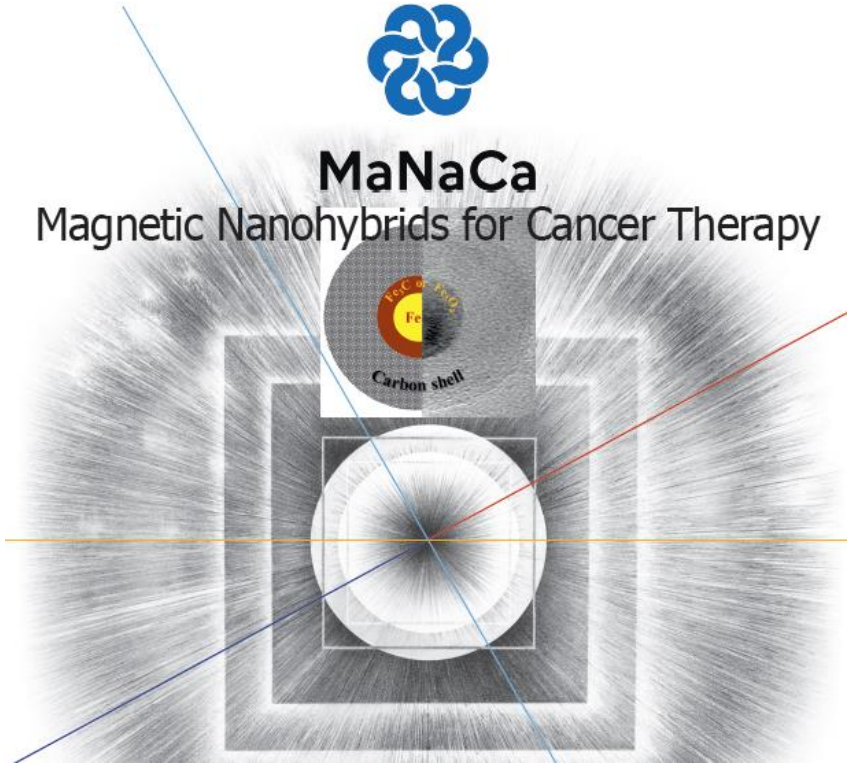


ONLINE EVENT FOR TWINNING PROJECT CORDINATORS

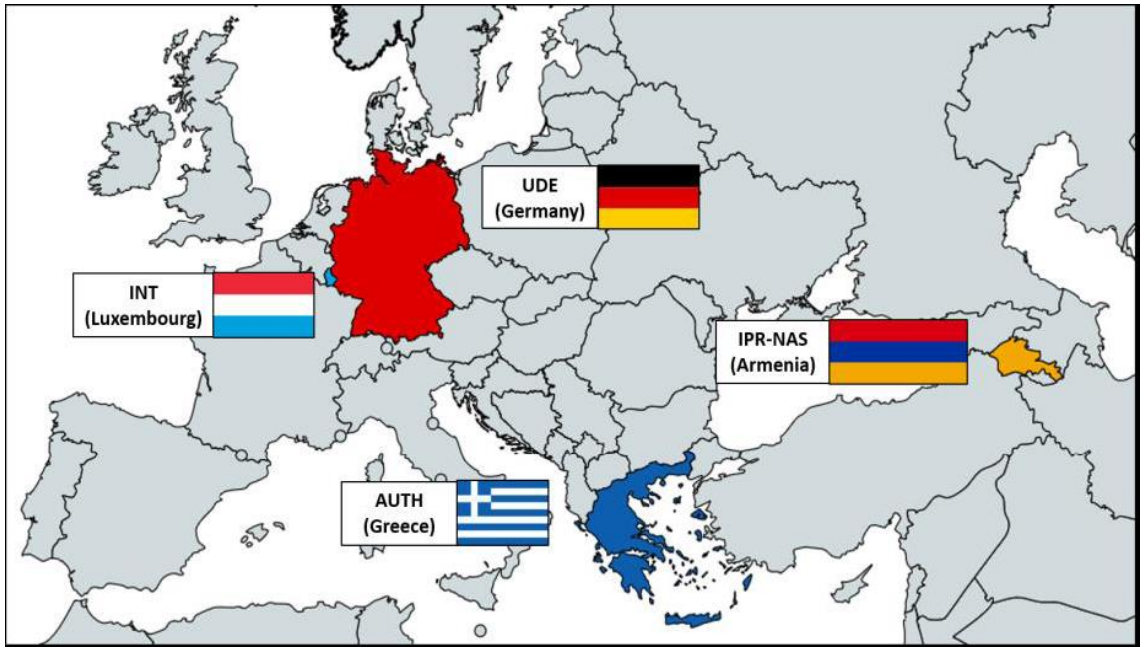
March 24-25, 2021

Dr. Aram Manukyan

Magnetic Nanohybrids for Cancer Therapy

MaNaCa

UNIVERSITY OF DUISBURG-ESSEN
Germany
Prof. Michael FARLE



INSTITUTE FOR PHYSICAL RESEARCH OF NAS
Armenia

Dr. Aram MANUKYAN

INTELLIGENTSIA CONSULTANTS SARL
Luxembourg

Giles BRANDON
Managing Director

ARISTOTLE UNIVERSITY OF THESSALONIKI
Greece
Prof. Makis ANGELAKERIS

About the MaNaCa Project

Magnetic Nanohybrids for Cancer Therapy

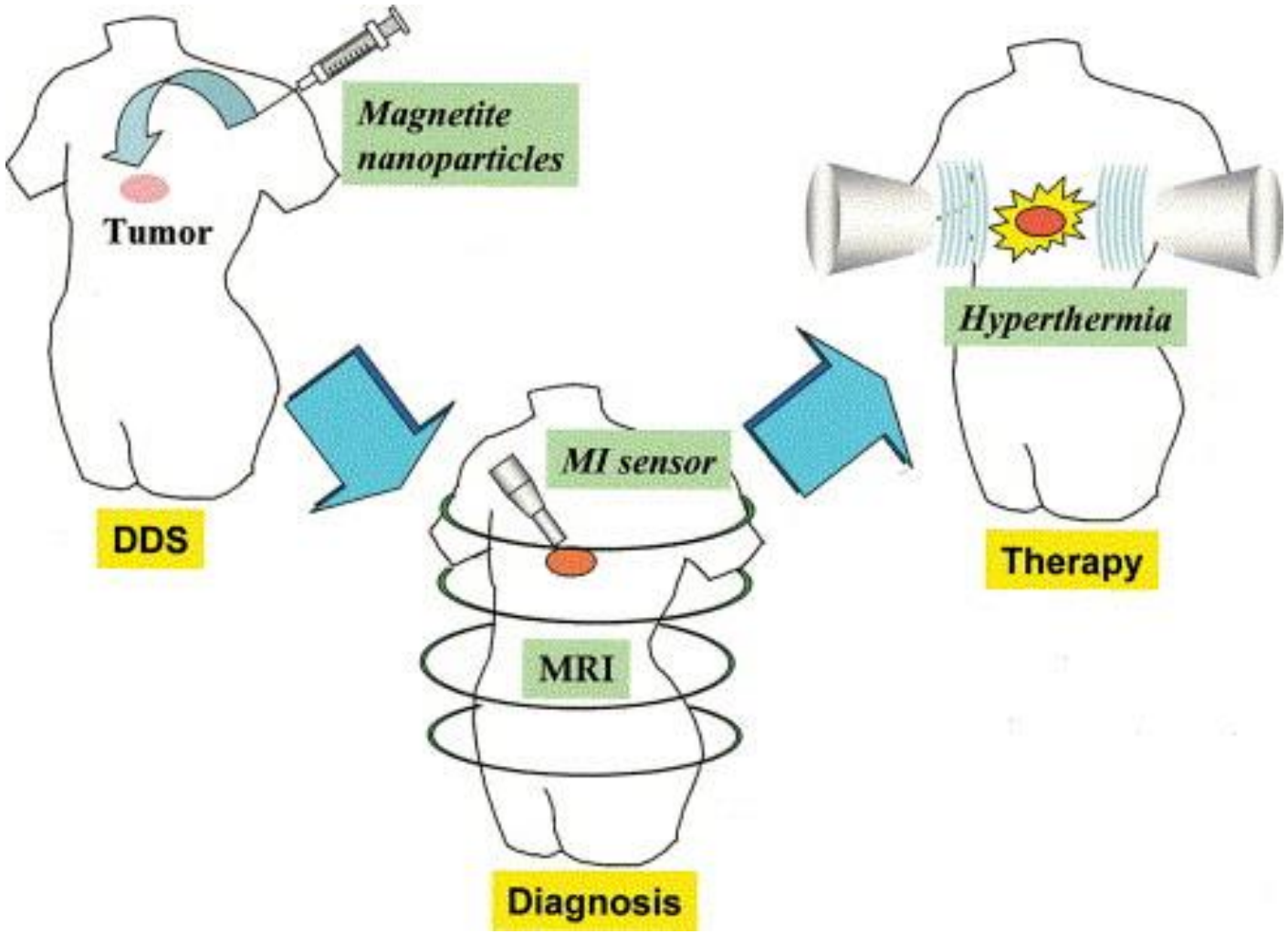
Start date 01.10.2019
End date 30.09.2022

The aim of MaNaCa project is to develop the scientific and technological capacity as well as raise the research profile of the Institute for Physical Research of the National Academy of Sciences (IPR-NAS) in