

Preparation and characterization of single/few layer antimonene and germanium



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The consortium

2D-Sb&Ge

P1



Theoreticians

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Félix Zamora

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Experimentals

P3



Zoran Levnajic

P2



Gonzalo Abellan



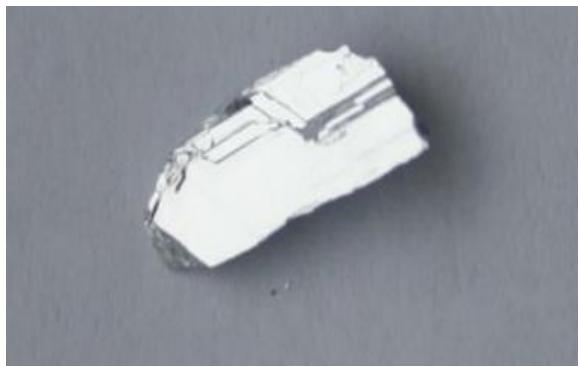
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Antimonene

2D-Sb&Ge

7	N	Nitrogen
15	P	Phosphorus
33	As	Arsenic
51	Sb	Antimony



Relevant lattice parameters

$t = 1.57 \text{ \AA}$ layer thickness

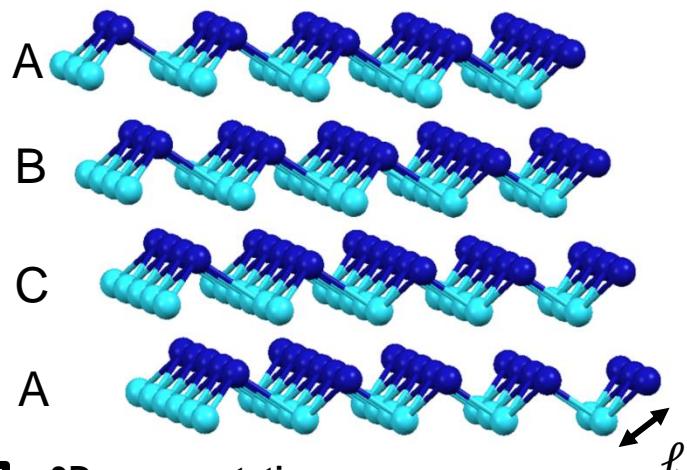
$d = 3.73 \text{ \AA}$ interlayer distance

