EXCITON SCIENCE

LIGHT IDEAS DESIGN COMPETITION

Australian Research Council Centre of Excellence in exciton science

THE UNIVERSITY OF MELBOURNE

UNSW SYDNEY

RMIT UNIVERSITY

THE UNIVERSITY OF SYDNEY

MONASH University

Call for Designs

<u>Exciton Science Design Ideas Competition</u>
To achieve a renewable energy future, we aim to explore how novel solar materials and photovoltaic technologies can be integrated into new structures, building elements, furniture and other devices in the urban landscape.

<u>Luminescent Solar Concentrators</u>
The material that entrants are challenged to creatively integrate into their designs is the Luminescent Solar Concentrator (LSC). Luminescent Solar Concentrators as a material for innovative design and construction have properties very similar to a sheet of transparent coloured plastic or Perspex. Unlike conventional, roof-mounted solar panels, LSCs have the potential to be more closely integrated into buildings and other structures, serving as semi-translucent windows or Perspex panels, significantly increasing the exterior surface area coverage achievable by architects and builders. The energy collected could then be used to power at least some of the building or structure's functions.

<u>Competition purpose</u>
The Exciton Science Light Ideas Design Competition will direct and encourage the next generation of architects and designers to prepare for a future in which LSC materials are widely available in our cities.. Their perspective may help guide the scientific development direction of these materials further by proposing innovative uses of this emerging technology.

One-way colour tunnel, 2007 Olafur Eliasson

Exciton Science

Centre and Theme introduction

The ARC Centre of Excellence in Exciton Science is a collaborative research centre focused on innovative research to improve solar energy technology, lighting and security systems. The Centre is based across five Australian universities-The University of Melbourne, Monash University, RMIT, UNSW and The University of Sydney. Researchers also work closely with industry partners including the Reserve Bank of Australia, CSIRO and the Defence Science &Technology Group.

A core part of our research and the first of our three themes involves building the ultimate light-harvesting systems by efficient conversion and transport of excitons. Excitons are formed when an atom's electron becomes energized and elevated to higher energy levels but is still atomically bound. The formation of excitons can be thought of as the intermediary state of a material when converting energy between light and electrical forms or vice versa.

This research involves spectral and spatial manipulation of the solar spectrum and aims to deliver new, light-harvesting concepts and novel, full-spectrum materials for next-generation, low-cost, high-efficiency excitonic light-harvesting devices.

Design brief

Exciton Science's light ideas competition challenges designers and architects to creatively and innovatively integrate Luminescent Solar Concentrator (LSC) materials into design forms for the urban landscape.

Your design may resemble already existing urban structures, outdoor furniture, building elements and spaces or may reimagine the requirements for the urban landscape completely. However, the Luminescent Solar Concentrator and its unique properties should be showcased in your concept.

Design concepts should be ambitious and surprising, yet feasible.

Please note this is an ideas competition and will not result in the winning designs being realized.

Good designs will:

- *Consider the material brief and characteristics*
- *Explore how the material is used to maximise renewable energy potential*
- *Be innovative, creative and ambitious*
- *Have the ability to be feasily integrated into the urban environment*

Glass and light installation by photographer Autumn de Wilde. Image by Autumn de Wilde.

Competition details

Entrants

This competition is open for students and early career graduates (graduated in 2017 or later) in design/architecture related disciplines. Entrants may submit proposals as individuals or in a small team of three or less individuals.

Competition structure

Stage 1

Entrants will be required to submit a design proposal in the provided template, which will include the following elements;

- a description of the type and material consideration of LSC panels
- maximum 5 pages of drawings, sketches, renders or diagrams, describing the design intention, function and form of the intervention, including images speculating on the potential integration into the urban environment.

10-12 entries will be shortlisted to proceed to stage 2 and will each receive $500 to continue.
An additional selection of entries will receive a commendation and be featured on our website.