Armenia. MaNaCa is focused on the synthesis, structural and magnetic characterization of magnetic nanohybrids and their application for cancer therapy and supported by an excellent consortium consisting of scientific partners, Aristotle University of Thessaloniki in Greece and the University of Duisburg – Essen in Germany, as well as the management expertise of Intelligentsia Consultants from Luxembourg.

List of work packages

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Exchange of senior researchers	2 - AUTH	16.00	1	36
WP2	Exchange of early stage researchers	3 - UDE	32.00	1	36
WP3	Dissemination and Outreach	4 - INT	9.00	1	36
WP4	Project Management	1 - IPR NAS	8.00	1	36
WP5	Ethics requirements	1 - IPR NAS	N/A	1	36
		Total	65.00		

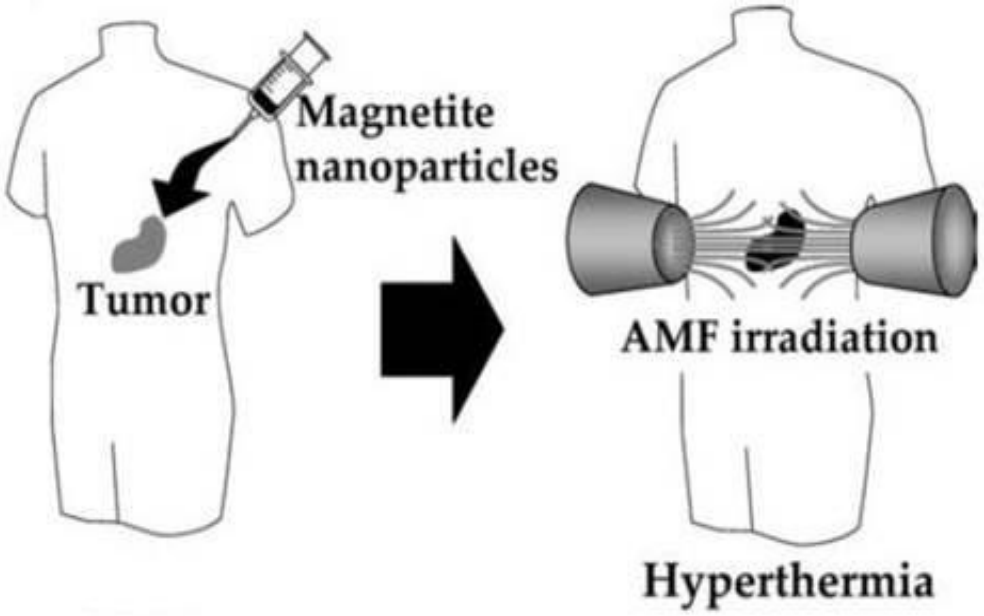
Application of magnetic nanoparticles in medicine