$|\vec{a}| = |\vec{b}| = 4.28 \text{ \AA}$ lattice vector module

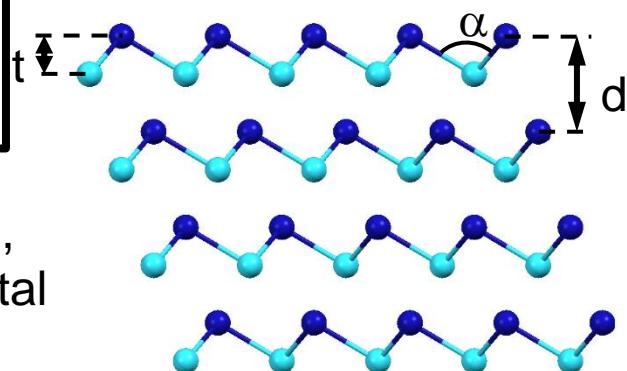
Estimated band-gap: 0.76-2.4 eV

Layered,
semimetal

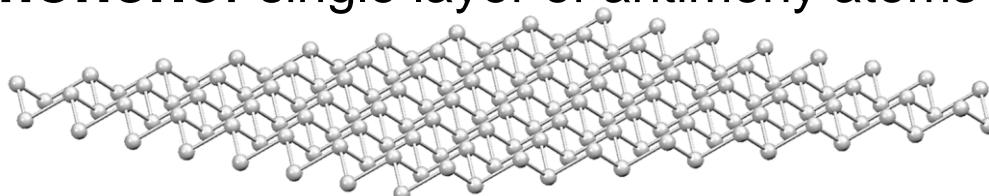
Structure for β -antimony



3D representation



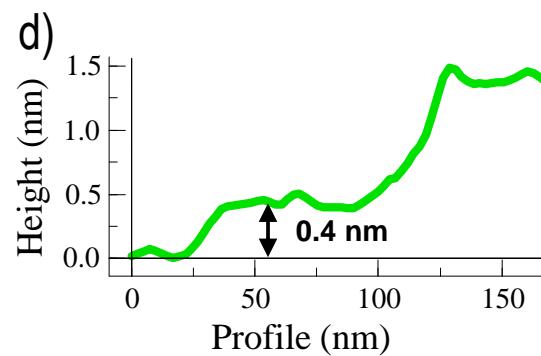
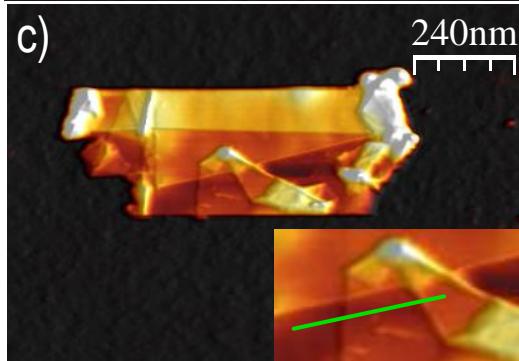
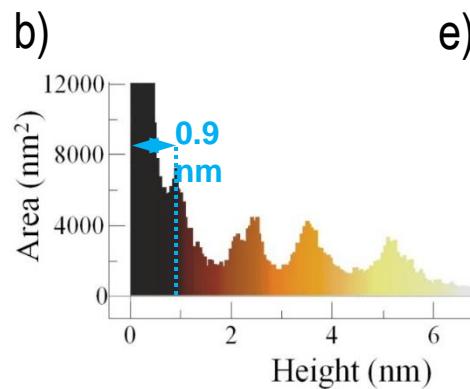
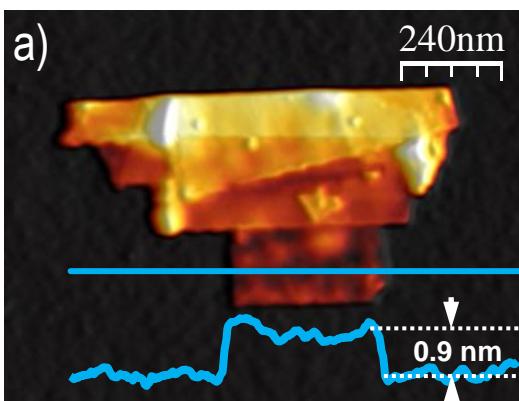
Antimonene: single layer of antimony atoms



Antimonene: Preparation

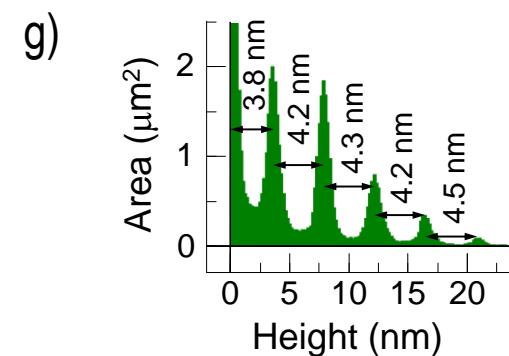
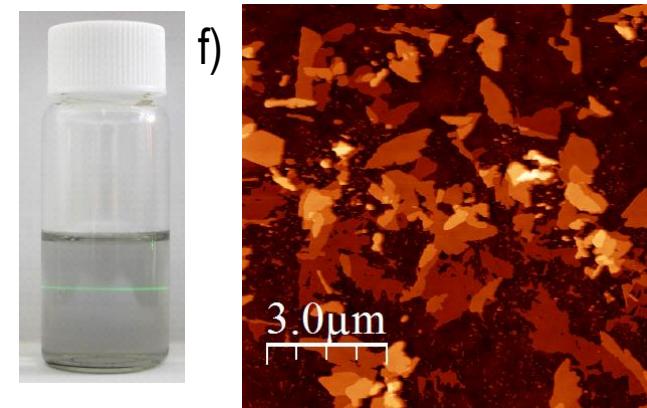
2D-Sb&Ge

