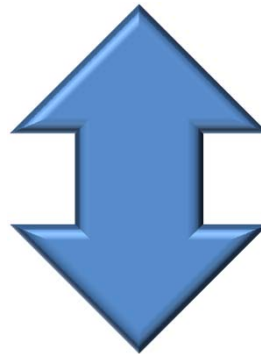


basic science \leftrightarrow communication

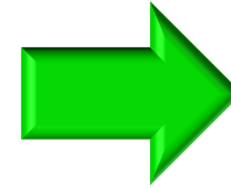
Deutsches Museum



TUM

Technische Universität München

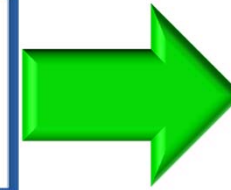
**BASIC
SCIENCE**



**comm-
unication**



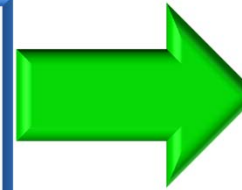
**research &
development**



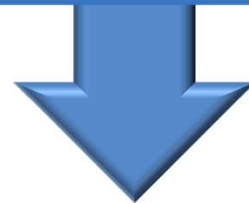
**comm-
unication**



**risk
assessment**



**comm-
unication**



**economic power:
products → jobs → wealth**

thoughts on science communication

→ unbiased

provide arguments not opinions
independent sources of information

→ balanced

→ only good analogies are useful

→ avoid unkeepable promises

challenges & balances

simple but not wrong

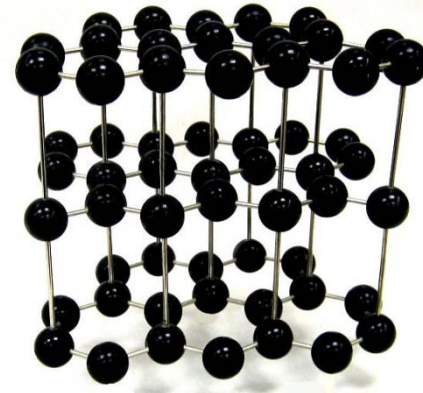
realistic ↔ exciting

education ↔ entertainment

-inhomogeneous backgrounds

-mobilizing “inert” audiences

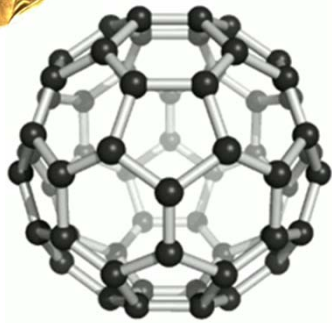
example: carbon nanomaterials



graphite (3D)

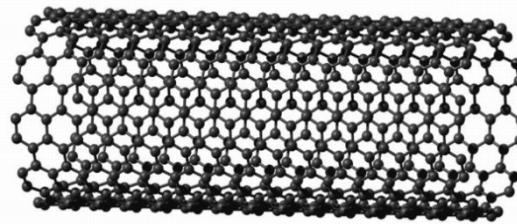


1985



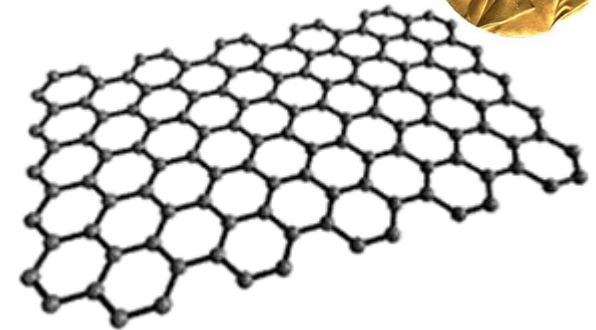
C_{60} fullerene (0D)

