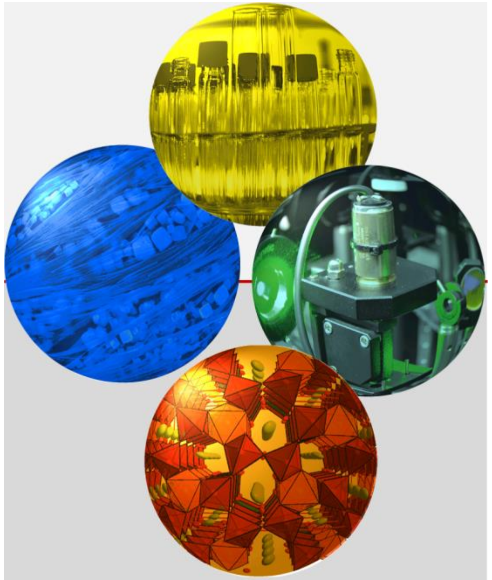
Interreg Italia-Österreich
European Regional Development Fund
EUROPEAN UNION

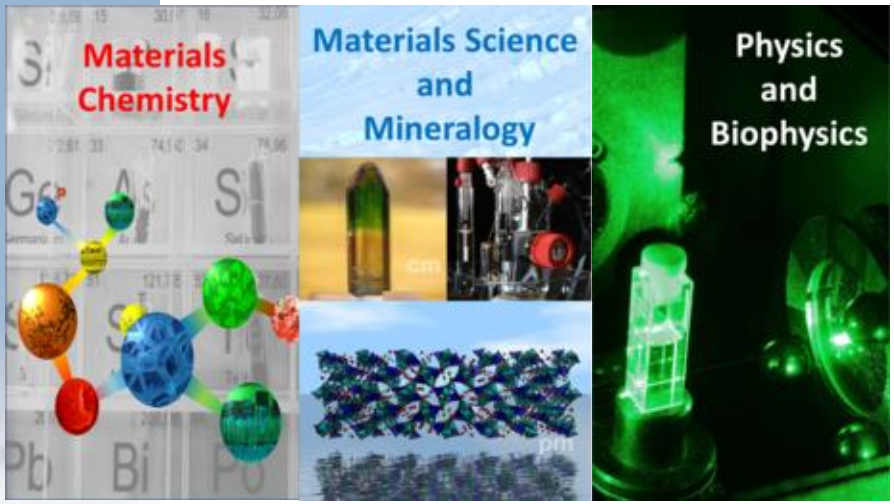
UNIVERSITÄT SALZBURG

InCIMa



InCIMa – PP2 University of Salzburg

Maurizio Musso – Gilles Bourret



Department of Chemistry And Physics of Materials

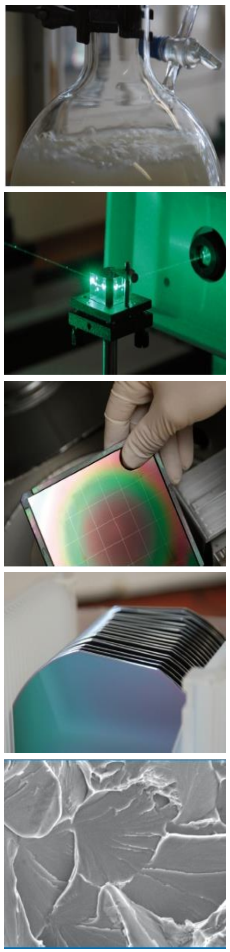
New Building for Research and Teaching at the Location Salzburg Itzling

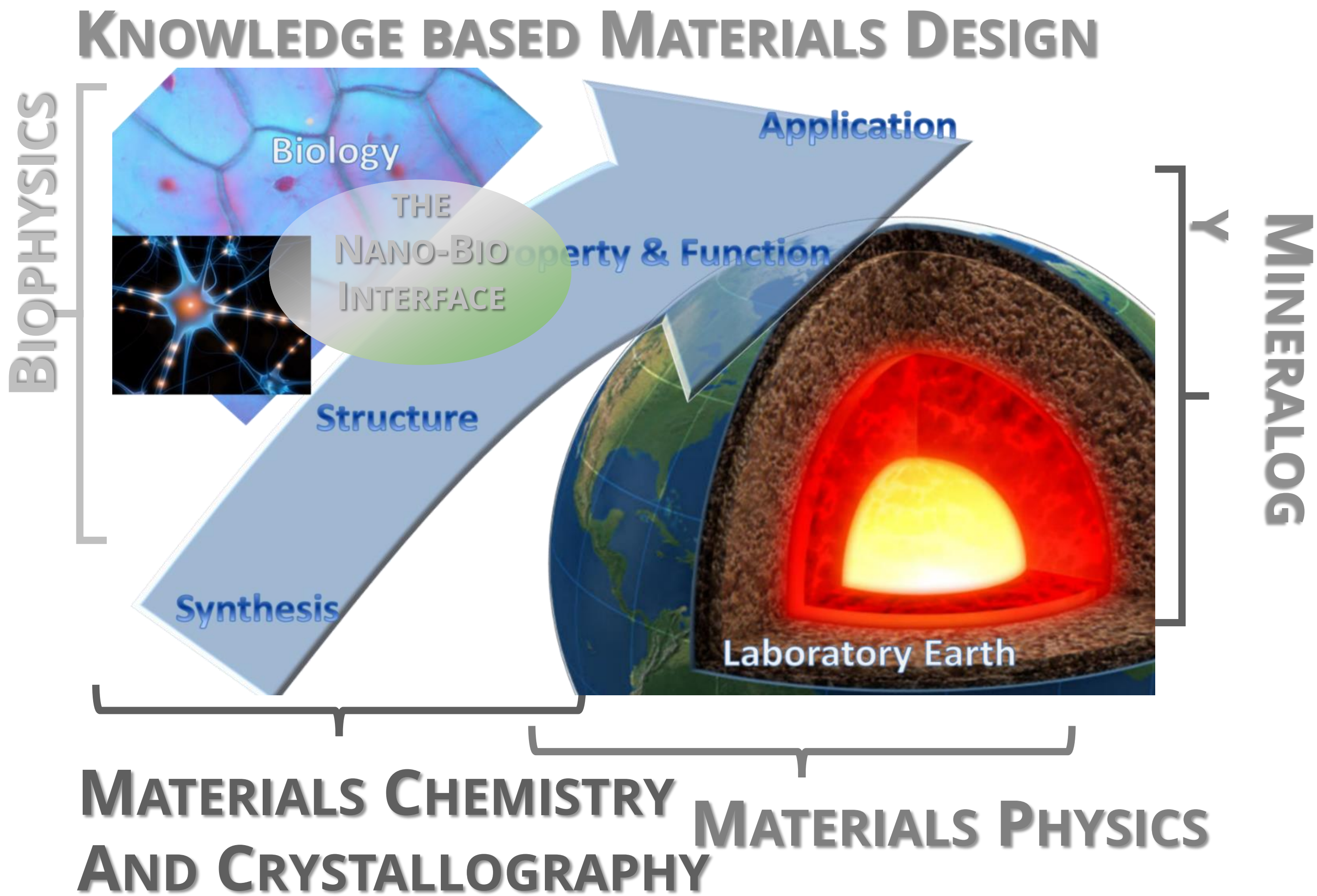
	approx. 5500 m^2 Area
Research:	6 Professorships: Materials Chemistry, Materials Science and Mineralogy, Materials Physics, Experimental Physics, Biological Physics (2017), Functional Materials (2018)
	at present ≈30 university employees and ≈30 research funded employees
Core Facilities:	Spectroscopy, Electron Microscopy
University courses:	Joint-Degree Bachelor of Engineering PLUS-TUM, Master Chemistry and Physics of Materials