Micromechanical Exfoliation



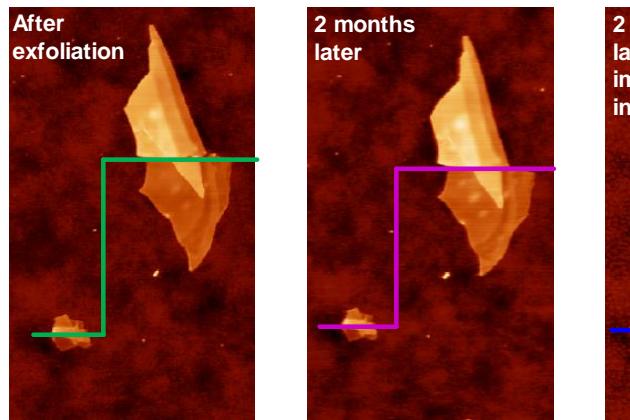
Adv. Matter. 28, 6332 (2016)

Liquid Phase Exfoliation



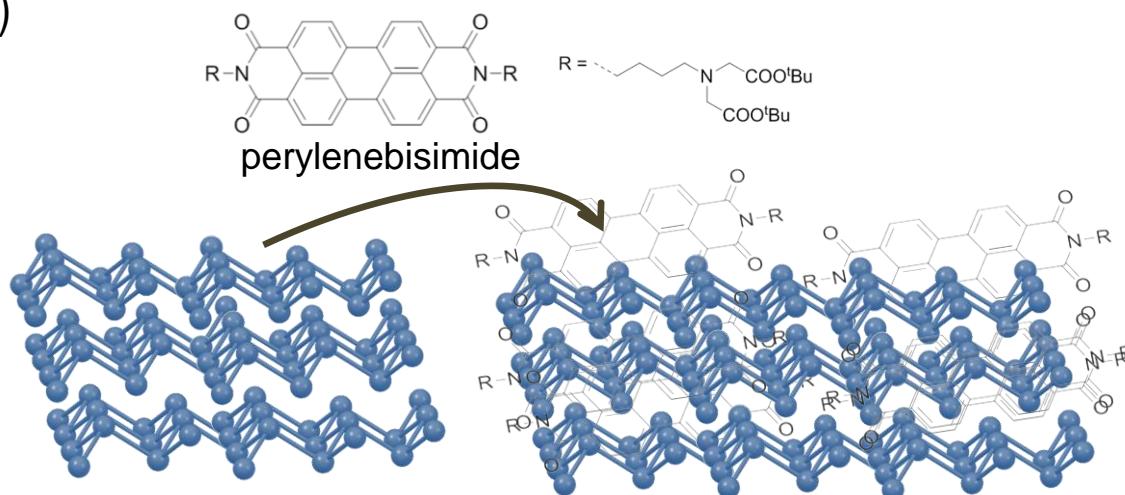
Angew. Chem. Int. Ed. 55, 14345 (2016)