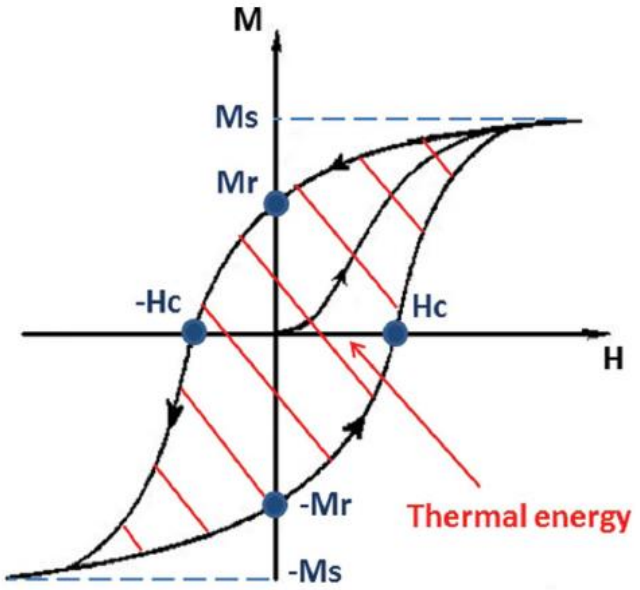


What is the magnetic hyperthermia?

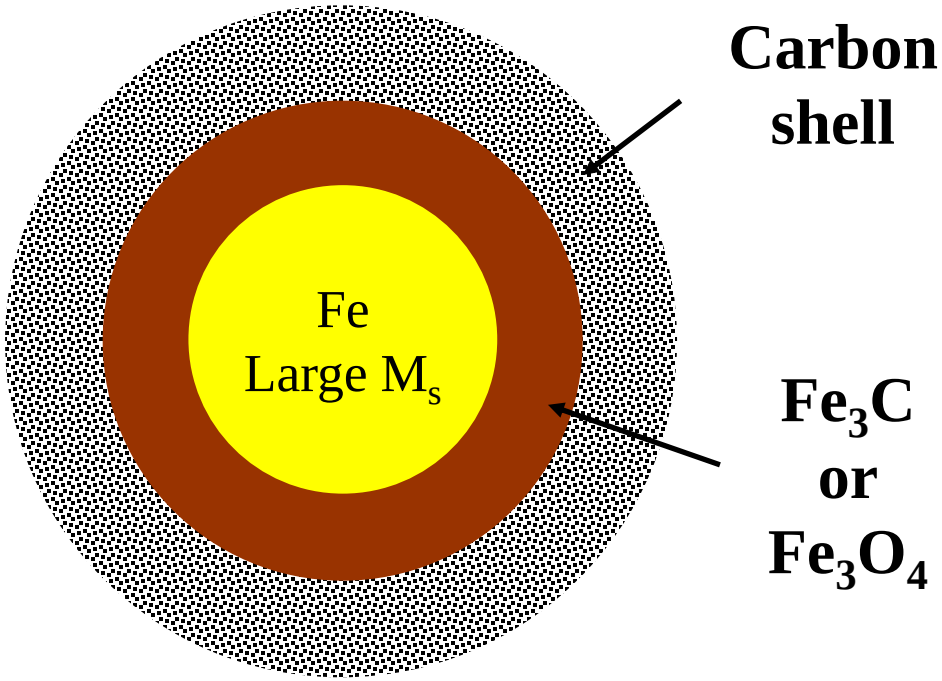
Magnetic nanoparticles (MNPs) generate heat under alternating magnetic field as a result of hysteresis and/or relaxational losses, leading to the tissue heating in which MNPs are accumulated.

The destruction of cancer cells occurs at T = **43 - 45°C**.





Carbon coated **Fe-Fe_3C or Fe-Fe_3O_4** “core-shell” nanoparticles



Carbon shell

Fe_3C or Fe_3O_4

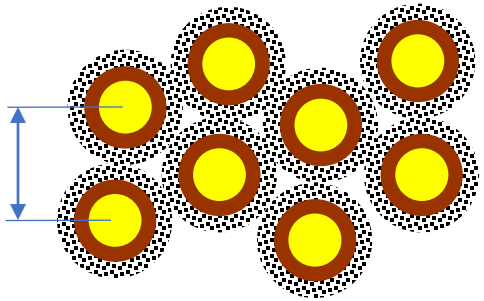
Advantages:

High value of **M_s**

Tailor **H_c**

No magnetic interaction between nanoparticles

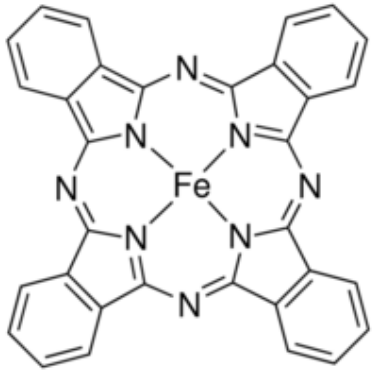
Fixing nanoparticles in a certain distance



Sample Preparation

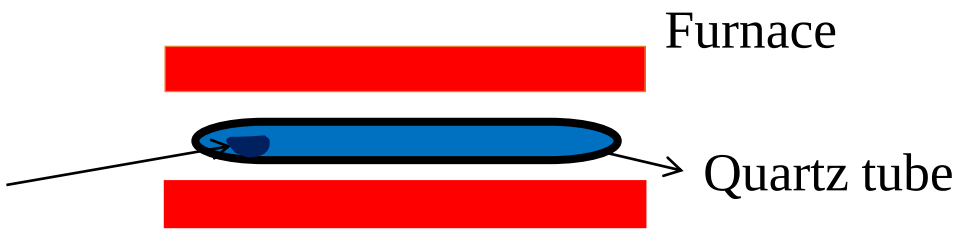
(IPR-NAS)

Solid-phase pyrolysis of Iron Phthalocyanine



Iron(II) phthalocyanine (FePc)