1991 / 1993



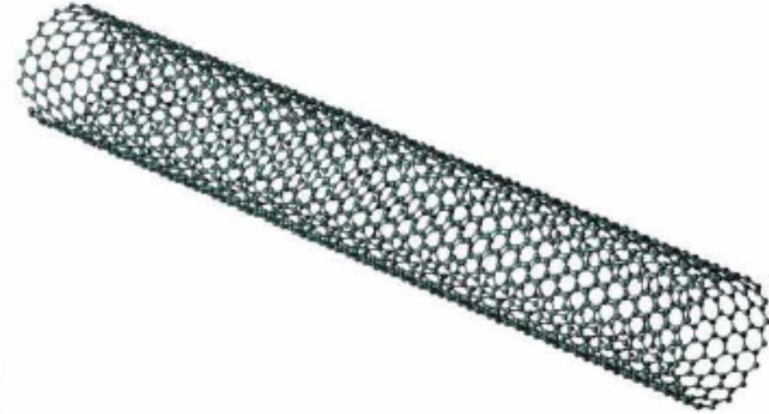
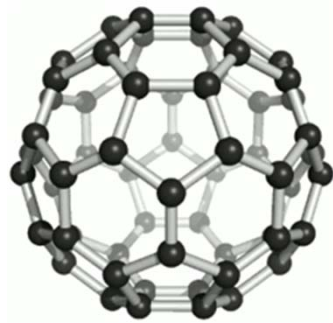
nanotubes (1D)

2004



graphene (2D)

consumer products



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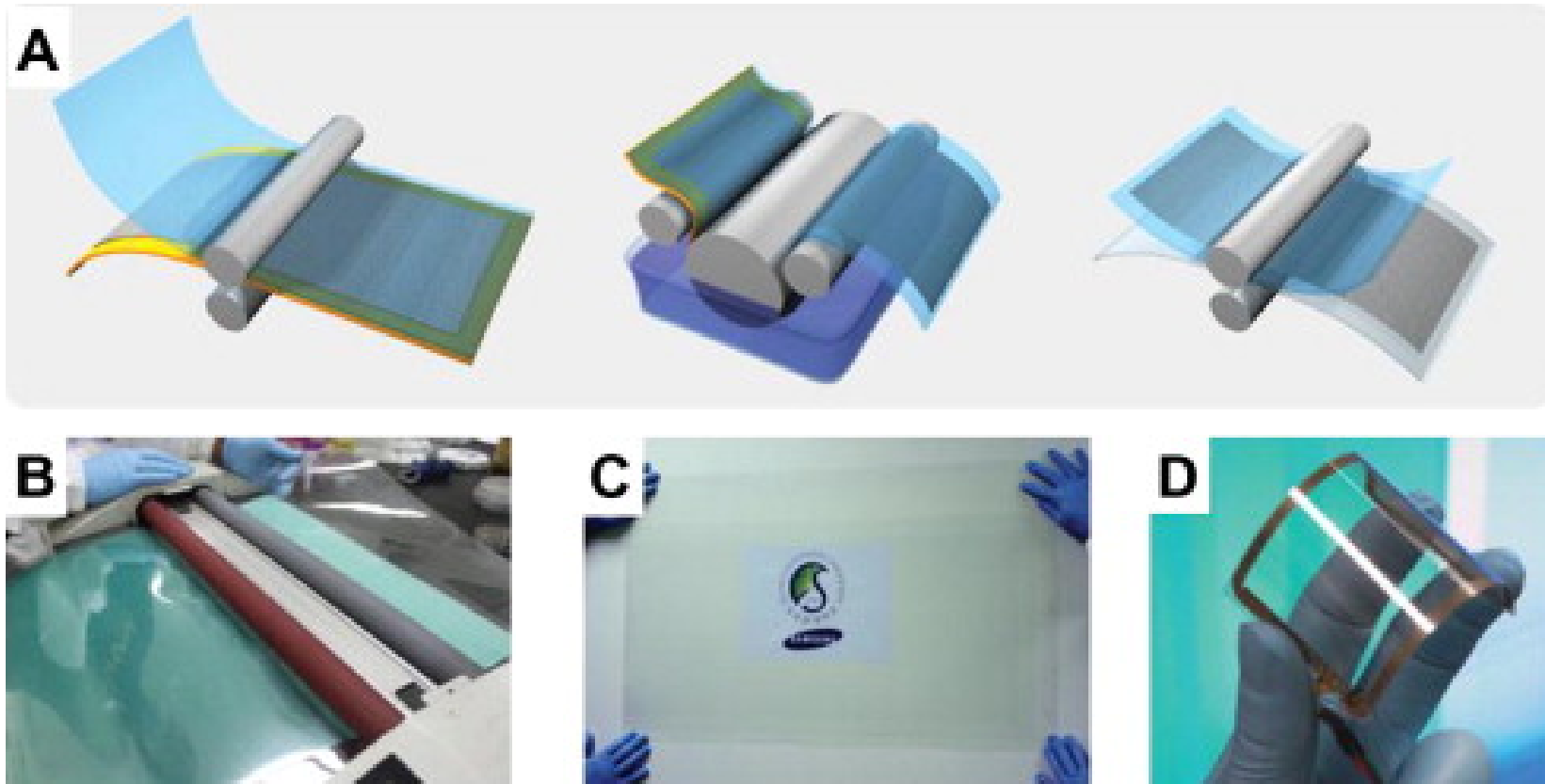
<http://www.novaadvancedskincare.com>