High Stability

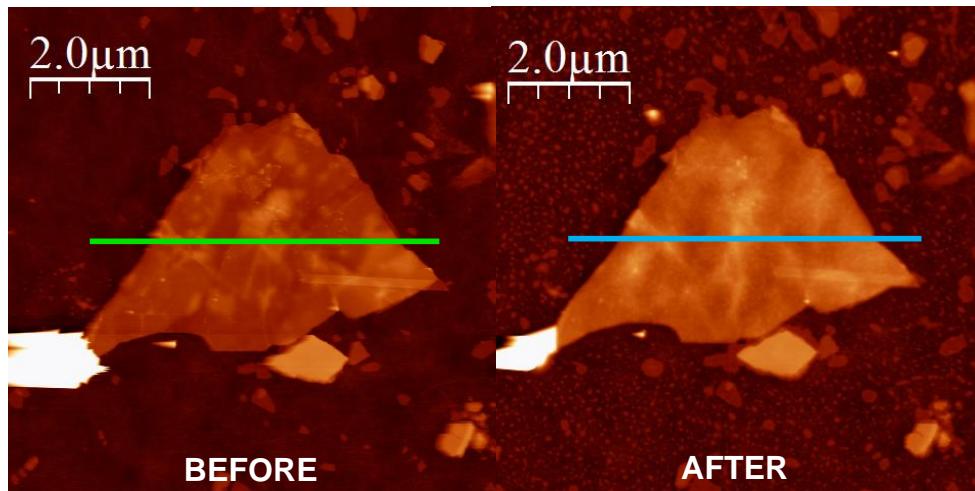


Antimonene: Chemical Functionalization 2D-Sb&Ge

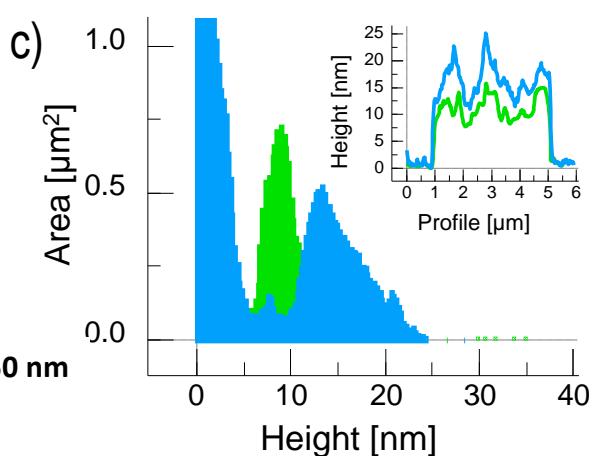
a)



b)

