M2 / Final-Year Engineering Internship Offer

Numerical and Experimental Development of Solar Thermophotovoltaics

General information:

Location: PROMES-CNRS – 7 rue du Four Solaire, 66120 Font-Romeu-Odeillo-Via, France.

Supervisors: Maxime Giteau & Alexis Vossier (CNRS researchers).

Allowance: ~630€/month (15% of the French social security hourly ceiling).

Start date and duration: Flexible (between February and May 2026), 4–6 months

Keywords: Thermophotovoltaics, thermal energy storage, concentrated solar energy, phase-change materials, radiative heat transfer.

Context:

Thermophotovoltaic (TPV) conversion consists in placing a photovoltaic (PV) cell in front of a high-temperature thermal emitter (***Fig. 1a***). Such systems convert heat to electricity radiatively while naturally enabling energy storage—an attractive pathway to mitigate solar intermittency. In solar-driven TPV, the storage material is **heated to ~1000–1500 °C by concentrated sunlight**; the stored energy is later re-emitted as thermal radiation and converted by TPV cells.

A key challenge is **efficiently absorbing and storing concentrated solar energy**. Conventional opaque media can develop strong internal temperature gradients, limiting performance (***Fig. 1b***). At PROMES-CNRS, we explore **optically transparent storage materials** (e.g., quartz and transparent PCMs) that let sunlight pass through the storage and be absorbed at the cavity walls (***Fig. 1c***), **inverting the thermal gradient** and improving storage efficiency.

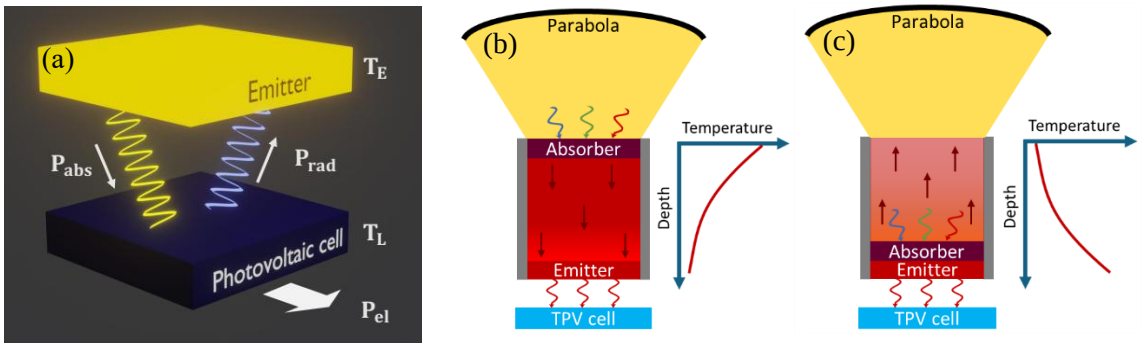

Figure 1: (a) General schematic of a TPV system (b) Conventional solar TPV system with a strong thermal gradient between absorber and emitter. (b) Concept under investigation at PROMES, implementing transparent thermal storage.

Ongoing work combines **predictive models** to capture the principles of transparent storage with **experiments on a 6-kW solar concentrator** (***Fig. 2***). A growing focus is on **transparent phase-change materials** (e.g., certain molten salts and glasses) to leverage latent heat for higher performance.

Figure 2 : Experimental solar TPV setup operating at the 6-kW solar furnace in PROMES.

Possible Internship Topics (tailored to the candidate):

We are offering **2–3 internship positions** within this research program, covering complementary aspects from modeling to experiments:

- **Predictive modeling** of solar TPV systems employing transparent PCMs using 1D implicit heat-transfer models coupled to TPV conversion models (MATLAB).
- **Experimental demonstration** of a solar TPV system with transparent thermal storage using the existing prototype operated under the 6-kW solar concentrator at PROMES.
- **Radiative exchange modeling and optimization** between a hot emitter and a TPV cell in a mirror-based cavity using Monte-Carlo ray tracing (Ansys Zemax OpticStudio).

Environment:

The internship takes place at **PROMES-CNRS in Odeillo (Font-Romeu)**, in the **French Pyrenees** at high altitude (1600 m), combining a **unique mountain setting** with world-class solar research infrastructure. PROMES hosts one of the **largest solar facilities worldwide**, including the **1-MW solar furnace** and a **6-kW solar concentrator** for lab-scale experiments. Expect **clear skies, abundant sunshine, and immediate access to outdoor activities** (hiking, skiing, climbing)—all alongside cutting-edge high-temperature energy research.

You will join a **small, dynamic team** (two researchers, one postdoc, one PhD student, two internship students) and interact daily with **other interns, PhD students, engineers, and researchers**. The atmosphere is **collaborative and multidisciplinary**, with strong encouragement for initiative and curiosity.


Candidate Profile

- Background in **thermal / optical / materials science**, or **energy engineering**.
- Strong motivation for **renewable energy** challenges.
- **Rigor, initiative, teamwork.**
- Experience with MATLAB/Python/COMSOL and/or laboratory work is a plus (not mandatory).

What we value most: motivation, curiosity, and a **growth mindset**. Your **motivation letter** should be specific to this position and clearly state which aspects excite you most—**theory vs. experiments**, and **TPV conversion vs. thermal storage**.

Continuation: Outstanding interns may be offered a **PhD starting ~October 2026**.

How to apply:

Please send (i) your CV and (ii) a tailored motivation letter to:

- **Maxime Giteau**: maxime.giteau@cnrs.fr
- **Alexis Vossier**: alexis.vossier@promes.cnrs.fr