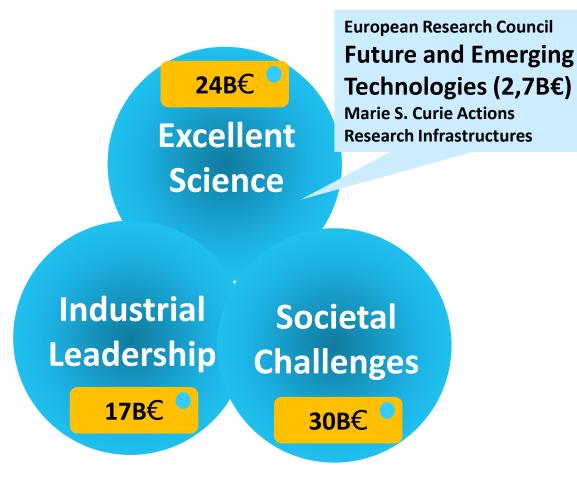**HORIZON 2020 - Future & Emerging Technologies (FET)**

Work Programme 2018-2020 & FET Flagships

Athens, 26 September 2017

FET Flagships in Horizon 2020: Graphene, Human Brain Project and Quantum

Thomas Skordas

Director 'Digital Excellence and Science Infrastructure'

DG Connect, European Commission

Horizon 2020
[2014-2020]

Excellent Science

24B€

European Research Council
Future and Emerging Technologies (2,7B€)
Marie S. Curie Actions
Research Infrastructures

Industrial Leadership

17B€

Societal Challenges

30B€

Future and Emerging Technologies (FET)

*"**Future and emerging technologies** shall support collaborative research in order to extend Europe's <u>capacity for advanced and paradigm-changing innovation</u>. It shall foster <u>scientific collaboration across disciplines</u> on <u>radically new, high-risk ideas</u> and accelerate development of the most promising emerging areas of science and technology..."*

HORIZON 2020 - THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION (2014-2020)

Future and Emerging Technologies

Individual research projects	Research Clusters	Strategic Research Agenda
Early Ideas **FET Open**	**Incubation** **FET Proactive**	**Large-Scale Initiatives** **FET Flagships**

European Commission

DRAFT FET Work Programme 2018-2020

Early Ideas

FET Open

FET Open call continues: ~ 650 M€ budget

Deadlines: 16 May '18 [123 M€], 24 Jan '19 [160M€]

18 Sep '19 [160 M€], 13 May '20 [203 M€]

Incubation

FET Proactive

(1) FET Proactive: Calls in 2018 and in 2020

❖ 2018: 6 topical areas for 88 M€

(2) FET Proactive HPC: Calls in 2018, 2019 and 2020

❖ 2018: INCO (Mexico & Brazil) for 4 M€

❖ 2019: Extreme scale HPC technologies: 64 M€

Large-Scale Initiatives

FET Flagships

❖ Graphene &the Human Brain Project [150 M€ / Flagship]

❖ NEW: Quantum Technologies [130 M€]

❖ NEW: preparatory actions for new Flagships [6 M€]
(1) ICT and Connected Society
(2) Health and the Life Sciences
(3) Energy, Environment and Climate change

European Commission

FET Flagships

What are they?

■ Science-driven, large-scale research initiatives built around an ambitious unifying vision

■ grand S&T challenges requiring interdisciplinary cooperation and involving academia and industry

■ convert scientific advances into technology developments: from lab to the market place

~ 1 Billion Euro	~ 10 year duration

Flagships are implemented in close cooperation between the European Commission and the Member States

European Commission

Why FET Flagships?

- Unprecedented S&T Collaboration
- Openness - New Partnership
- International Collaboration
- Innovation
- Talents in Europe