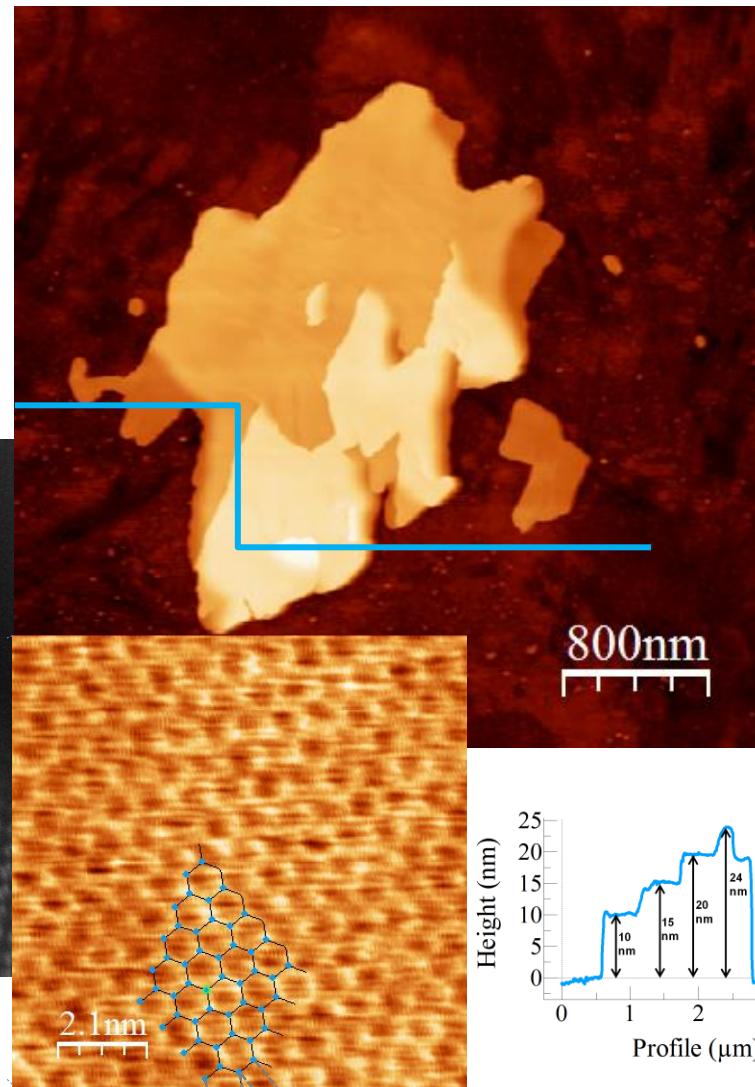
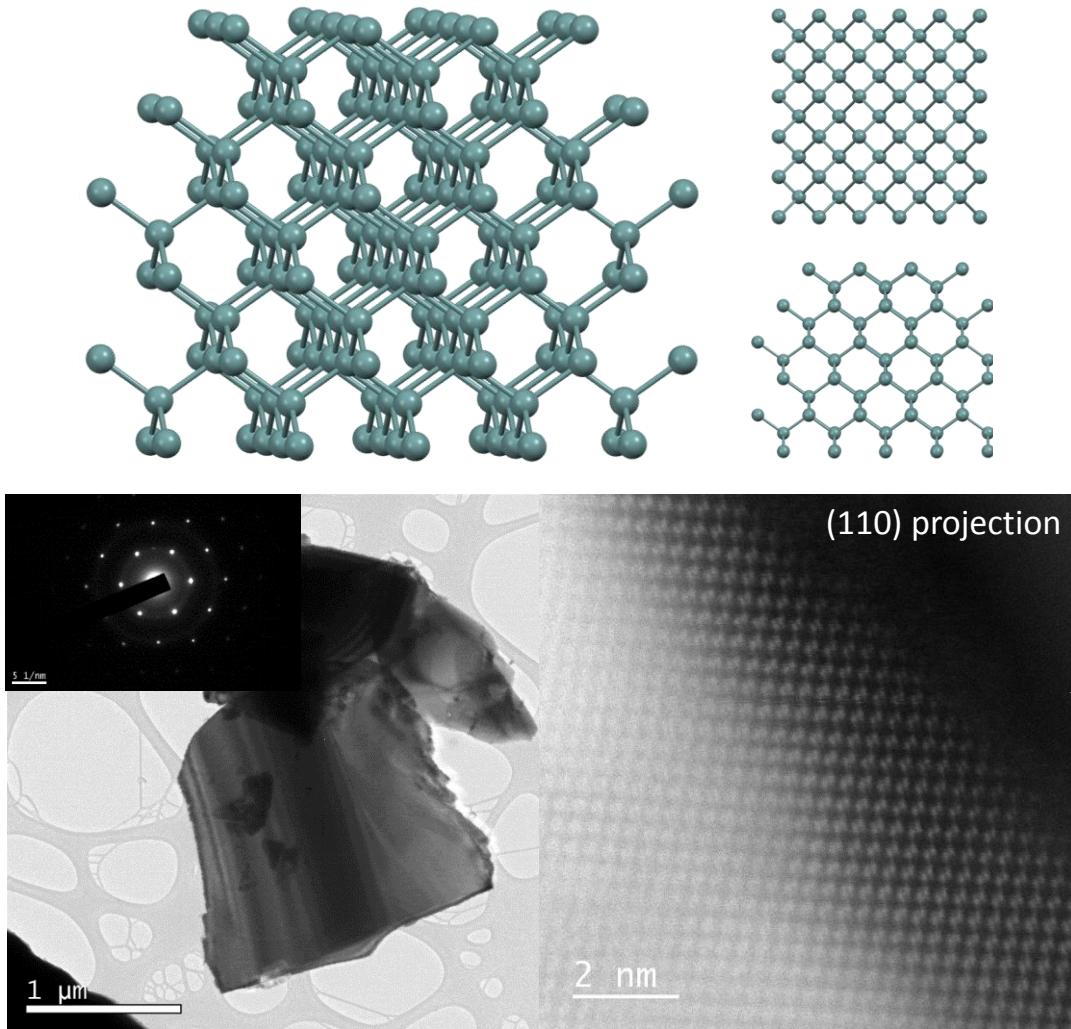