Interreg Italia-Österreich
European Regional Development Fund
EUROPEAN UNION

UNIVERSITÄT SALZBURG
InClMa

Chemistry and Physics of Materials
- Research -



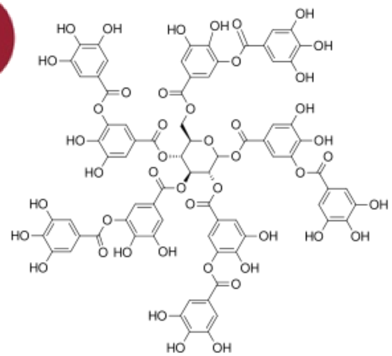


Specific Goal 1_Characterization and optimization of smart materials for advanced environmental applications

Interreg
Italia-Österreich
European Regional Development Fund
EUROPEAN UNION

InCIMa

Molecular

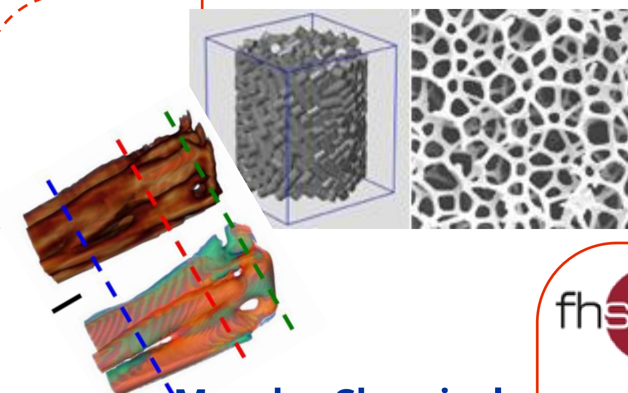


Molecular properties

Micro-Nano

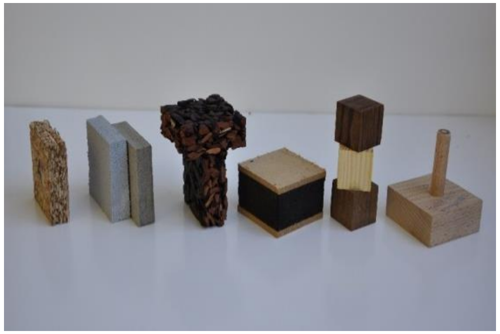
(Mesoscale)

The Mesoscale is the missed link between Molecular properties and Functional properties



Morpho-Chemical Characterization

Macro



Functional properties

Tune the synthesis parameters for improving material functionality via mesoscale analysis

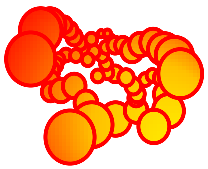
Interreg Italia-Österreich
European Regional Development Fund
EUROPEAN UNION

UNIVERSITÄT SALZBURG

InCIMa

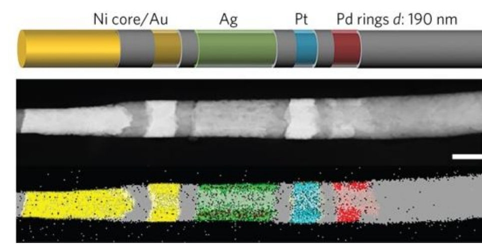
InCIMa: PLUS, PP2

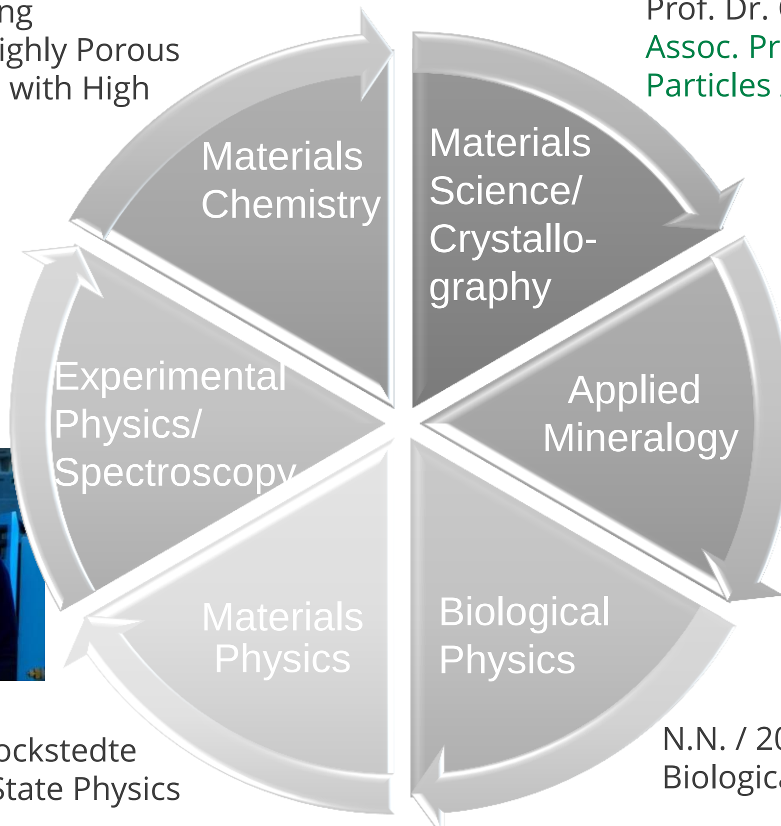
Department Chemistry and Physics of Materials Professorships



Prof. Dr. Nicola Hüsing
Sol-Gel Processes, Highly Porous Materials / Materials with High Specific Surfaces

Prof. Dr. Oliver Diwald
Assoc. Prof. Gilles Bourret
Particles / Interfaces and Nanostructures





Prof. Dr. Maurizio Musso
Raman spectroscopy

N.N. / 2018
Functional Materials

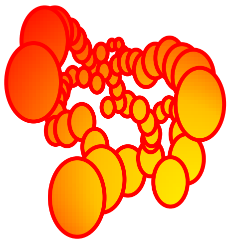
Prof. Dr. Michel Bockstedte
Theoretical Solid State Physics

N.N. / 2017
Biological Physics

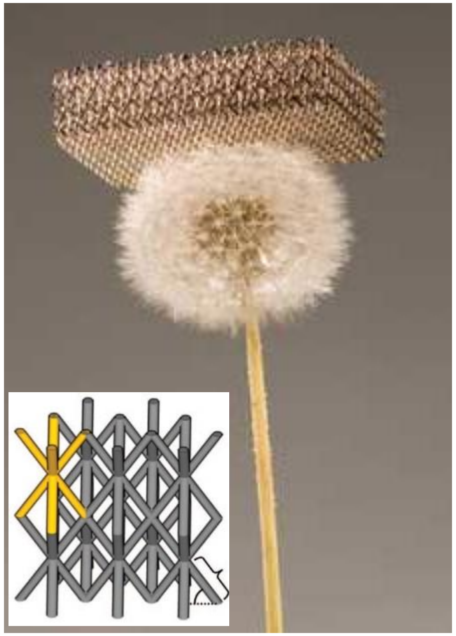
2017: In total about 30 university employees and 30 research funded employees.
University courses: Joint-Degree Bachelor of Engineering PLUS-TUM, Master Chemistry and Physics of Materials

