



# Soutenance de thèse

Vendredi 6 septembre

14h00

Institut Photovoltaïque d'Ile de France (IPVF)  
30, Route départementale 128  
91120 Palaiseau, France  
*Amphithéâtre*

Amadeo MICHAUD

## “III-V/Silicon tandem solar cells grown with molecular beam epitaxy”

### Jury members :

M Alain Le Corre	FOTONS	Rapporteur
M James Connolly	IPVF	Rapporteur
M Andrea Gauzzi	IMPMC	Examineur
M Wilfried Favre	INES	Examineur
M Jean Christophe Harmand	C2N	Directeur de thèse
Mme Jara Fernandez Martin	TOTAL	Directrice de thèse

### Abstract :

Terrestrial photovoltaic is dominated by Silicon based devices. For this type of solar cells, the theory predicts an efficiency limit of 29%. With photovoltaic modules showing 26.6% efficiency already, Silicon-based modules is a mature technology and harvest almost their full potential. In this work, we intend to explore another path toward the enhancement of photovoltaic conversion efficiency. Tandem solar cells that consist in stacking sub-cells, allow overcoming the Si efficiency limit. Since solar cells made of III-V semiconductors are good complements to Silicon solar cells, theory predicts that efficiency above 40% is attainable when combining those types of cells. This work focuses on the elaboration of a performant III-V solar cell, compatible for a tandem use. The first stage of the PhD was to build expertise on phosphide alloys epitaxy with MBE. The influence of the growth conditions on GaInP properties were studied. Then GaInP single junction solar cells were fabricated. The different layers composing the cells were optimized.

P-GaInP is presented as a potential limit of solar cell performance. Indeed, a small diffusion length of the generated carriers was evidenced in this material. A practical solution was proposed and implemented: we designed a cell combining GaInP and AlGaAs in a heterojunction cell. An efficiency of 18.7% was obtained using this structure.