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Nota di contenuto	Part I: Introduction and basics -- Scientic context and motivation -- Laser-plasmas -- Part II: Experimental methods -- High-power lasers -- Transportable Paul trap for isolated micro-targets in vacuum -- Part III: Laser-microplasma interactions -- Laser-driven ion acceleration using isolated micro-sphere targets -- Laser-driven micro-source for bi-modal radiographic imaging -- Part IV: Summary and perspectives -- Summary -- Challenges and perspectives -- Appendix.
Sommario/riassunto	This thesis provides the first comprehensive theoretical overview of the electronic and optical properties of two dimensional (2D) Indium Selenide: atomically thin films of InSe ranging from monolayers to few layers in thickness. The thesis shows how the electronic propertes of 2D InSe vary significantly with film thickness, changing from a weakly indirect semiconductor for the monolayer to a direct gap material in the bulk form, with a strong band gap variation with film thickness

predicted and recently observed in optical experiments. The proposed theory is based on a specially designed hybrid k.p tight-binding model approach (HkpTB), which uses an intralayer k.p Hamiltonian to describe the InSe monolayer, and tight-binding-like interlayer hopping. Electronic and optical absorption spectra are determined, and a detailed description of subbands of electrons in few-layer films and the influence of spin-orbit coupling is provided. The author shows that the principal optical excitations of InSe films with the thickness from 1 to 15 layers broadly cover the visible spectrum, with the possibility of extending optical functionality into the infrared and THz range using intersubband transitions. .