Materials Chemistry

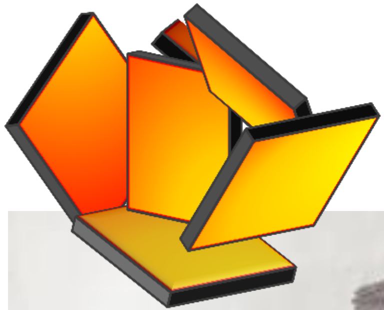
Prof. Dr. Nicola Hüsing
Sol-Gel Processes,
Highly Porous Materials
Materials with High Specific Surfaces



SiO_2 aerogels
N. Hüsing, U. Schubert.
Angew. Chem. 1998,

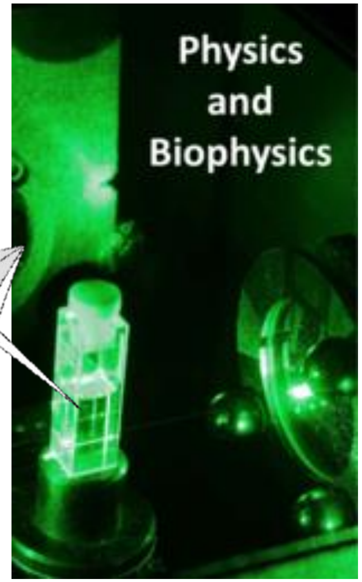


Nickel-based metallic microlattices
T.A. Schaedler et al.
Science, 2011, *334*, 962.



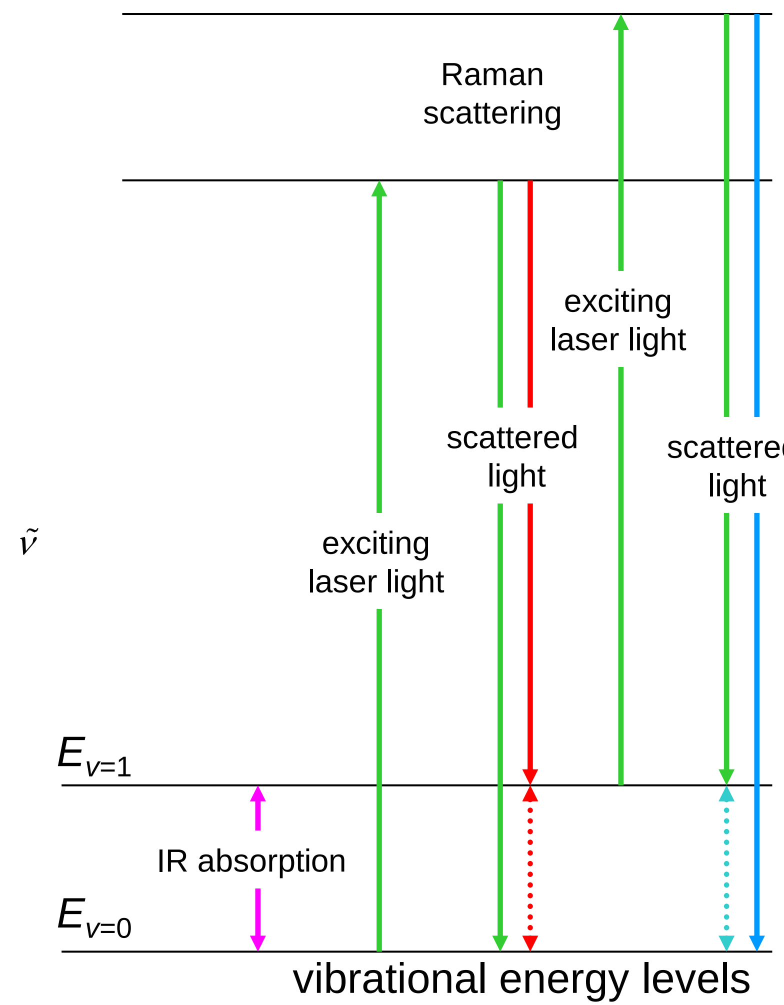
Graphene Sheets/ CNT wires
H. Sun et al.
Adv. Mater. 2013, *25*, 2554.

Raman spectroscopy

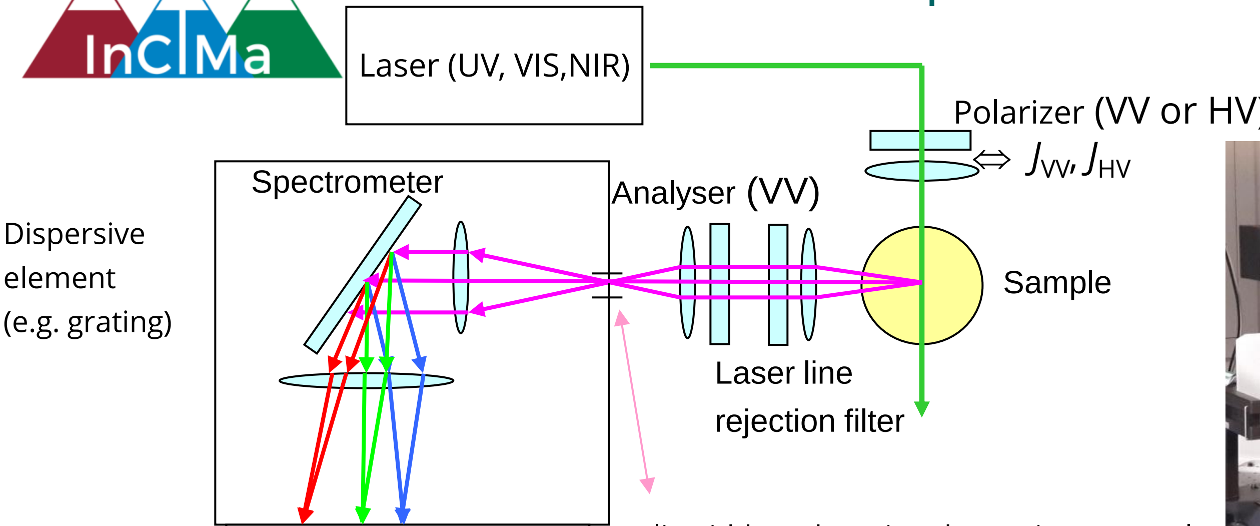


Raman spectroscopic studies for the characterization of condensed matter is routinely performed at the Department of Chemistry and Physics of Materials of the University of Salzburg since several years, and some of the more recent results deal with polymeric and with biogenic materials.

