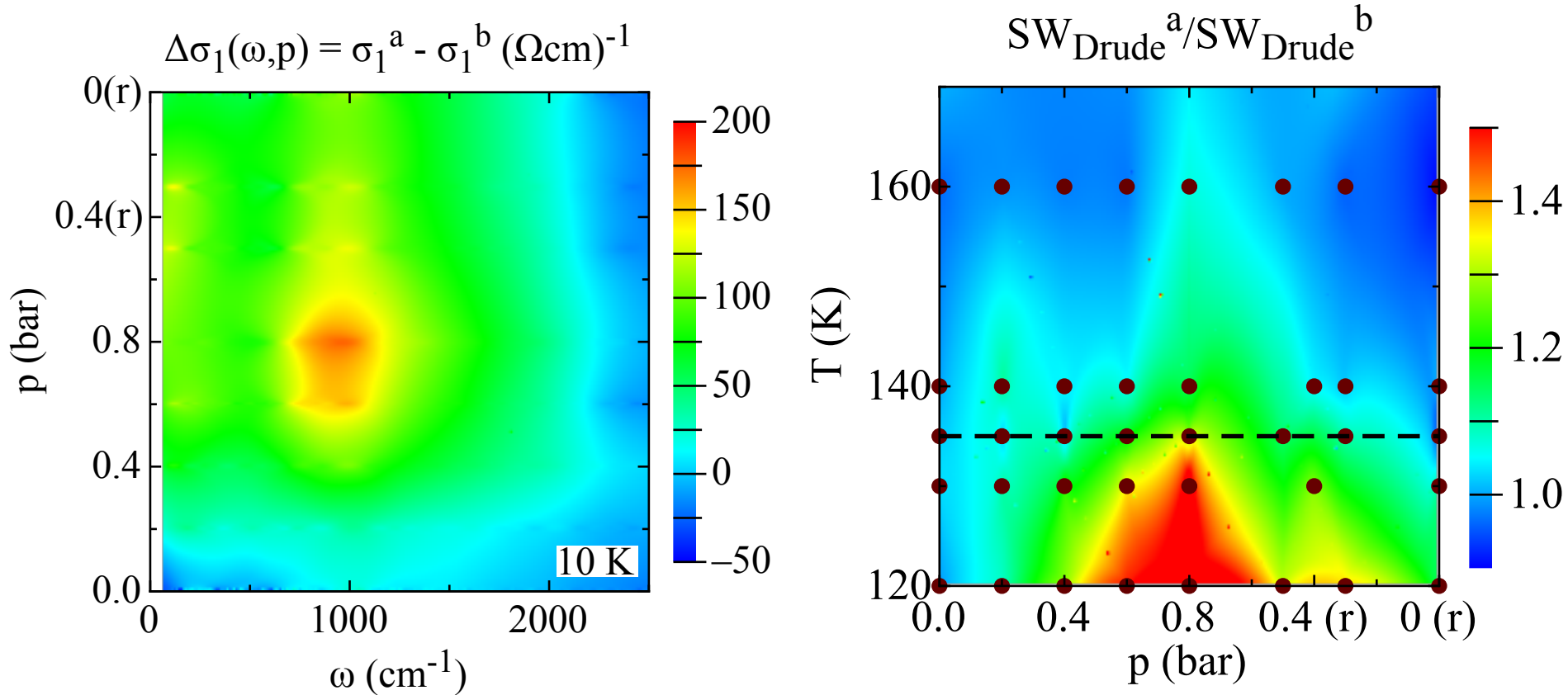
DC Transport Properties from the Fit ($x = 0$)