first graphene devices

→ large area growth of high quality graphene on surfaces

roll-to-roll

→ first displays with transparent graphene electrodes



Roll-to-roll production of 30-inch graphene films for transparent electrodes
Sukang Bae et al., Nat. Nanotech. 5, 574 (2010)

chances & challenges for graphene high-tech products

displays / e-paper / solar cell:

- economic materials for transparent electrodes
 - bendable supports

electronic circuits:

hard to compete with silicon technology
established processes + high performance

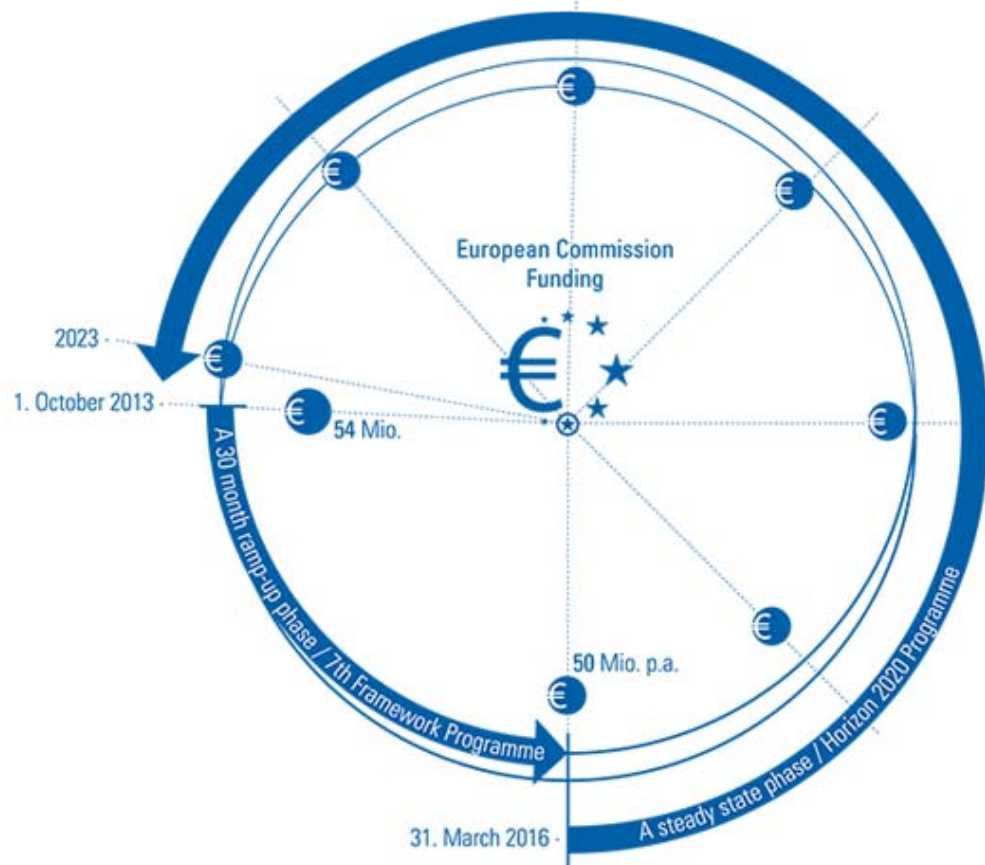
no proven concepts for integrated circuits
1 transistor!!! → billions of transistors???