M. Musso, K.L. Oehme, *Raman spectroscopy*, in: M. Lackner (Ed.), *Lasers in Chemistry: Probing and Influencing Matter*, Wiley-VCH, Weinheim, 2008, pp. 531–591



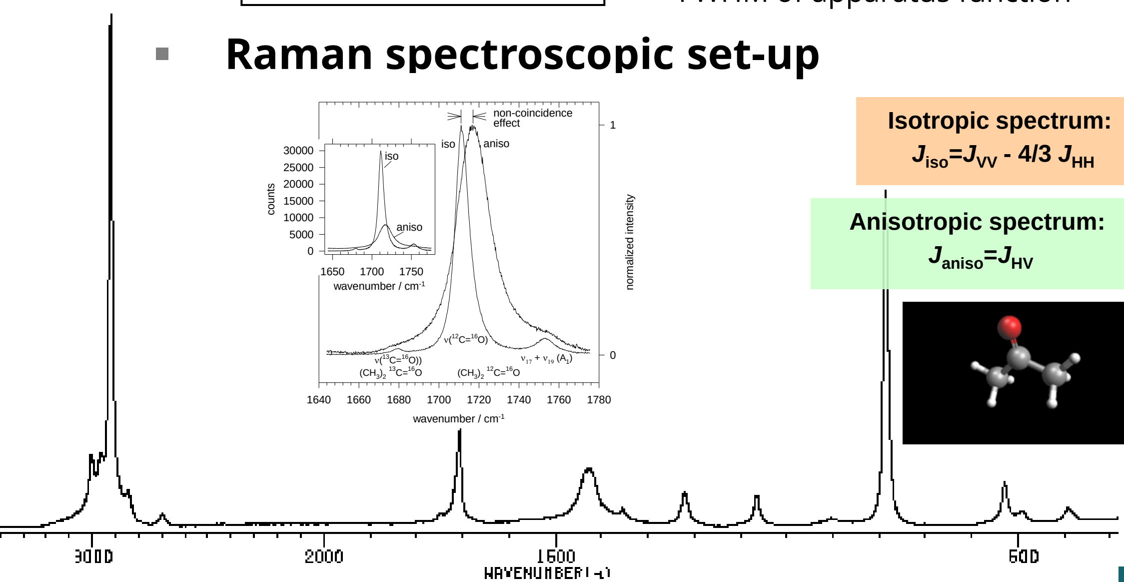
Dispersive Raman spectrometers



slit width and grating determine spectral re
= FWHM of apparatus function

Dispersive Raman spectrometer S&I Monovista CRS+ with confocal

- **Raman spectroscopic set-up**



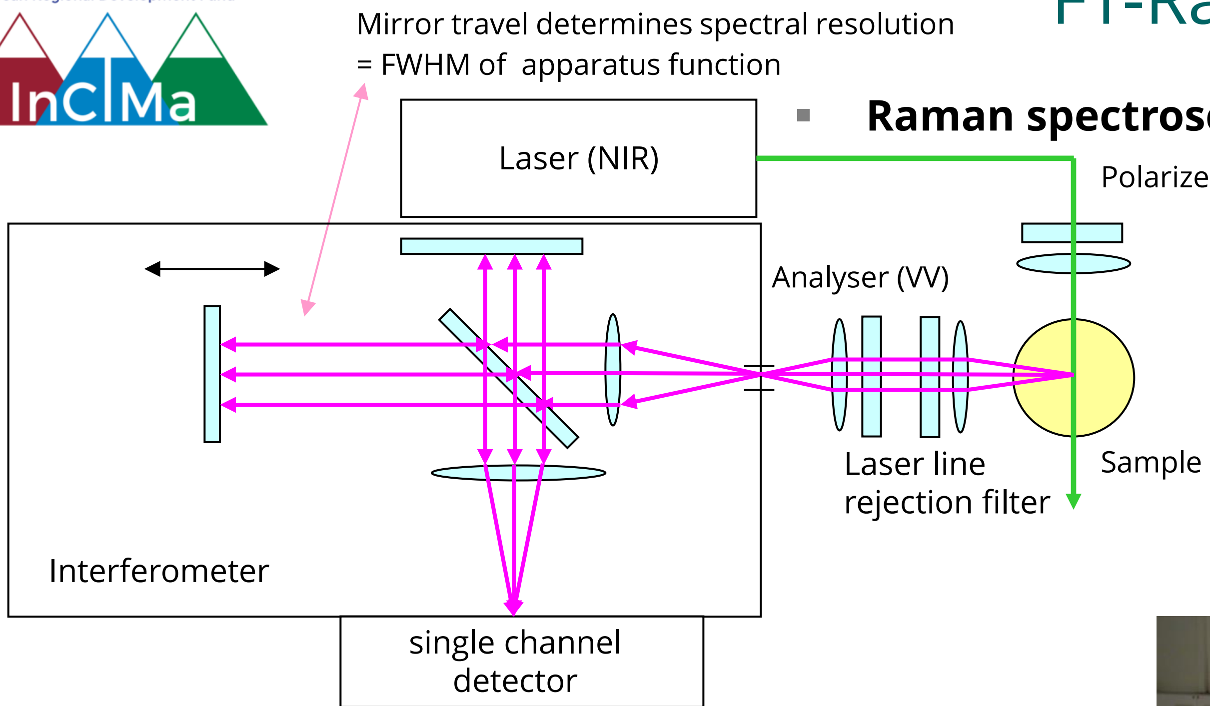
Isotropic spectrum:
$J_{iso} = J_{VV} - 4/3\ J_{HH}$

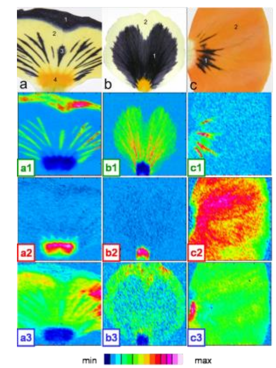
Anisotropic spectrum:
$J_{aniso} = J_{HV}$

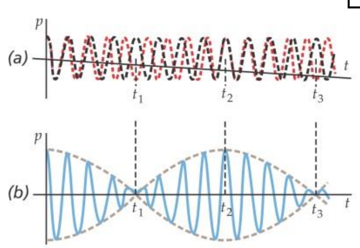
Dispersive confocal Raman microscope Thermo DXR