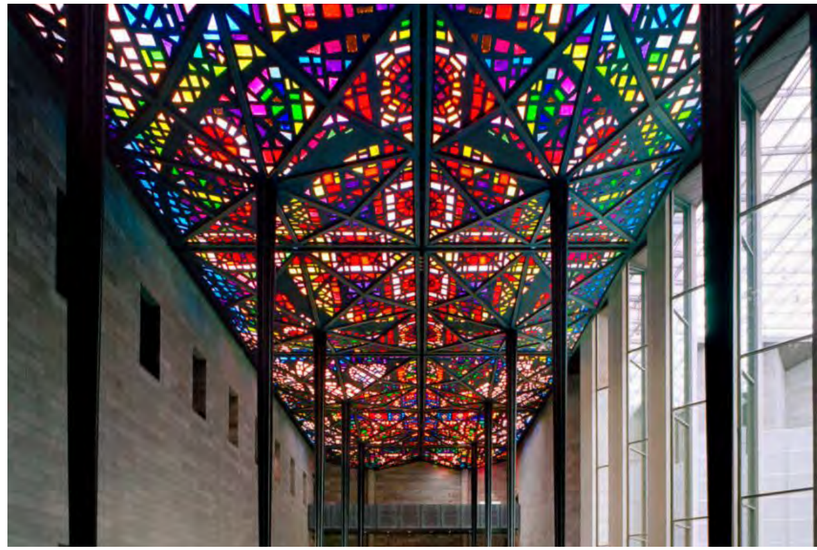
Stage 2

The shortlisted entrants will be given feedback to implement into their designs for the next phase by a mentoring panel of architects and researchers. All entrants from this stage will be featured in an exhibition to be hosted in Melbourne in 2021 (details TBC).

One entrant will win the overall prize of $5000 to be awarded at an awards ceremony (details TBC).

*Key Dates *UPDATED*

Stage 1 closes	*28 Feb*
Stage 2 mentoring panels (online)	*Week of 15-19 March*
Stage 2 closes	*4 April*
Awards night	*Week of 12-16 April*



Great Hall Ceiling, NGV by artist Leonard French and opened in 1968. Image from NGV Twitter.

Material brief

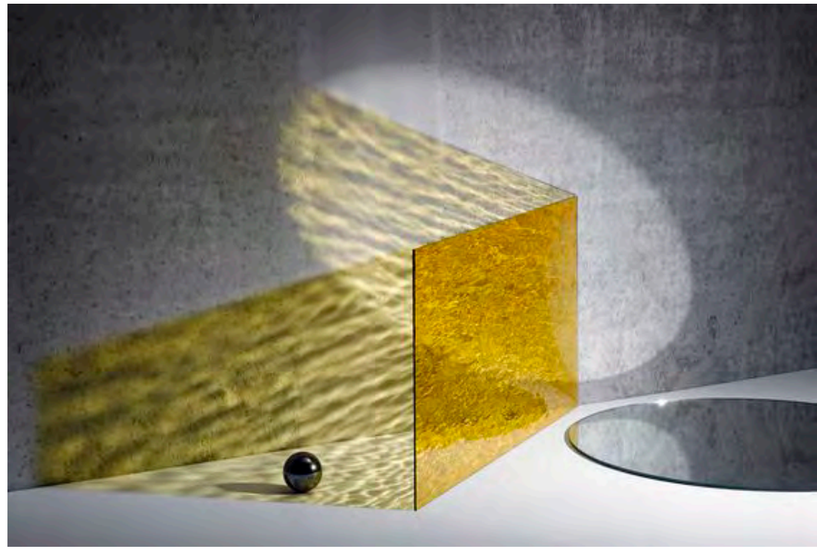
Introduction

Luminescent Solar Concentrators (LSCs) have been developed to capture and harness light in places without consistent exposure to the sun, like cities. In appearance and physical properties they are much like transparent Perspex or window panels.

LSCs contain highly luminescent compounds that absorb sunlight and re-emit it at longer wavelengths. The light is trapped and directed to the edges of the device through a process called total internal reflection. A small strip of photovoltaic cell can then be positioned on the outside edges of the LSC to capture this reflected light and generate electricity.

Physical properties

For the purposes of this competition, Luminescent Solar Concentrators should be treated as one would treat a piece of Perspex plastic or window. They can be formed in various shapes and with various textures. LSCs are transparent and either colourless or coloured. There is also no limitation to the thickness, layering and angle of installation of the LSC materials .