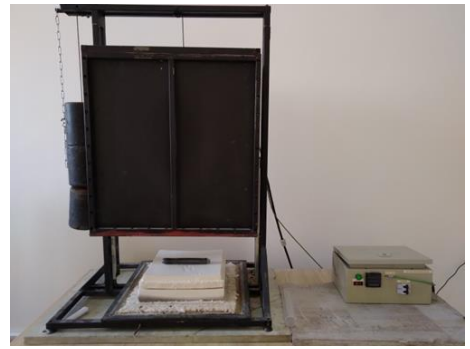
$FeC_{32}H_{16}N_8$



T_{pyr} = 700-1000°C
t_{pyr} = 10-1200 min
p = 1,5 MPa

$$Fe(C_{32}N_8H_{16}) \xrightarrow[-8H_2,-4N_2]{T_{pyr},t_{pyr},p} Fe + 32C$$

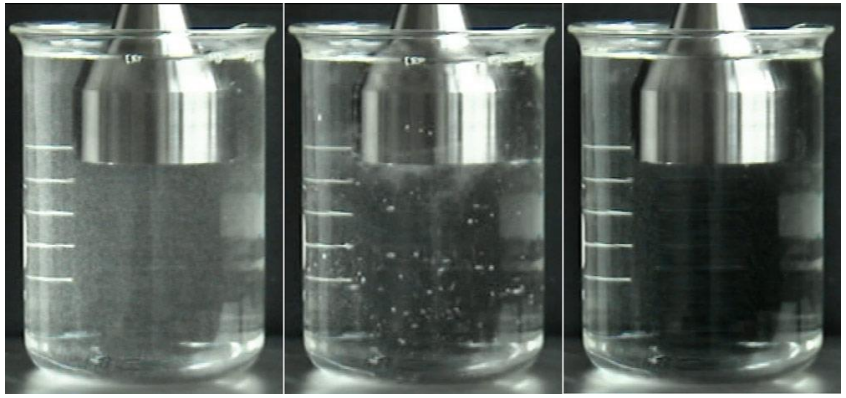
≈ 12 wt% Fe in Fe+32C



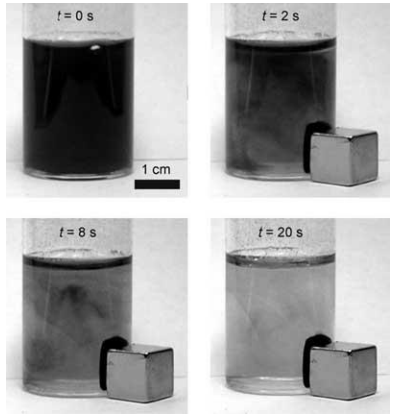
$$3Fe + C \rightarrow Fe_3C \rightarrow 3Fe + C$$