FT-Raman spectrometer

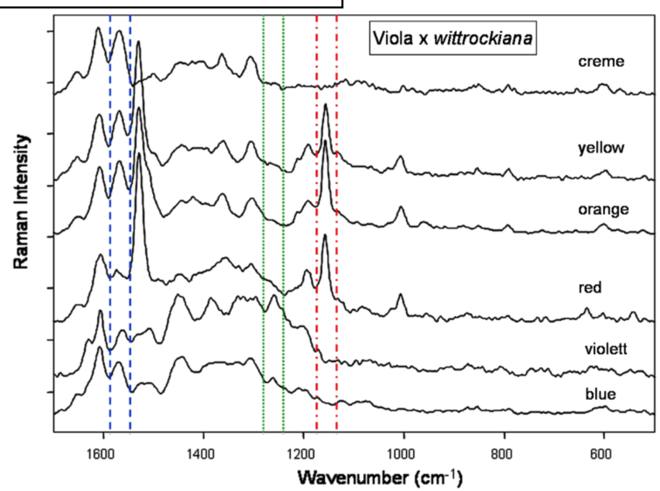
▪ **Raman spectroscopic set-up**







Interferogram
⇓
Fourier-analysis
⇓
Spectrum



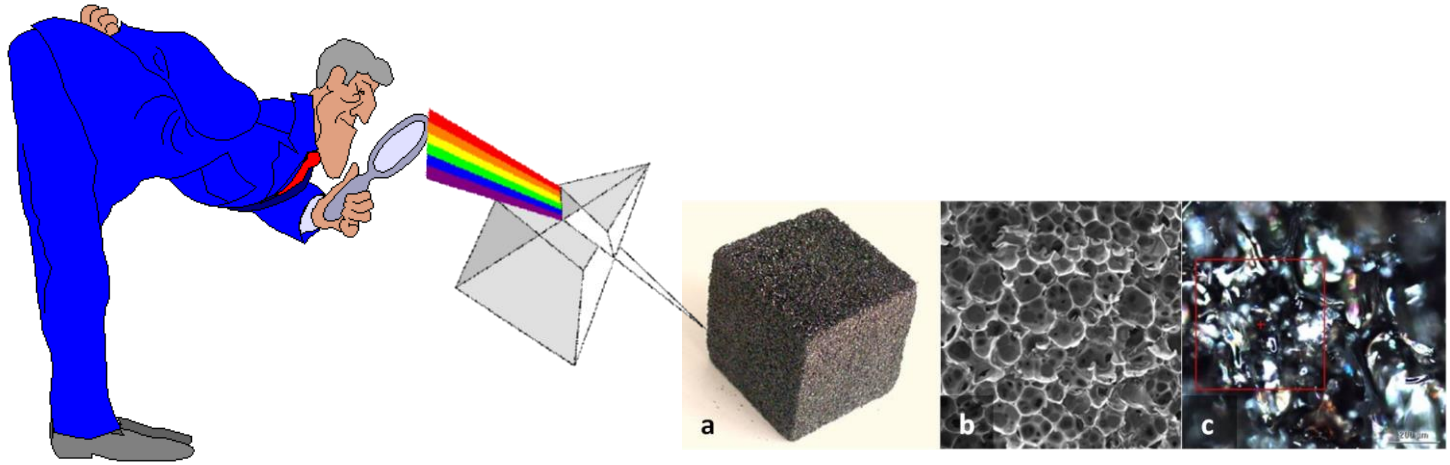
FTIR-Raman spectrometer Bruker IFS 66 and
Raman module FRA106

Interreg Italia-Österreich
European Regional Development Fund
EUROPEAN UNION

InCIMa

fhs Fachhochschule Salzburg University of Applied Sciences

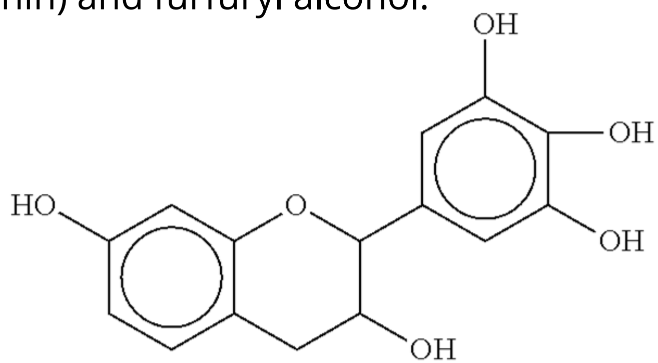
UNIVERSITÄT SALZBURG

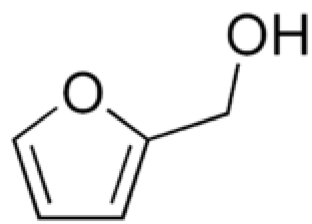


- **Raman spectroscopic investigation of tannin-furanic rigid foams**
  - A. Reyer, G. Tondi, R.J.F. Berger, A. Petutschnigg, M. Musso, Vibrational Spectroscopy 84 (2016) 58-66 .
- Raman spectroscopic investigation of tannin-furanic foam and its precursor materials has been performed with three laser wavelengths at 1064, 532, and 455 nm.
- The aim was
  - to establish a tool complementary to infrared spectroscopy for comparing their spectral signature with that of the precursor materials furfuryl alcohol, polymerized furfuryl alcohol, and Mimosa tannin, and
  - to discuss similarities and differences to the spectral signatures of sp^2 carbon-based materials, the still preserved organic nature of the tannin-furanic foam, and similarities and differences to recently reported infrared spectra.

Raman spectroscopic investigation of tannin-furanic rigid foams

Tannin-based rigid foams are innovative materials made of inexpensive organic ingredients, and are produced via an acid catalyzed polycondensation reaction between condensed flavonoids (e.g. Mimosa tannin) and furfuryl alcohol.





The most important physical properties of these bio-friendly foams are their low thermal conductivity and their high fire resistance.

Due to these surprising properties, such innovative materials have already been proposed as insulating material for eco-sustainable buildings (green building technology).

By Raman spectroscopic technique we have tried to characterize the tannin-based foams and compared their spectral signature with that of tannins and of polymerized furfuryl alcohol.

A. Reyer, G. Tondi, R.J.F. Berger, A. Petutschnigg, M. Musso, Vibrational Spectroscopy 84 (2016) 58-66

Interreg Italia-Österreich
European Regional Development Fund

EUROPEAN UNION

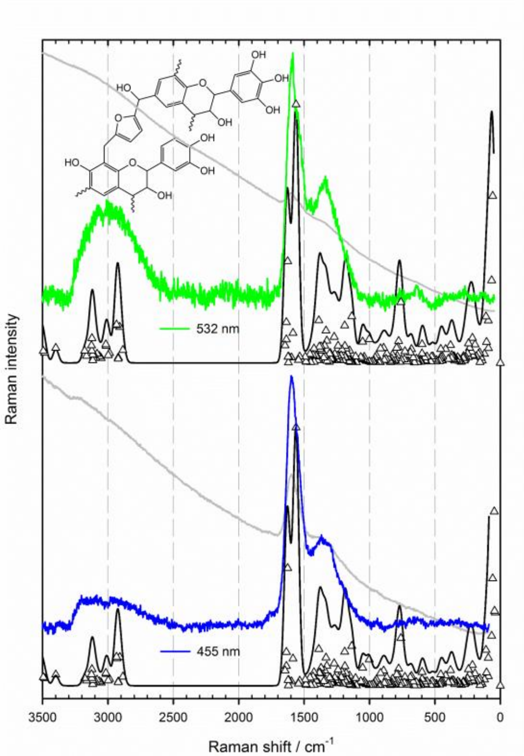
Fachhochschule Salzburg University of Applied Sciences