Kate Jackling photography

Material brief - continued

Entrants should develop designs that describe LSC panels in one or both of the following formats;

-LSC panels with PV cell framing, for solar energy collection (LSC-PV hybrid setup)
-LSC panels without PV cell framing, for a fluorescent lighting effect

LSC panel with PV cell framing- solar energy collection
Luminescent Solar Concentrators can be used in conjunction with photovoltaic (PV) cells in one of the two possible setups demonstrated on page 7 where the PV cell is located either on the edge of the pane or on the face of the pane. For the purposes of this competition, we will call this setup the LSC-PV hybrid.

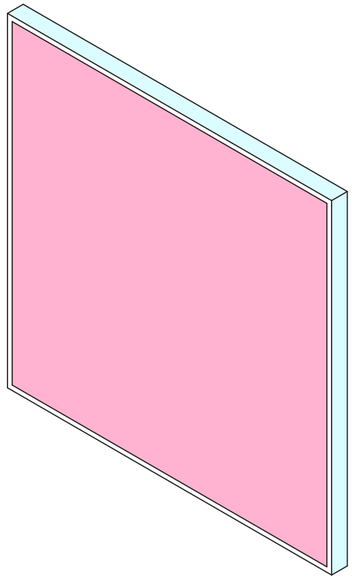
As LSC-PV hybrid setups collect and funnel light to the photovoltaic such that it can be converted into electricity, structures with this setup can self-power to an extent. It is not expected that this mechanism, or battery placement/storage is detailed in the design, but LSC-PV setups and any function they will self-power should be identified as so.

The current LSC:PV area ratio is recommended to not be any larger than 50:1 as device power output will be limited beyond this ratio.

LSC panel without PV cell framing- fluorescent lighting effect
If the LSC material is used on its own, without the PV included on the face or edges, the wave-guided light is observed to 'exit' the pane on the edges. This causes a bright fluorescent glow from even diffuse (non-intense) input light, such as on a cloudy or dark day. Photographs of this phenomenon are on page 7.

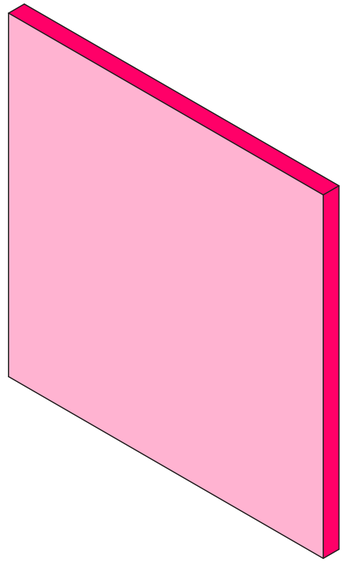
Uncertain Memory pavilion by Li Hao and Zhu Jianfei. Image by Wei Kang.

Material brief - in summary



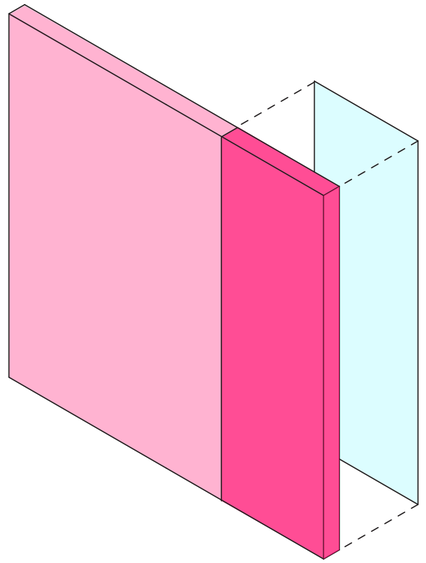
PV cell - edges

- *energy generating*
- *transparent*



No PV cell

- *does not generate energy*
- *fluorescent light effect on edges*



PV cell - partial face

- *energy generating*
- *partially opaque*

Laboratory samples of thin LSC Perspex with no PV cell

We look forward to receiving your entry for the Exciton Science Light Ideas Competition!

The Template, T&Cs and Submission details for this competition can be found on our website at https://excitonscience.com/lightideas

Please don't hesitate to contact Jasmine Lynch at outreach@excitonscience.com with any questions or clarifications that you may seek.

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