

# 1<sup>st</sup> SPECIAL PV Workshop

Space Photovoltaics for Energy Conversion in extra-terrestrial environment



Organized by



With the support of



23 & 24 November 2021  
2 half days – Online

Free of charge

Register at <https://www.ines-solaire.org/en>

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[www.ines-solaire.org](http://www.ines-solaire.org) |



## SCOPE

Since Vanguard 1 satellite, the first spacecraft to use solar panels back in 1958, space photovoltaics (PV) have been strongly improved from the initial single junction low efficiency silicon solar cells to the high efficiency III-V compound multi-junction solar cells. For such specific space applications, the driving force is still the long-term reliability, particularly considering radiation resistance, while improving the conversion efficiency and increasing the power-to-mass ratio. However, space conquest is currently intensified with new applications to become reality, such as satellite constellations, and overall costs have to be minimized in the course of space PV standardization.

**The 1<sup>st</sup> edition of the SPECIAL PV Workshop will focus on PV cells and arrays designed for space applications** with the latest research and industrial results presented by highly skilled experts of the field. Four sessions and one round table will take place virtually during two half-days, addressing the latest research topics of Space PV cell & arrays manufacturing, as well as their reliability and durability through indoor accelerated ageing tests and thermo-mechanical simulations.

*This workshop provides an informal, unclassified, international forum for the exchange of ideas and information on space photovoltaic cells and arrays. Addressed to researchers, industrials, academics and students. **Free of charge.***

*Due to the COVID situation uncertainty, this 1<sup>st</sup> edition will be an online-only event.*

This event is financed and promoted through the [ECoVEM European project](#) which aims at establishing a transnational cooperation platform of Centres of Vocational Excellence in Microelectronics working on the synergies between both the education and industrial sectors by fostering the development of technological and entrepreneurial skills for the new jobs in microelectronics, including photovoltaics. This project has received funding from the European Union's ERASMUS+ programme (Grant Agreement n° 620101-EPP-1-2020-1-BG-EPPKA3-VET-COVE).

The [RadHard European project](#) co-coordinates the SPECIAL PV Workshop. The RadHard consortium aims to combine the most radiation hard III-V materials to form a highly efficient four-junction space solar cell via direct wafer bonding. RadHard receives funding from the European Union's Horizon 2020 Research and Innovation Programme (Grant Agreement n°EU/821876).

## SPECIAL PV WORKSHOP PROGRAM

### DAY 1: Solar cells

#### Introduction | SPECIAL PV Workshop

10' talks

**Chairman:** Jean-François Lelièvre (INES)

14h00 (CET)	<b>David Lackner (Fraunhofer ISE)</b>	<i>Introduction &amp; RadHard European project</i>
14h15	<b>Slavka Tzanova (TUS)</b>	<i>ECOVEM Business-Science-Education Plan</i>
14h25	<b>Romain Cariou (CEA)</b>	<i>Brief overview of Space PV research</i>

#### Session 1 | High efficiency III-V solar cells

15' talks + 5' Q&A

**Chairman:** Romain Cariou (CEA)

14h40	<b>Victor Khorenko (Azur Space)</b>	<i>State-of-the-art in European industrial solar space cells: highest performance for advanced space applications</i>
15h00	<b>Iván Garcia (IES-UPM)</b>	<i>Space solar cells on detachable Ge virtual substrates</i>
15h20	<b>David Lackner (Fraunhofer ISE)</b>	<i>Flexible &amp; high efficiency cells (title to be confirmed)</i>
15h40	<b>Ryan France (NREL)</b>	<i>High efficiency advanced concept cell designs</i>

10' break

#### Session 2 | Advanced concepts for radiation hardness

15' talks + 5' Q&A

**Chairman:** David Lackner (Fraunhofer ISE)

16h10	<b>Bruno Boizot (CEA)</b>	<i>Controlling parameters like energy, dose and fluence during solar cells irradiation testing</i>
16h30	<b>Antonino Alessi (LSI-Polytechnique)</b>	<i>Sirius electron accelerator and solar cell test</i>
16h50	<b>Andrea Cattoni (C2N-CNRS)</b>	<i>Recent advances in ultrathin solar cells</i>
17h10	<b>Carla Costa (CEA/ONERA)</b>	<i>Perovskites for space : challenges and advances</i>
17h30	<b>Pilar Espinet (Caltech)</b>	<i>Radiation resistant nanowire solar cells</i>

### DAY 2: Solar arrays

#### Session 3 | III-V solar arrays for space applications

15' talks + 5' Q&A

**Chairman:** Paul Zevenbergen (Airbus)

14h00 (CET)	<b>Anderson Bermudez (CEA)</b>	<i>Viability of solar power in various space environment</i>
14h20	<b>Jean-Baptiste Charpentier (CEA)</b>	<i>The mechanics of PV ribbons lengthening induced by thermal cycling</i>
14h40	<b>Emanuele Ferrando (STI)</b>	<i>STI Solar Array product growth</i>
15h00	<b>César Dominguez (IES-UPM)</b>	<i>Micro-concentrator PV architectures for high-efficiency solar generators</i>

10' break

#### Session 4 | Towards standardization of Space PV: reliability, durability and low cost

15' talks + 5' Q&A

**Chairman:** Victor Khorenko (Azur Space)

15h30	<b>Philippe Voarino (CEA)</b>	<i>Cubesat : solar array innovations trends</i>
15h50	<b>Vicente Diaz (DHV technology)</b>	<i>Design and qualification of PVA for constellations at DHV</i>
16h10	<b>Maite Carreras (OneWeb)</b>	<i>Solar arrays in the context of mega-constellations</i>
16h30	<b>Julien Gaume (CEA)</b>	<i>Silicon low cost solar arrays</i>
16h50	<b>Paul Zevenbergen (Airbus)</b>	<i>Foldable disruptive solar array technology</i>

10' break

#### Session 5 | Roundtable: Defining the R&D priorities to answer Space PV industrial challenges

30' Q&A

**Chairman:** Carlos Algora (IES-UPM)

17h20-17h50	<b>Contributors:</b> Victor Khorenko (Azur Space)	Paul Zevenbergen (Airbus)
	Ryan France (NREL)	Romain Cariou (CEA)
	David Lackner (Fraunhofer ISE)	