graphene flagship

<http://graphene-flagship.eu/>



-  Graphene Flagship
-  EU countries
-  Academic Partners
-  Industrial Partners



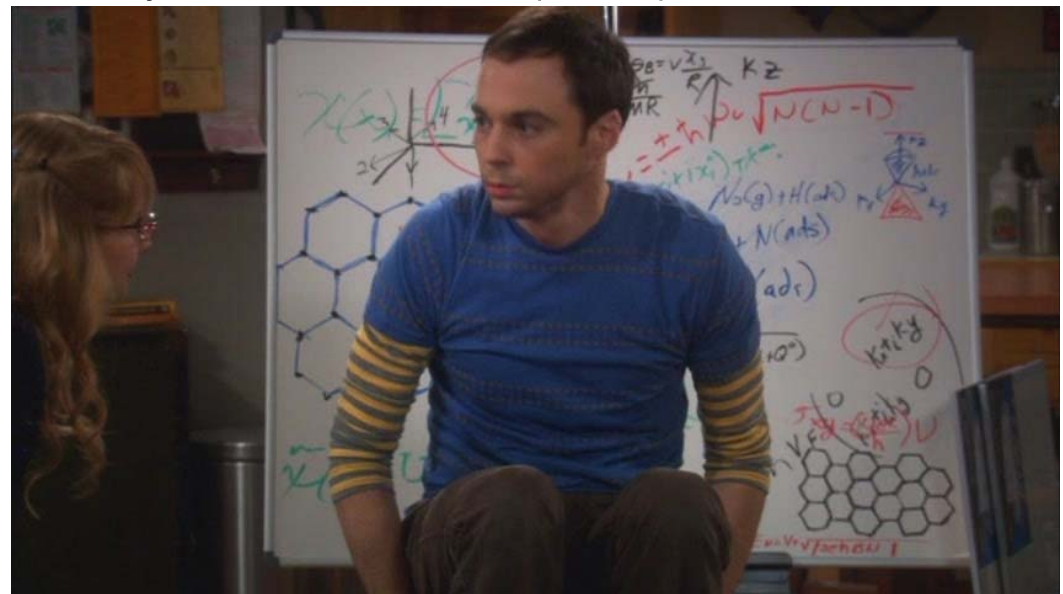
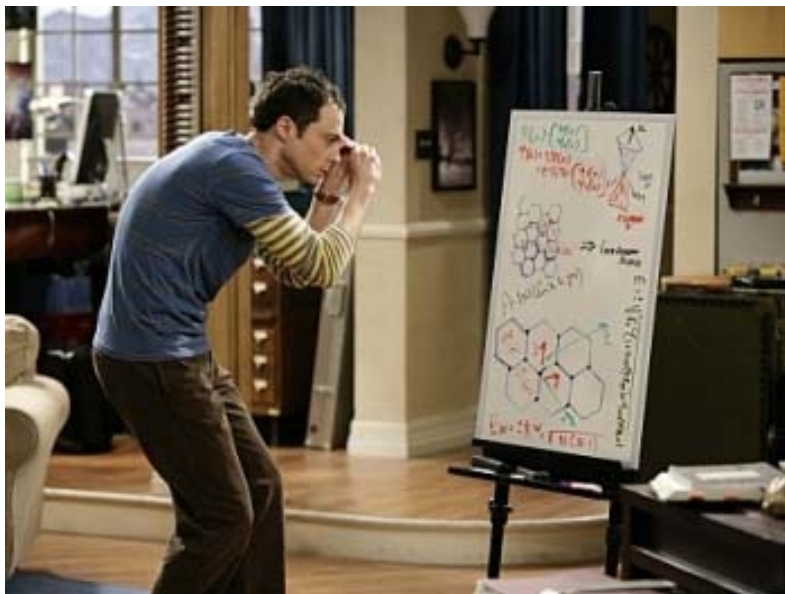
- 1: Materials
- 2: **Health and Environment**
- 3: Fundamental science of graphene and 2D materials beyond graphene
- 4: High frequency electronics
- 5: Optoelectronics
- 6: Spintronics
- 7: Sensors
- 8: Flexible electronics
- 9: Energy
- 10: Nanocomposites
- 11: Production
- 12: Innovation
- 13: Dissemination
- 14: Management
- 15: Research Management
- 16: Alignment

first commercial application of graphene



“The fact that one of the first practical uses of this material was not in a high-expectation, predictable field such as transistors or photonics, but instead in the **entertainment industry** indicates its **great potential and versatility.**”

K.S. Novoselov, Nobel Lecture: Graphene: Materials in the Flatland
Rev. Mod. Phys. 83, 837-849 (2011)



US Sitcom, Chuck Lorre und Bill Prady