



Proceedings of the

# 2011 Microwave Power Transfer Symposium

Georgia Tech Campus

15 December 2011

**General Chair:** Darel Preble, Space Solar Power Institute

**Executive Chair:** Gregory D. Durgin, Georgia Tech

**Keynote Speaker:** Dr. Frank Little, Texas A&M

**Competition Co-chairs:** Blake Marshall and Marcin Morys, Georgia Tech

## Special Thanks:

Chris Valenta, ECE 6390 class, ECE 4370 class, Prof. Narayanan Komerath

Event Patrons: 



**Georgia Institute  
of Technology**



*Message from the "Organizing Committee"*

The idea for the Microwave Power Transfer Symposium came this past summer when Darel Preble and I were brainstorming on ways to generate some interest in space solar power. Actually, I was initially interested in learning more about this topic, since most of my activity in microwave power transfer has come from the very low-powered field of sensors and RFID. After inheriting the senior-level Antenna Engineering in Fall 2011, which was coincident with the graduate Fall Satellite Communication & Navigation Systems class, the stars seemed aligned to try an ambitious mini-symposium on the topic of microwave power transfer. The seniors in Antenna Engineering would work on 5.8 GHz energy-harvesting antennas and charge pumps that would be used in a fun competition for the longest distance for lighting a diode. The graduate students in Satcom would design Space Solar Power systems that used microwave power to beam MegaWatts back to earth stations. Everyone would have a good time over a pizza reviewing and admiring one another's work.

Darel Preble upped the ante by inviting Dr. Frank Little to give a truly excellent keynote on the topic of space solar power. With a standing-room audience of over 60 very attentive attendees, Dr. Little delivered an excellent culminating talk on the subject of microwave power transfer for space and various other applications. His slides as well as the design project posters from both classes are included in these proceedings. Special thanks to Darel Preble for his determination and willingness to promote the symposium, to Blake Marshall and Marcin Morys for running the rectenna competition, and to all the participants. Well done, everyone.

Keep Shooting for those Stars!

Sincerely,

Prof. Gregory D. Durgin  
Georgia Tech School of Electrical and Computer Engineering



Come to the inaugural 2011 Microwave Power Transfer Symposium! See cutting edge work on topics in Microwave Power Transfer and Space Solar Power. Admission is free.

### Event Schedule

- 3:00 – 3:15 **Introductory Remarks:** Prof. Gregory D. Durgin, Room 102A.
- 3:15 – 4:00 **Keynote Talk, Room 102A:** “Opportunities and Challenges in Wireless Power Transmission” by Frank Little, Associate Director of the Center for Space Power, Texas A&M.
- 4:00 – 4:15 **Rectenna Device Presentation, Room102A**
- 4:15 – 6:00 **Poster Session:** Microwave Power Transfer Projects
- Track A, Room 102B:** *Design of a Space Solar Power Network.* Results from the Georgia Tech ECE 6390 Satellite Communications’ Space Solar Power Project. Roving judges will evaluate posters and designs of the various student projects.  
<http://www.propagation.gatech.edu/ECE6390/project/Fall2011/Project11.htm>
- Track B, MiRC Hallway:** *5.8 GHz Rectenna Design and Implementation.* Results from the Georgia Tech ECE 4370 Antenna Engineering Rectenna Design Competition. Posters on display for devices in the rectenna shoot-out.  
<http://www.propagation.gatech.edu/ECE4370/projects/projects.html>
- 4:15 – 4:45 **Microwave Rectenna Shoot-off:** MiRC hallway or courtyard (weather permitting). 5.8 GHz Rectennas will be used to energize an LED in a competition for the longest range.
- 4:15 – 6:00 **Pizza Party, Room 102A:** Pizza and light refreshments served.

**General Chair**  
Darel Preble

**Executive Chair**  
Greg Durgin

**Competition Co-chairs**  
Blake Marshall,  
Marcin Morys

**Confirmed SSP Judges:** Frank Little, Darel Preble, Greg Durgin

Event Patrons:

Space Solar Power Institute



Georgia Institute of Technology



Slides for Keynote Speech

# Opportunities and Challenges in Wireless Power Transmission

by Dr. Frank Little

Associate Director of the Center for Space Power

Texas A&M University



Posters for ECE 6390 Project Teams

<http://www.propagation.gatech.edu/ECE6390/project/Fall2011/Project11.htm>

Fall 2011 Space Solar Power

[Project Statement](#)

[Resource Page](#)



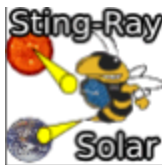
**HELIOS**



**Sunwire**



**Star Tek Enterprises**



**Sting-Ray Solar**



**IRIS**



**L.E.E.Co.**



**Death Raytheorp**



**The Van Allen Co.**

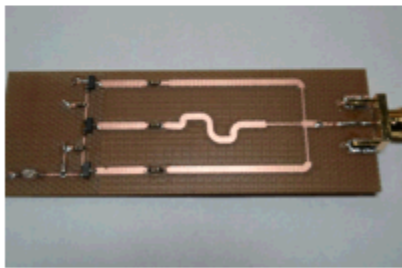


Posters for ECE 4370 Project Teams

<http://www.propagation.gatech.edu/ECE4370/projects/projects.html>



**5.8 GHz Energy-Harvesting LED**



[Project Statement](#)



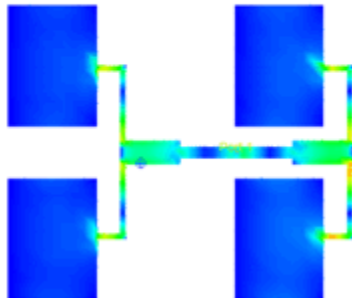
[Group 1](#)

[Group 2](#)

[Group 3](#)

[Group 4](#)

**5.8 GHz Directional PCB Antenna**



[Project Statement](#)

[Group 1](#)

[Group 2](#)



[Group 3](#)

[Group 4](#)



## ECE 6390 Survey Results

16 Respondents

Statement	strongly agree	Partly agree	either way	partly disagree	strongly disagree
This class was the first time that I had ever heard of the concept of space solar power.	9	1	1	0	5
As a student, the end-of-term Microwave Power Transfer Symposium is a valuable experience and worth the time to attend.	7	7	1	0	0
The website format of the final report is preferable to a conventional final written report.	7	6	3	0	0
I would have preferred an individual project to the group project.	0	2	4	5	5
I do not like the competitive aspect of the group project.	0	3	6	5	2
The Space Solar Power group project made this class more work than the average graduate engineering course.	1	8	4	2	1
As a result of the Space Solar Power project, I have more interest and appreciation of RF engineering.	4	9	3	0	0
As a result of the Space Solar Power project, I have more interest and appreciation of solar cells and/or microelectronics.	1	8	5	2	0
As a result of the Space Solar Power project, I have more interest and appreciation of antennas and/or electromagnetic waves.	5	6	5	0	0
As a result of the Space Solar Power project, I have more interest and appreciation of system engineering concepts.	5	7	3	1	0
By the end of this project, I have come to the conclusion that Space Solar Power is an impossible undertaking that will <i>never</i> result in an economical energy source for mankind.	1	4	3	4	4
As a result of this class and project, I plan to study space solar power more in the future.	0	6	5	3	2