Treatment and separation of magnetic nanoparticles and nanoalloys

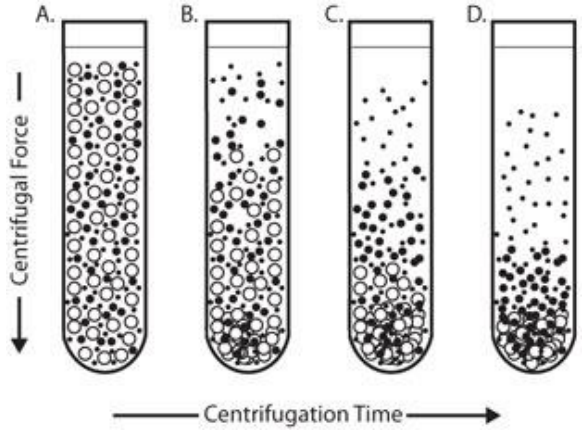
Ultrasonic



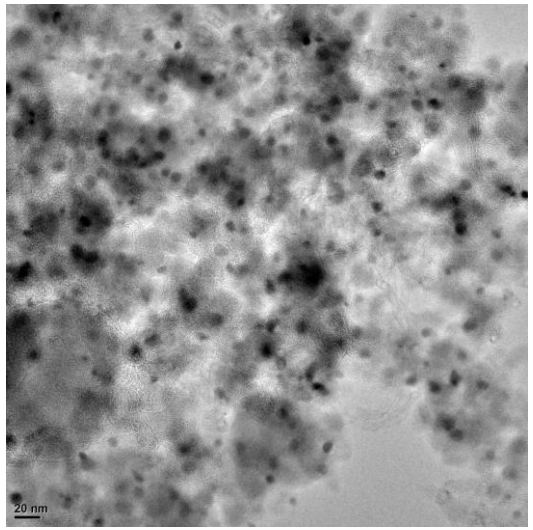
Magnetic separation

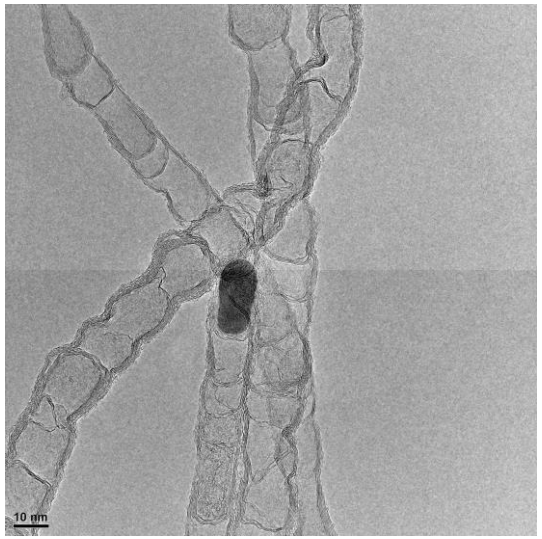


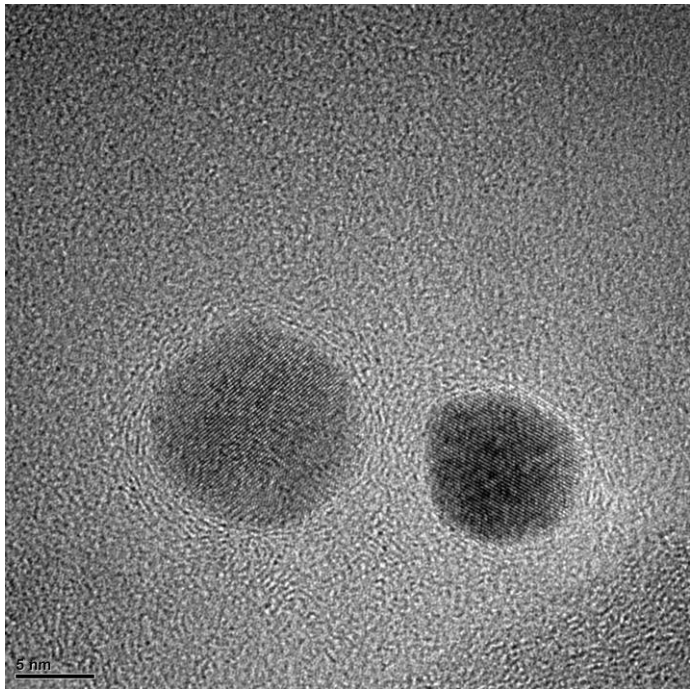
Centrifuge separation

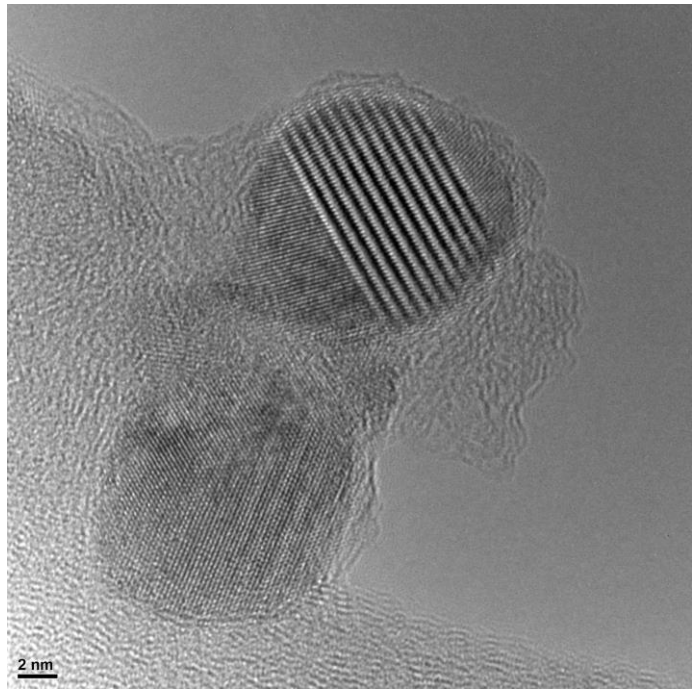


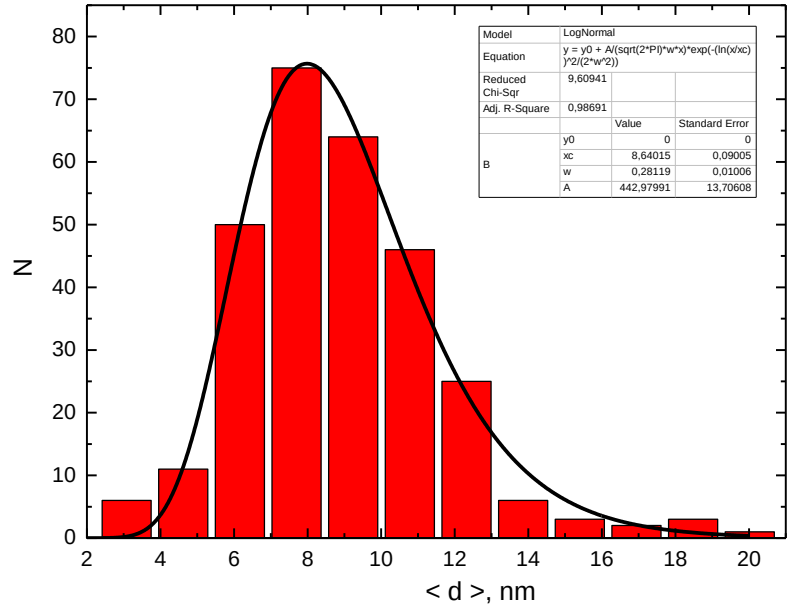
Morphology and size distribution







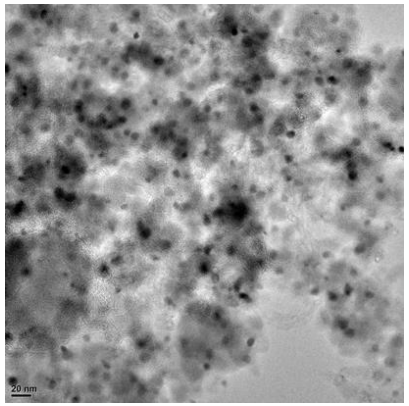




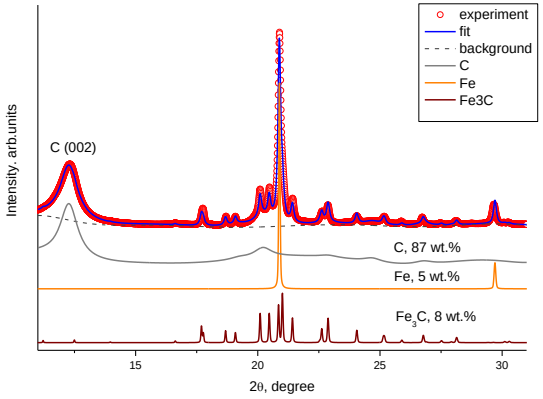
Structural and Magnetic Investigations

UNIVERSITÄT DUISBURG ESSEN *(UDE)*