Band-gap Modulation



α -Germanium: Production & Characterization

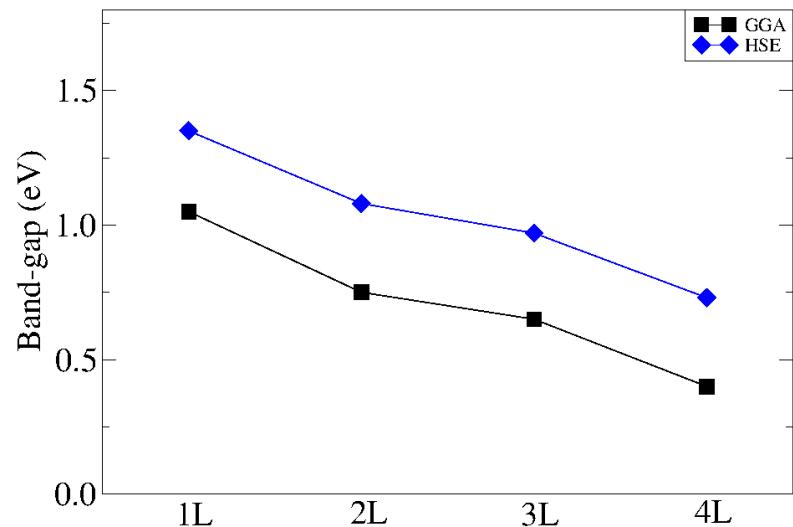
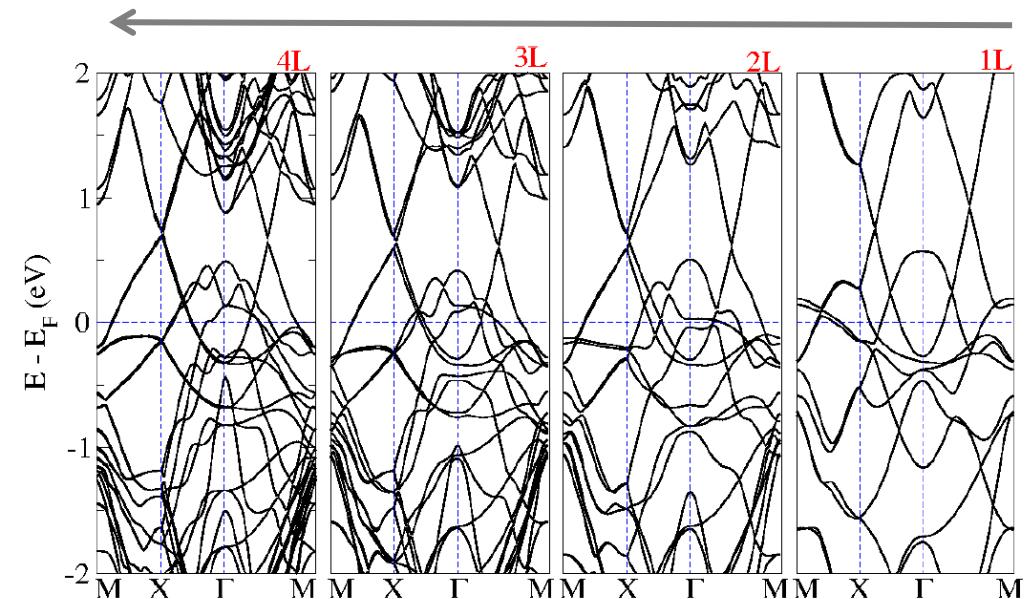
2D-Sb&Ge



α -Germanium: Band Gap

2D-Sb&Ge

Band-gap Theoretical Calculations on Nanolayers of α -Germanium



Band gap is modulated with the thickness:
decreases upon increases the number of layers