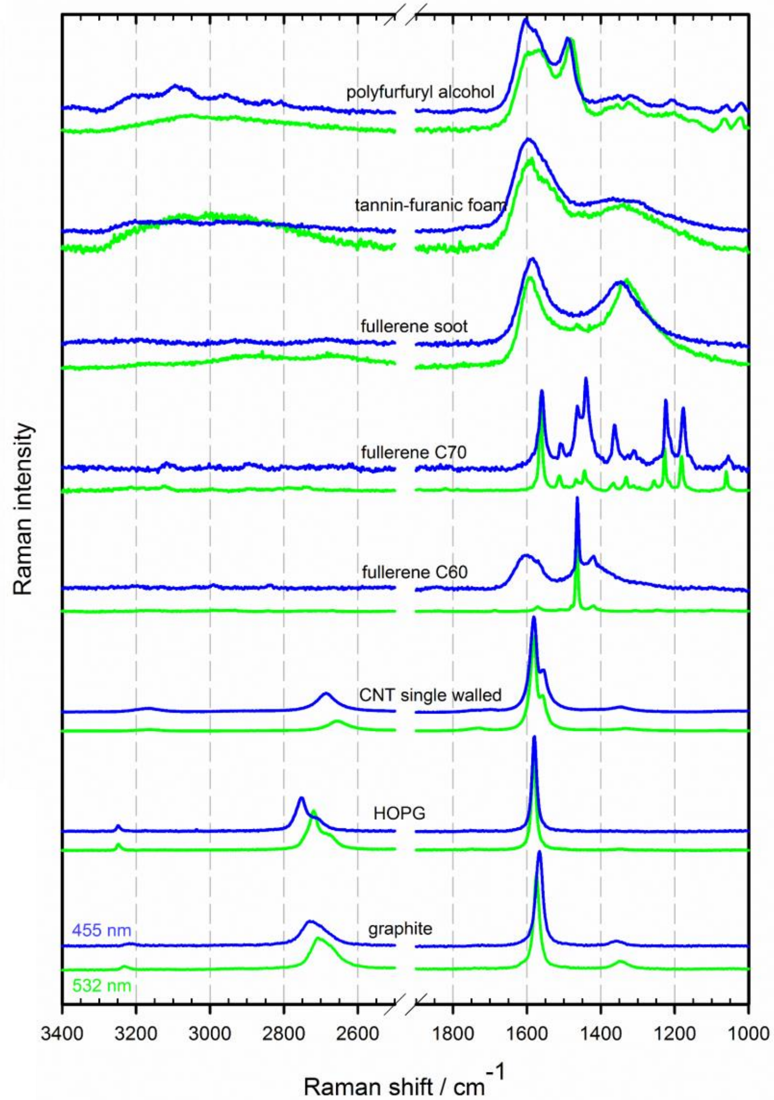
UNIVERSITÄT SALZBURG

InCIMa

Raman spectroscopic investigation of tannin-furanic rigid foams

A. Reyer, G. Tondi, R.J.F. Berger, A. Petutschnigg, M. Musso, Vibrational Spectroscopy 84 (2016) 58-66





We find reasonable agreement between the experimental Raman spectra obtained at 455 nm and at 532 nm laser excitation and the calculated counterparts based on a model structure of the hetero-polymer.

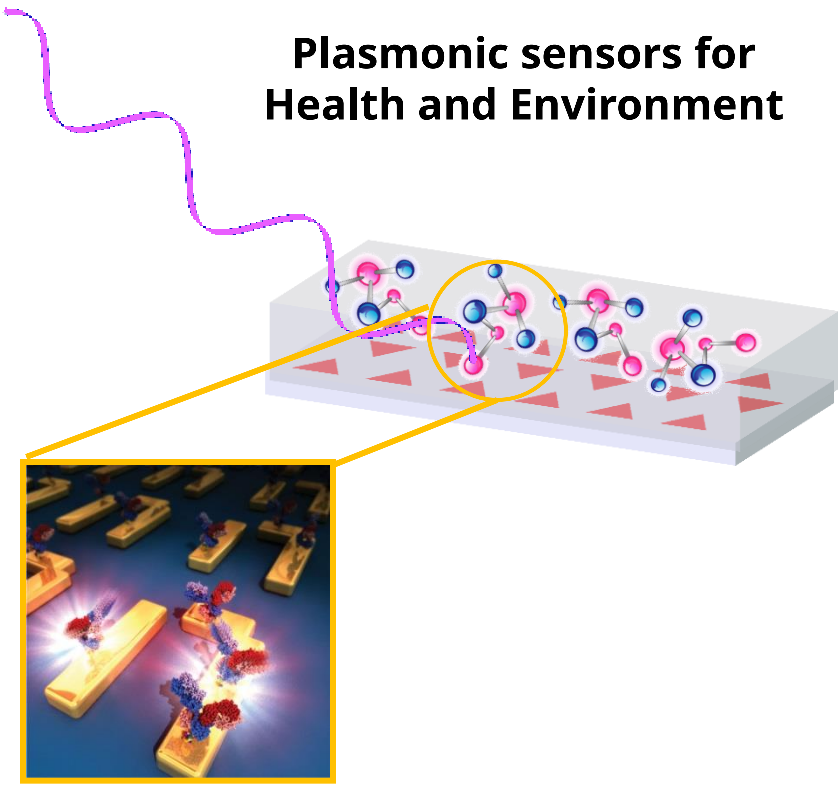
According to the parameters adopted by C. Casiraghi, A.C. Ferrari, J. Robertson, Phys. Rev. B 72 (2005) 085401, the **tannin-furanic foam** (and polyfurfuryl alcohol too) fall in the category of **hydrogenated amorphous carbon materials**.

Interreg
Italia-Österreich
European Regional Development Fund
EUROPEAN UNION
InCIMa

Specific Goal 2_Characterization and optimization of smart materials for advanced Technological applications (WP5)

Plasmonic metamaterials for ultra-diluted analyte detection

Plasmonic sensors for Health and Environment



- **Metallic Nanosheets**
- **Metallic Nanowires**
- **Metallurgical Processes**

Production of nano- and micro-patterned plasmonic surfaces

Characterization of UV, Vis and IR plasmonic efficiencies

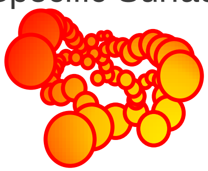
Integration of plasmonic nanostructure into bio-foams

fhs

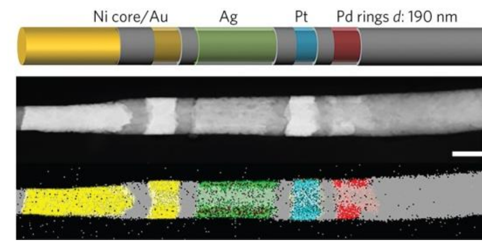
InCIMa: PLUS, PP2

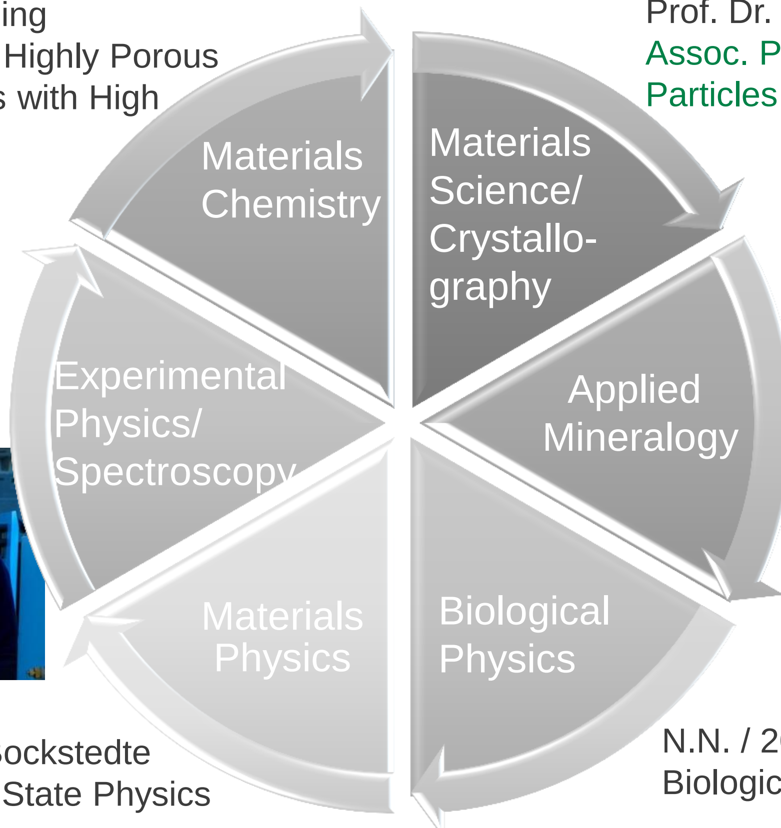
Department
Chemistry and Physics of Materials
Professorships