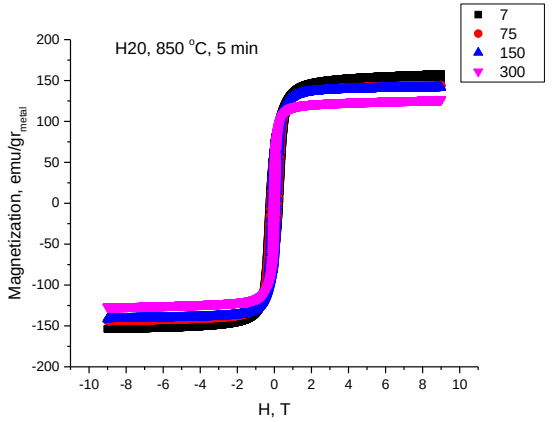
Electron microscope investigations

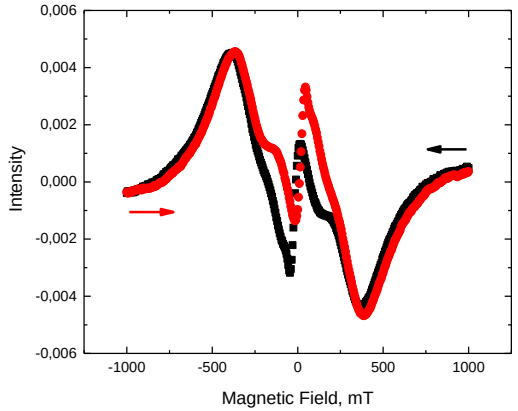


X-ray diffraction investigations



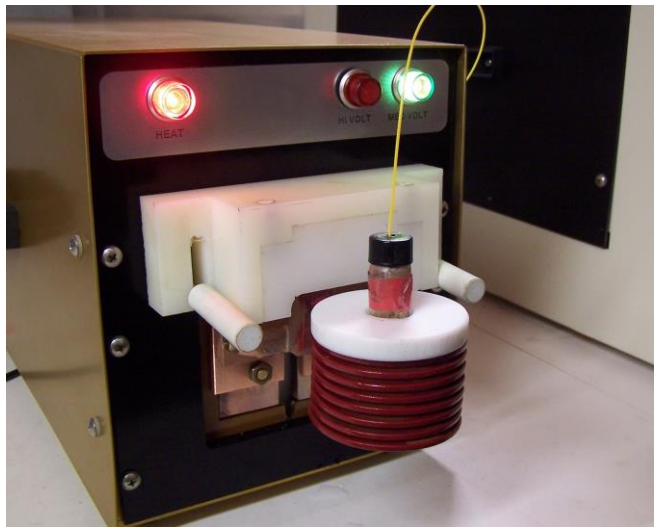
Magnetic and magnetic resonance investigations

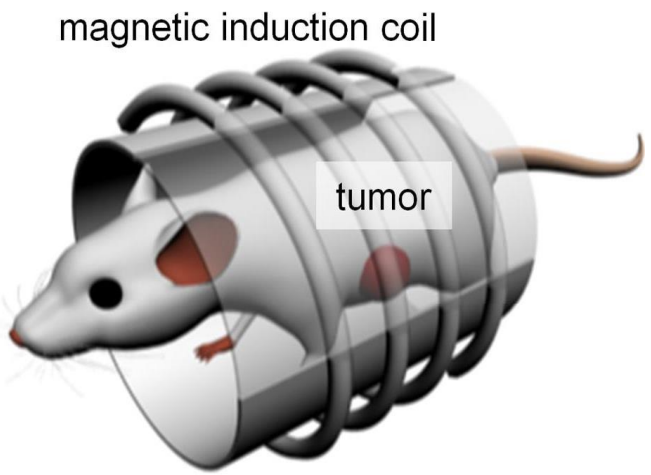


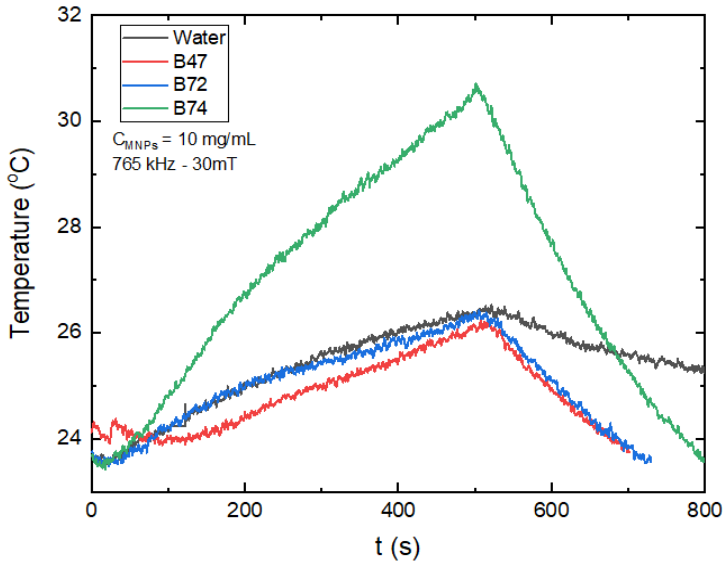


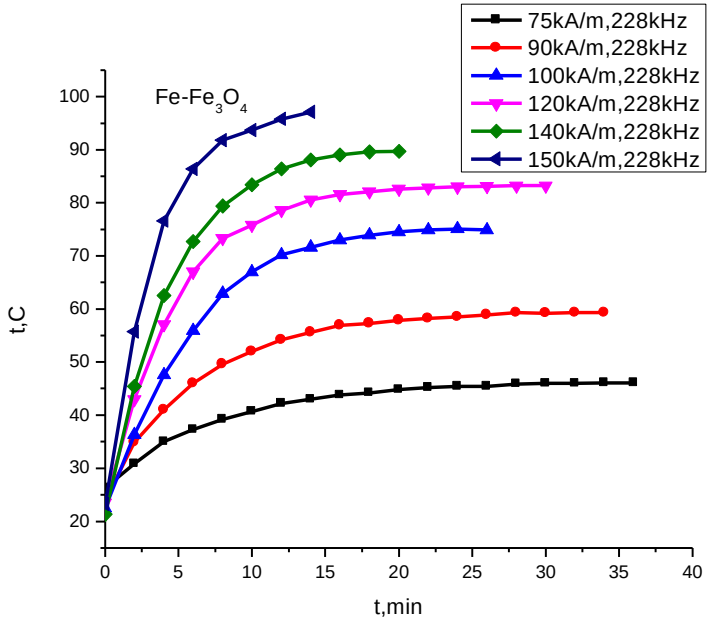
Magnetic Particle Hyperthermia

ARISTOTLE UNIVERSITY OF THESSALONIKI *(AUTH)*





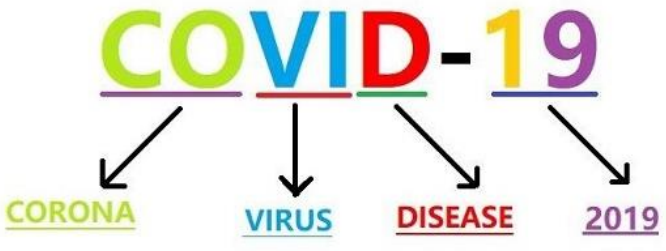


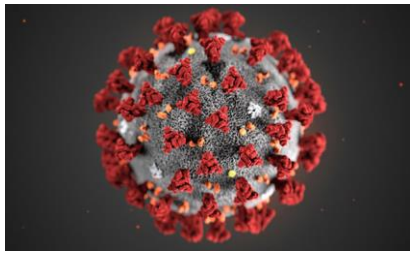


Project Management and Dissemination Support

(INT)