Experiments on-going

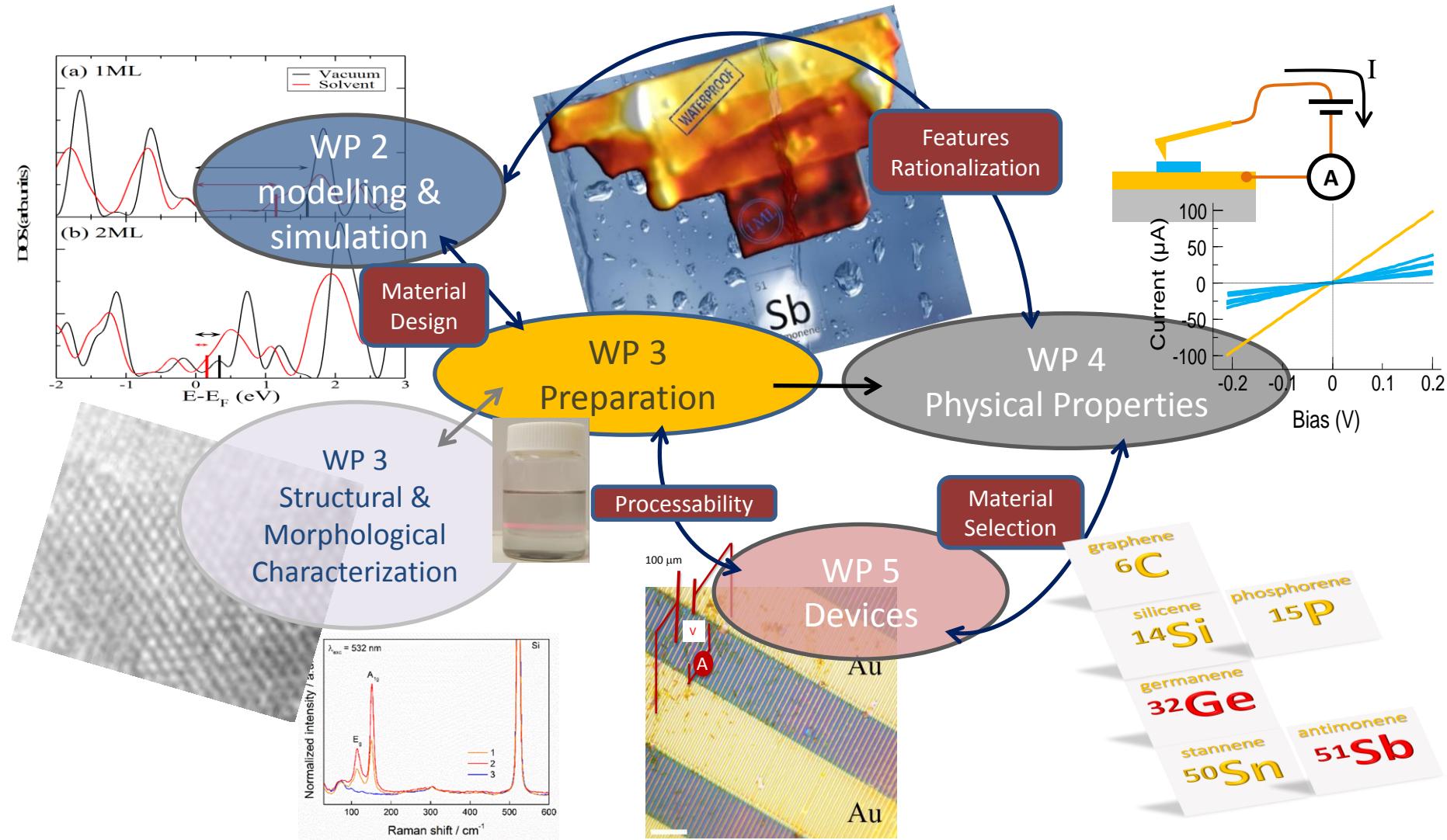
Objetives

The production, characterization and modelling of these two novel layered materials.