Nematic Transport: Anisotropic Impurity States versus Fermi Surface Anisotropy

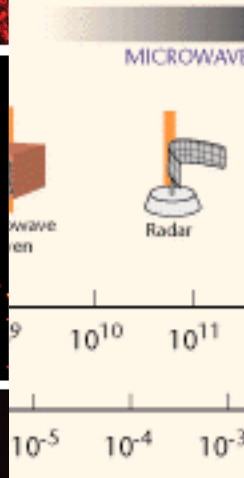
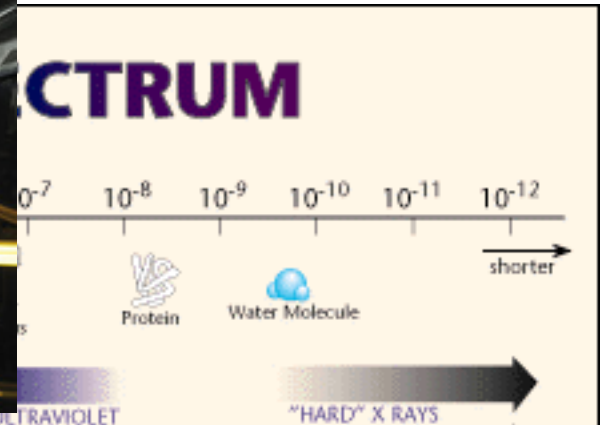
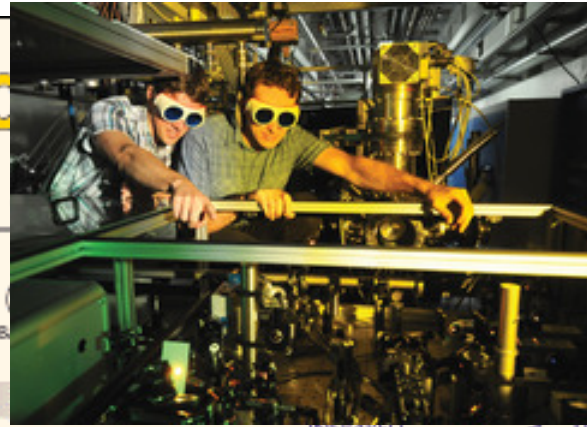
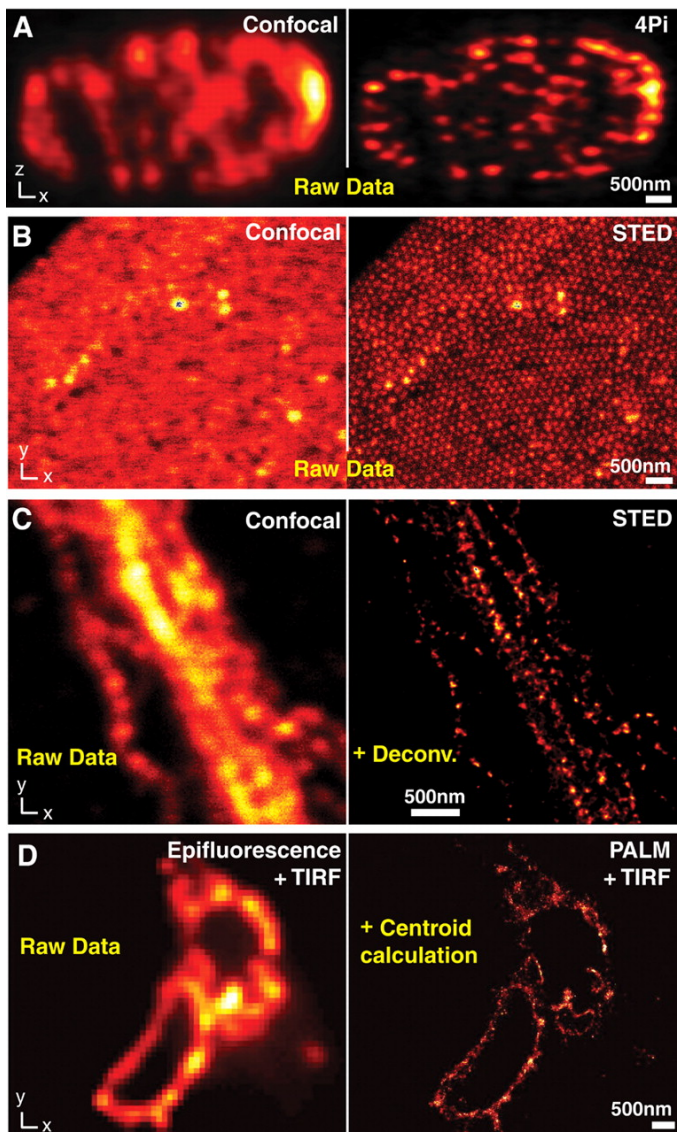


Conclusions



More details in cond-mat/1504.06829 and soon in Phys. Rev. Lett.

Light for Science



Acknowledgements



Chiara Mirri



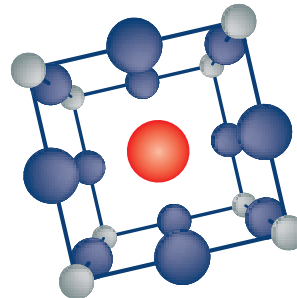
Adam Dusza



Manuel Chinotti



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FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION



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Samples

I.R. Fisher
J.G. Analytis
J.-H. Chu
H.-H. Kuo
(Stanford University)

Theory

A. Sanna
S. Sharma
J.K. Dewhurst
E.K.U. Gross
(MPI Halle)

G. Profeta
(University of Aquila)

F. Bernardini
S. Massidda
(University of Cagliari)