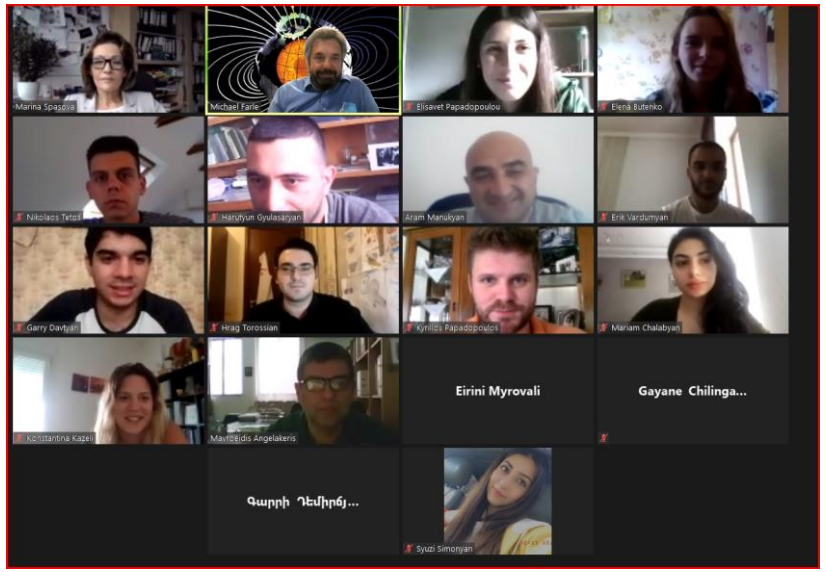
- Organizing training workshops
- Producing a data management plan
- Design, implementation and maintenance of the project website
- Producing of promotional materials
- Supporting to most other tasks





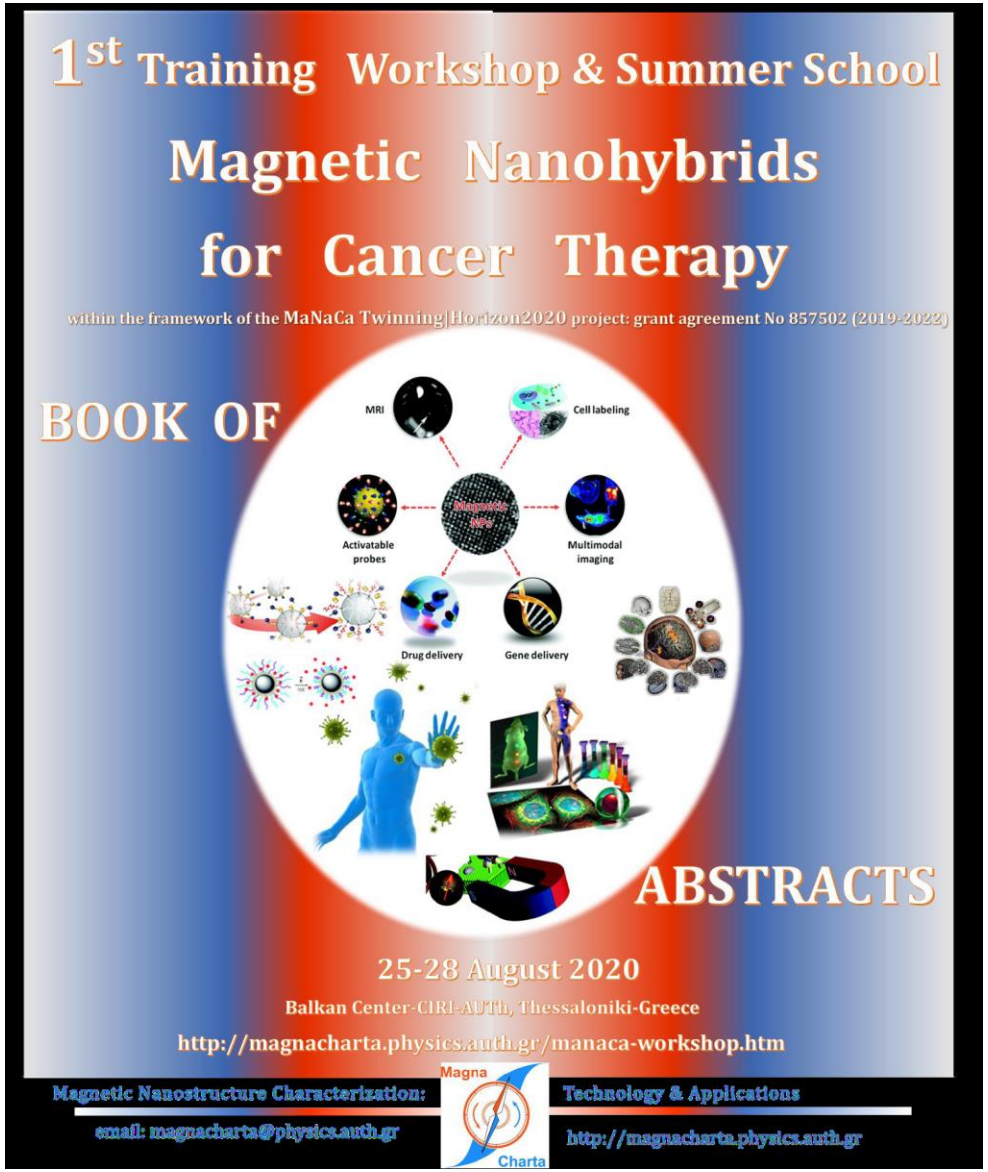
The COVID-19 crisis has severely restricted the implementation of WP1 'Exchange of senior researchers' and WP2 'Exchange of early stage researchers' during Year 1 of the project. For this reason we plan to request a one-year extension of the project.