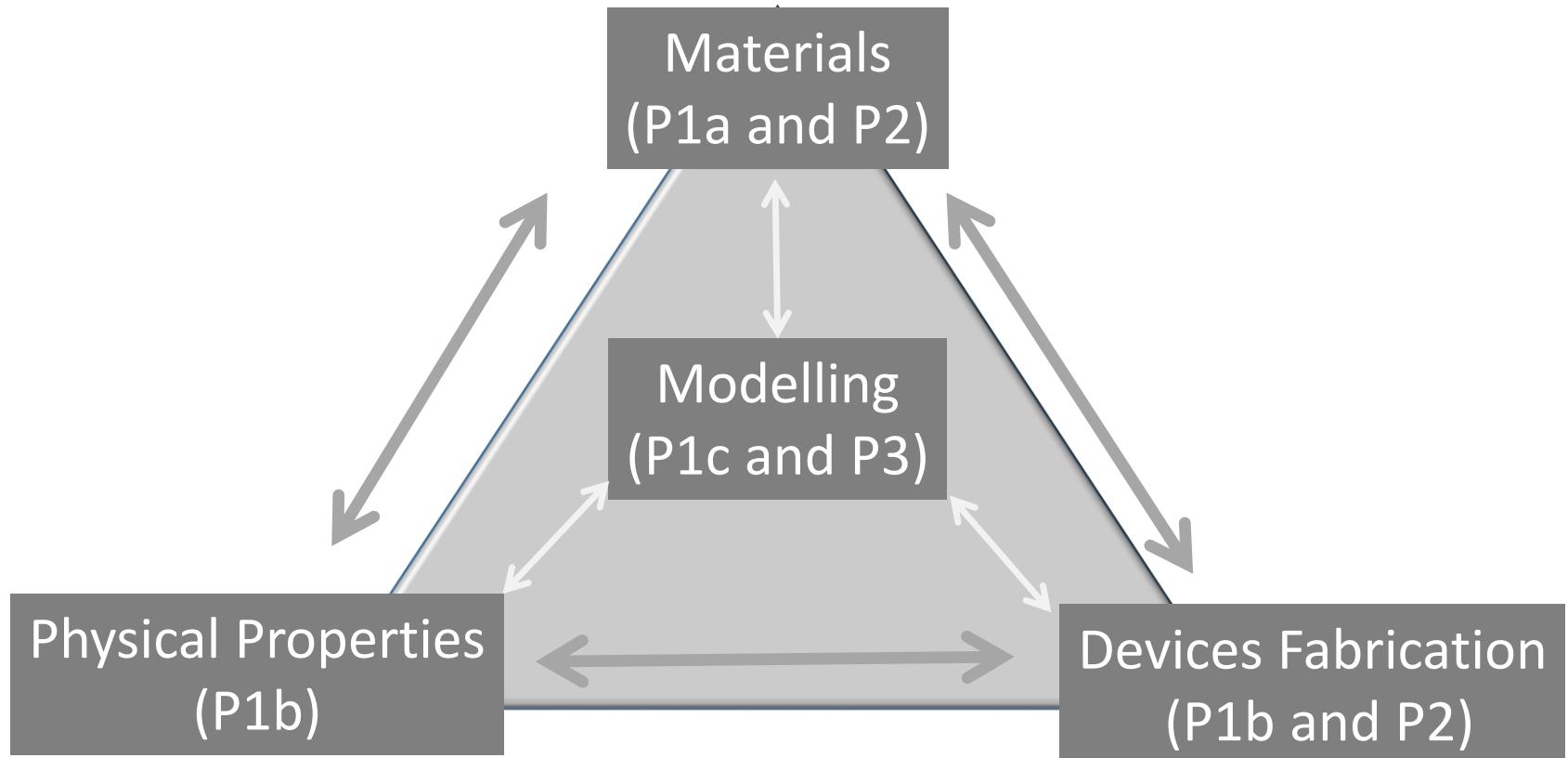
1. The optimization of preparation conditions and chemical functionalization
2. Characterization of basic electrical and optoelectronical properties
3. Rationalize the results with the help of first-principles calculations.
4. Fabricate simple proof-of-concept transistor-type devices

Graphical presentation of the components of 2D-Sb&Ge project showing how they inter-relations and complementary activities

2D-Sb&Ge



Partners Interactions



Thanks for your kind attention !!