Prof. Dr. Nicola Hüsing
Sol-Gel Processes, Highly Porous Materials / Materials with High Specific Surfaces

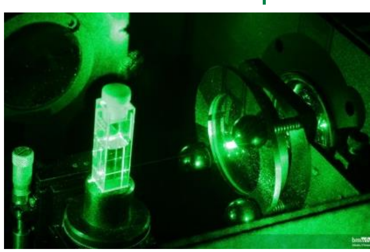


Prof. Dr. Oliver Diwald
Assoc. Prof. Gilles Bourret
Particles / Interfaces and Nanostructures





Prof. Dr. Maurizio Musso
Raman spectroscopy



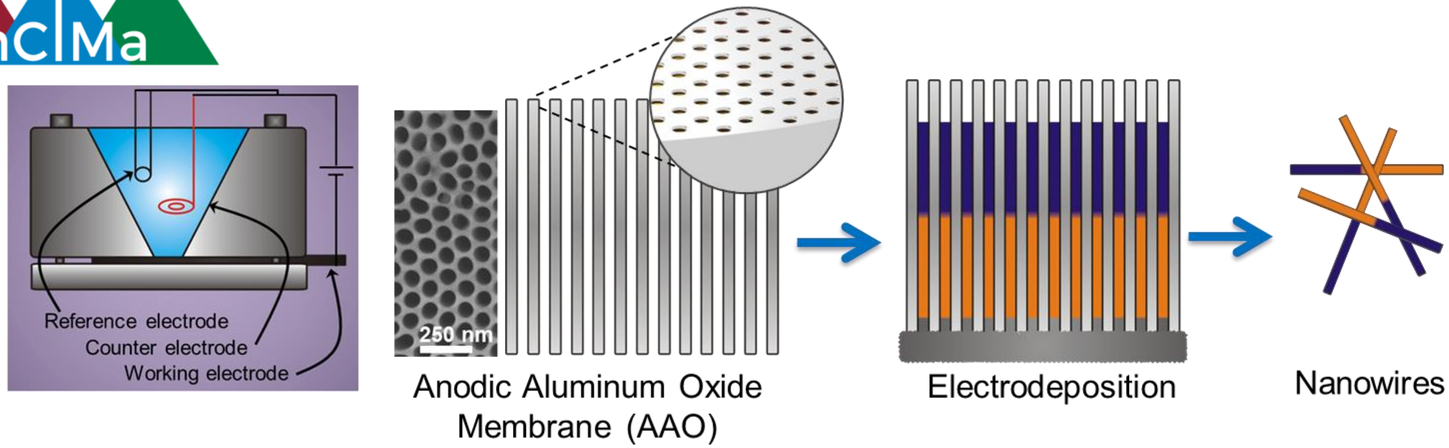
N.N. / 2018
Functional Materials

N.N. / 2017
Biological Physics

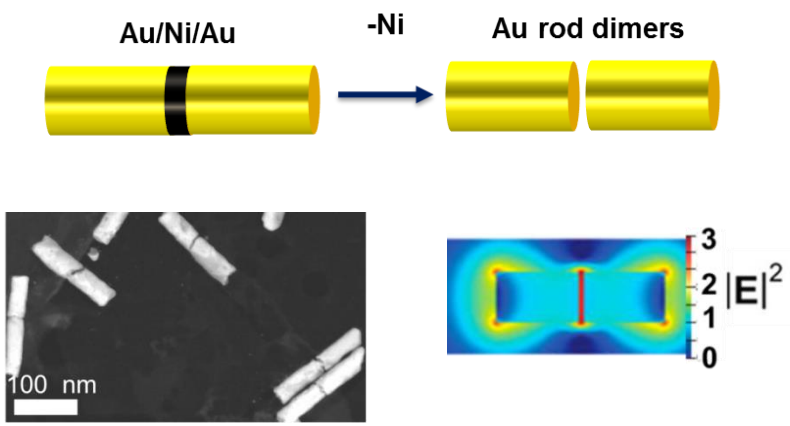
Prof. Dr. Michel Bockstedte
Theoretical Solid State Physics

2017: In total about 30 university employees and 30 research funded employees.
University courses: Joint-Degree Bachelor of Engineering PLUS-TUM, Master Chemistry and Physics of Materials

Templated Syntheses for Plasmonics

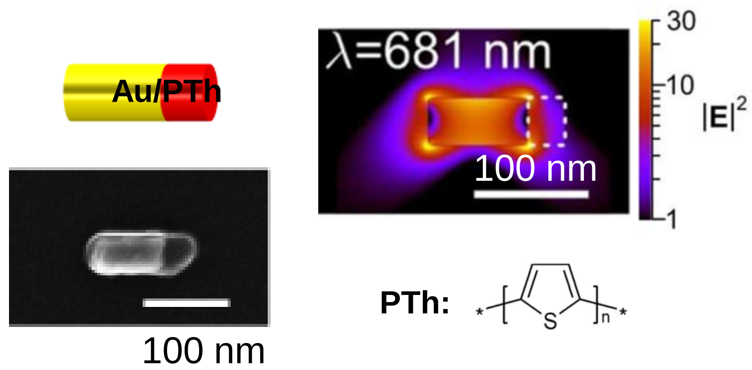


Au nanorod dimers



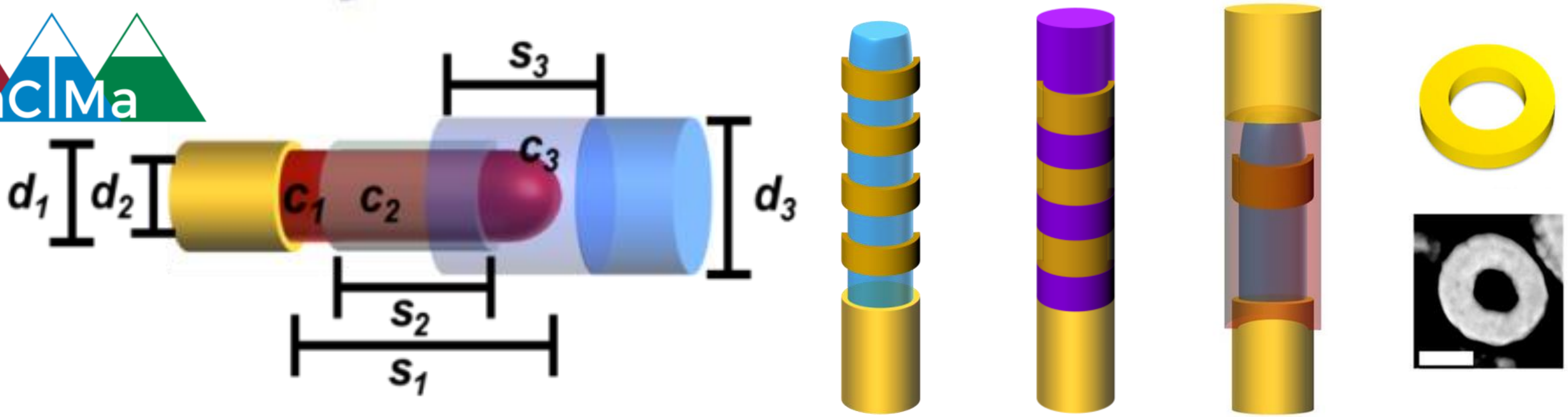
Obserg, Rycenga, Bourret et al. *Adv. Mater. 24*, 6065 (2012)
U.S. Patent Application No. 61/677,810
International Patent Application No. PCT/US2013/052610