European Commission
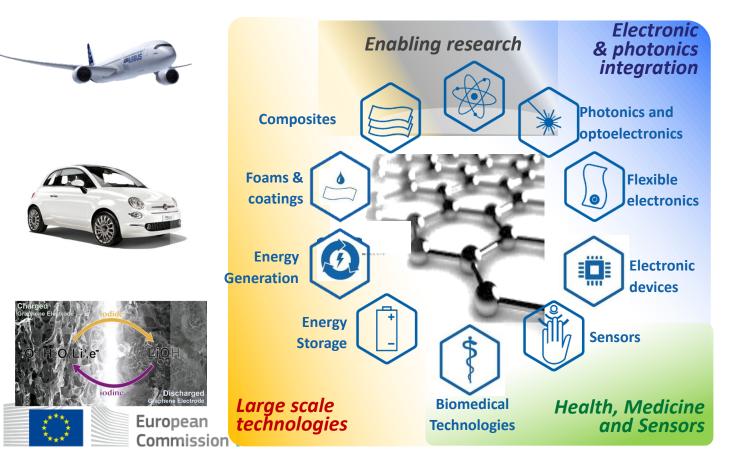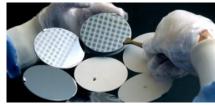
The Graphene FET Flagship:
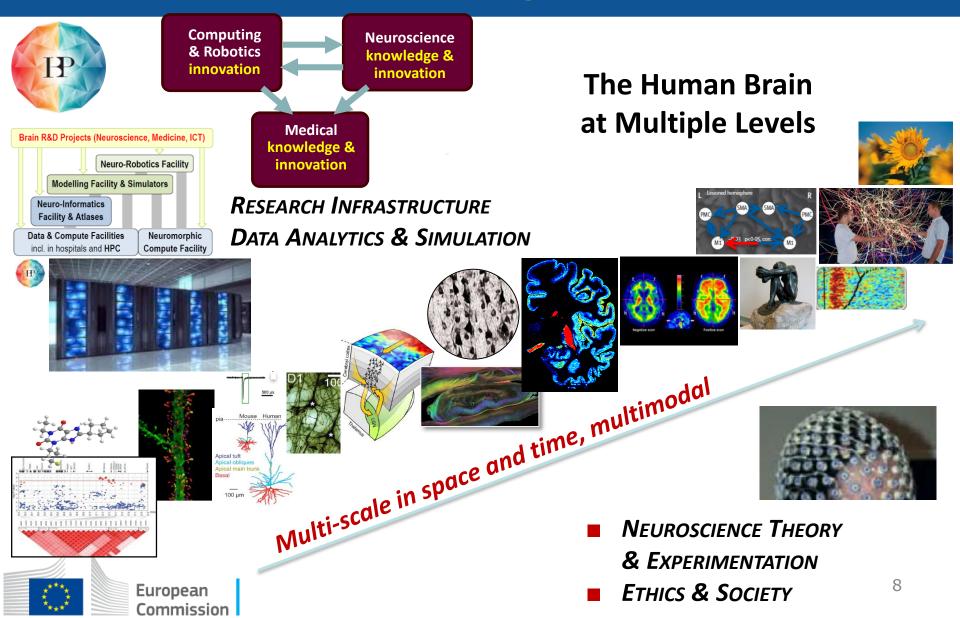## Large potential for many applications

AIM: Move graphene and related layered materials from the lab to the market
Consortium: 150+ partners from 23 countries, and almost 50 associated members
Duration and budget: October 2013 for 10 years – EU budget: ~380 M€ (FP7 + H2020)
➔ Driven by a Science and Technology roadmap + Technology and Innovation roadmap

Enabling research

Electronic & photonics integration

Composites

Photonics and optoelectronics

Foams & coatings

Flexible electronics

Energy Generation

Electronic devices

Energy Storage

Sensors

Large scale technologies

Biomedical Technologies

Health, Medicine and Sensors

The Human Brain Project FET Flagship (HBP)
for understanding the brain

Computing & Robotics innovation

Neuroscience knowledge & innovation

Medical knowledge & innovation

The Human Brain at Multiple Levels

RESEARCH INFRASTRUCTURE
DATA ANALYTICS & SIMULATION

Brain R&D Projects (Neuroscience, Medicine, ICT)
- Neuro-Robotics Facility
- Modelling Facility & Simulators
- Neuro-Informatics Facility & Atlases
- Data & Compute Facilities incl. in hospitals and HPC
- Neuromorphic Compute Facility

Multi-scale in space and time, multimodal

■ *NEUROSCIENCE THEORY & EXPERIMENTATION*

■ *ETHICS & SOCIETY*

European Commission

8

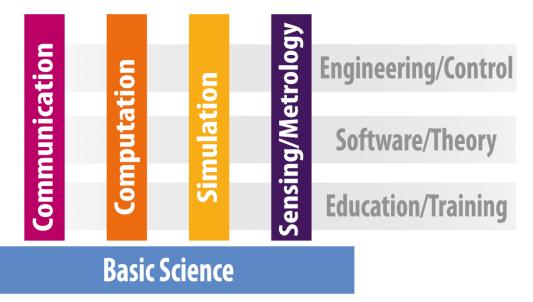# NEW: FET Flagship on Quantum Technologies
Draft

April 2016: *The European Commission announces
a Flagship initiative on Quantum Technologies*

Aims

- unlock the full potential of quantum technologies
- accelerate their development and bring commercial products to public and private users

130 M€

Closing Date: 20 FEB 2018

Communication | **Computation** | **Simulation** | **Sensing/Metrology**

Engineering/Control

Software/Theory

Education/Training

Basic Science

Final report of the High Level Steering Committee on the Quantum Technologies Flagship
https://tinyurl.com/qt-hlsc-report

European Commission

ICT Proposers' Day

Prepublication of (DRAFT) FET work programme 2018-2020:
https://ec.europa.eu/programmes/horizon2020/en/what-work-programme

ICT Proposers' Day
https://ec.europa.eu/digital-single-market/en/events/ict-proposers-day-2017

High Level Group ("Lamy Report")

- A vision and strategic recommendations to maximise the impact of the future EU R&I programmes: **'LAB – FAB – APP: Investing in the European future we want'**

