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Sommario/riassunto	This thesis reports on essential experimental work in the field of novel two-dimensional (2D) atomic crystals beyond graphene. It especially describes three new 2D crystal materials, namely germanene, hafnene,

and monolayer $PtSe_2$ fabricated experimentally for the first time, using an ultra-high vacuum molecular beam epitaxy (UHV-MBE) system. Multiple characterization techniques, including scanning tunneling microscope (STM), low energy electron diffraction (LEED), scanning transmission electron microscope (STEM), and angle-resolved photoemission spectroscopy (ARPES), combined with theoretical studies reveal the materials' atomic and electronic structures, which allows the author to further investigate their physical properties and potential applications. In addition, a new epitaxial growth method for transition metal dichalcogenides involving direct selenization of metal supports is developed. These studies represent a significant step forward in expanding the family of 2D crystal materials and exploring their application potentials in future nanotechnology and related areas.