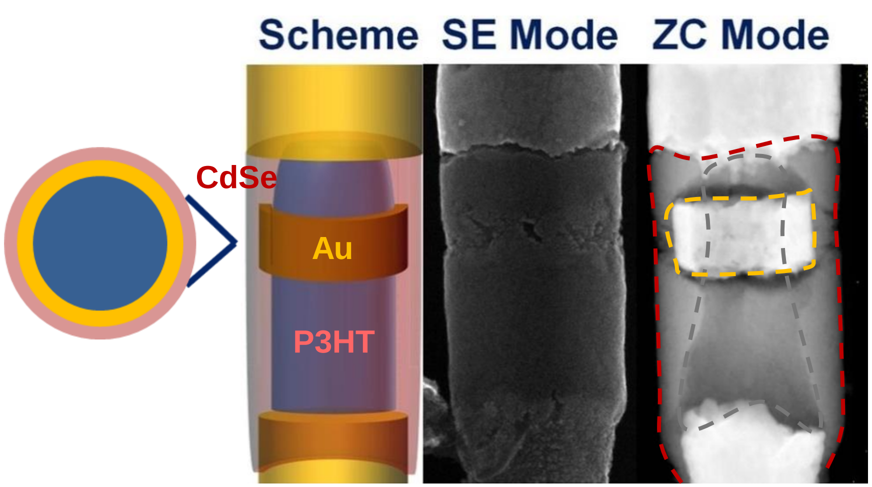
Plasmon modulated emission

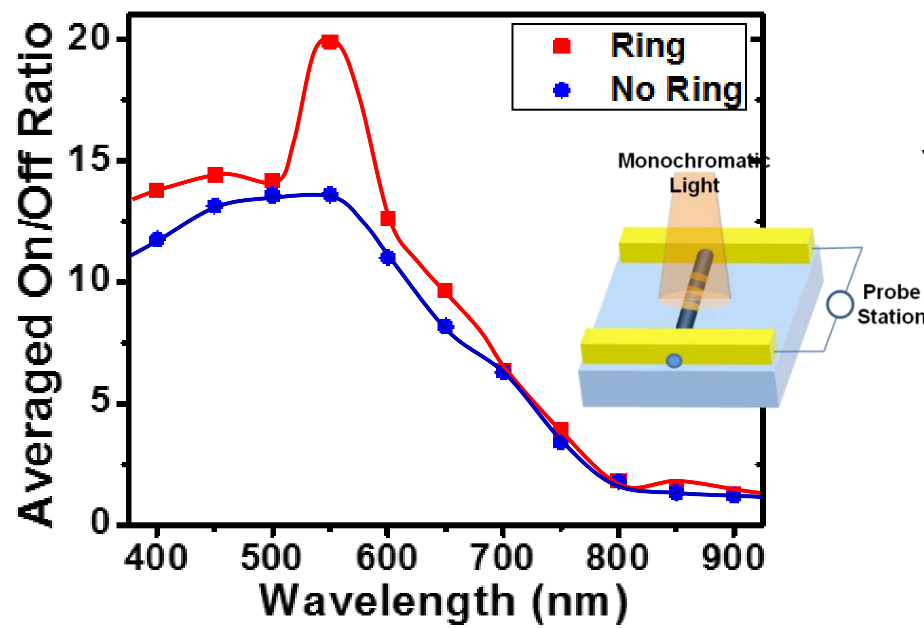


Bourret et al. *Nano Lett. 13*, 2270 (2013)

Integrating plasmonic materials within nanowire architectures: coaxial lithography







Bourret *et al. Nat. Nanotech.* 10, 319 (2015)
Ozel, Ashley, Bourret *et al. Nano Lett.* 15, 2773 (2015)
Bourret *et al. Adv. Mater. 25*, 4515 (2013)

Interreg
Italia-Österreich
European Regional Development Fund

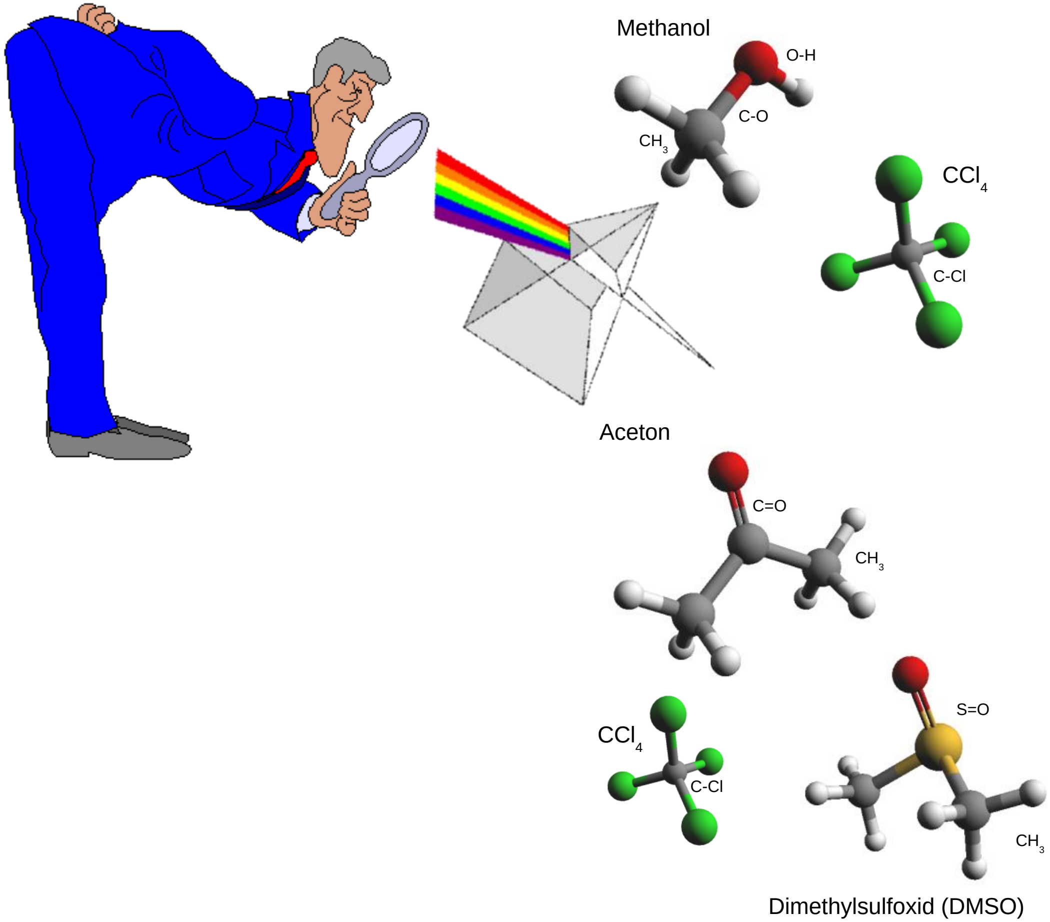
EUROPEAN UNION

InCIMa

UNIVERSITÄT SALZBURG

Thank you!

Thank you!



Methanol
O-H
C-O
CH3
CCl4
C-Cl
Aceton
C=O
CH3
CCl4
C-Cl
S=O
CH3
Dimethylsulfoxid (DMSO)