- 11 recommendations

  Budget; Innovation policy; Education and training; New FP design for impactful research; "Mission-oriented" challenges; Synergy with structural funds; Simplification; Involving the citizens; Aligning EU & national R&I actions; International Cooperation;
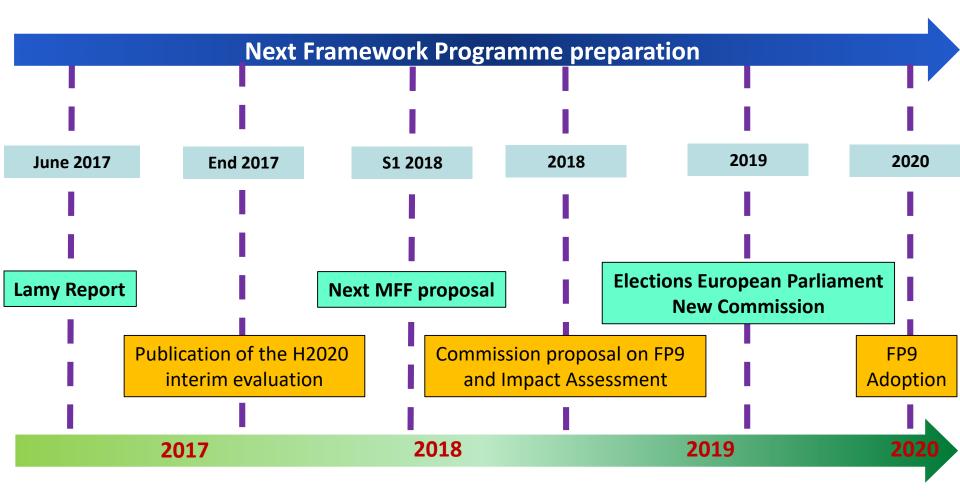 Better communications

- 3 pillars:
  - Science and Skills
  - Innovation & Competitiveness
  - Global Challenges

LAB – FAB – APP

Investing in the European future we want

Report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes

European Commission

Planning Towards FP9
Draft

Next Framework Programme preparation

June 2017	End 2017	S1 2018	2018	2019	2020

Lamy Report

Next MFF proposal

Elections European Parliament New Commission

Publication of the H2020 interim evaluation

Commission proposal on FP9 and Impact Assessment

FP9 Adoption

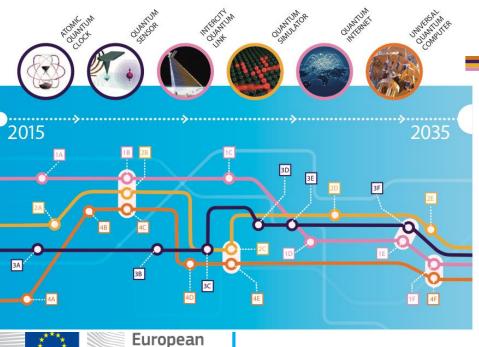**2017**   **2018**   **2019**   **2020**

European Commission

THANK YOU!

The Quantum Manifesto

- an initiative of the European Quantum Community

- published in May 2016 (NL Presidency event) supported by over 3500 scientists, research institutions and companies

- main goal: aid the selection of QT as the new European flagship project
  http://qurope.eu/manifesto

QuantumManifesto
A New Era of Technology
May 2016

ATOMIC QUANTUM CLOCK · QUANTUM SENSOR · INTERCITY QUANTUM LINK · QUANTUM SIMULATOR · QUANTUM INTERNET · UNIVERSAL QUANTUM COMPUTER

2015 — 2035

1. Communication

0 – 5 years
A Core technology of quantum repeaters
B Secure point-to-point quantum links

5 – 10 years
C Quantum networks between distant cities
D Quantum credit cards

> 10 years
E Quantum repeaters with cryptography and eavesdropping detection
F Secure Europe-wide internet merging quantum and classical communication

2. Simulators

A Simulator of motion of electrons in materials
B New algorithms for quantum simulators and networks

C Development and design of new complex materials
D Versatile simulator of quantum magnetism and electricity

E Simulators of quantum dynamics and chemical reaction mechanisms to support drug design

3. Sensors

A Quantum sensors for niche applications (incl. gravity and magnetic sensors for health care, geosurvey and security)
B More precise atomic clocks for synchronisation of future smart networks, incl. energy grids

C Quantum sensors for larger volume applications including automotive, construction
D Handheld quantum navigation devices

E Gravity imaging devices based on gravity sensors
F Integrate quantum sensors with consumer applications including mobile devices

4. Computers

A Operation of a logical qubit protected by error correction or topologically
B New algorithms for quantum computers
C Small quantum processor executing technologically relevant algorithms

D Solving chemistry and materials science problems with special purpose quantum computer > 100 physical qubit

E Integration of quantum circuit and cryogenic classical control hardware
F General purpose quantum computers exceed computational power of classical computers

European Commission