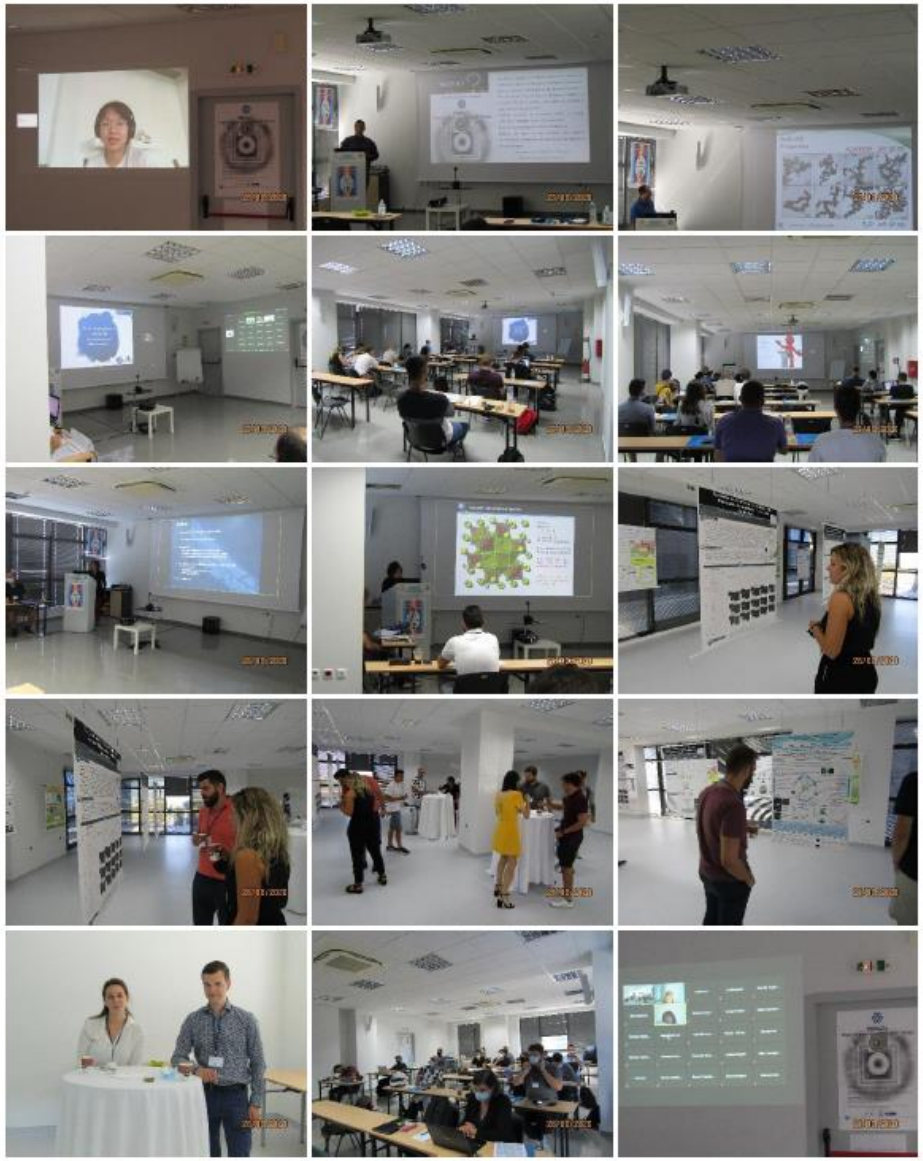
27/7/2020, 1st Web-based Training Workshop

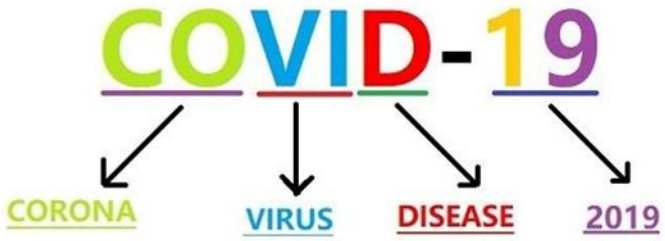


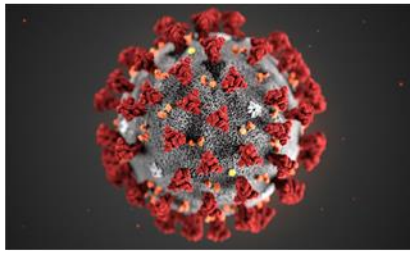
August 25-28, 2020, 2nd Hybrid Training Workshop and Summer School

Hybrid Training Workshop and Summer School

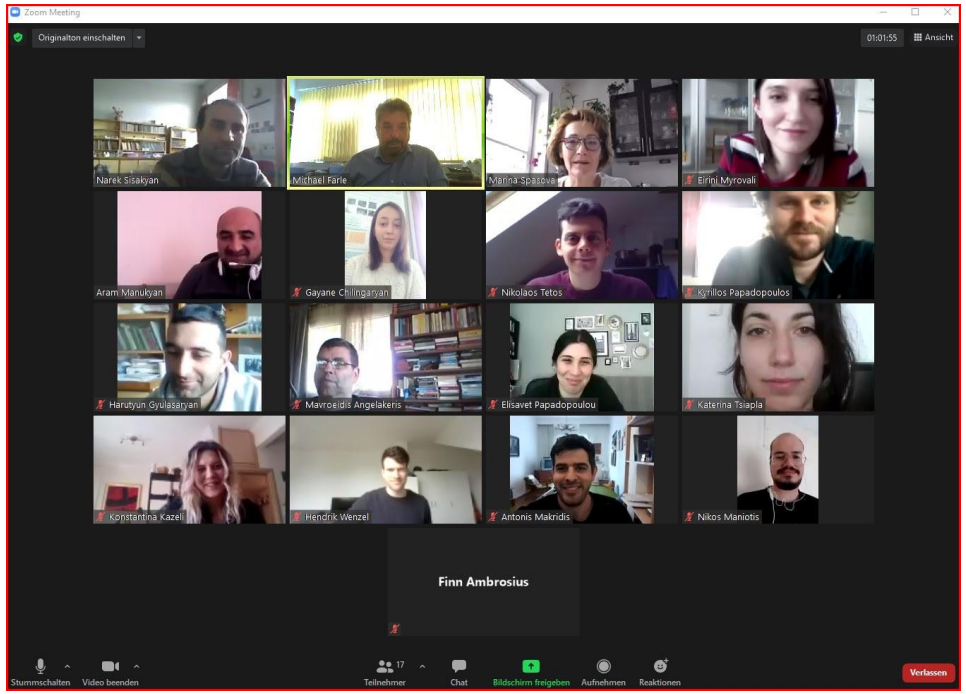








Weekly Seminars



Thank you for your attention!