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**RPPR Final Report**  
as of 04-Aug-2021

Agency Code: 21XD

Proposal Number: 75794MSRIP

**Agreement Number: W911NF-20-1-0161**

**INVESTIGATOR(S):**

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**Report Date:** 01-Aug-2021

Date Received: 03-Aug-2021

**Final Report** for Period Beginning 05-May-2020 and Ending 04-May-2021

**Title:** Probing Nonequilibrium Phonon-Magnon Coupling in Emerging Functional Materials with Femtosecond Transient Thermal and Spin Grating Spectroscopy

**Begin Performance Period:** 05-May-2020

**End Performance Period:** 04-May-2021

**Report Term:** 0-Other

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**Distribution Statement:** 1-Approved for public release; distribution is unlimited.

**STEM Degrees:** 0

**STEM Participants:** 2

**Major Goals:** The major goal of this project is to acquire equipment and components to develop a state-of-the-art transient grating spectroscopy setup that can flexibly generate periodic thermal and spin excitations with sub-picosecond time resolution and diffraction-limited spatial resolution. Once developed, this system will be used to study phonon and magnon transport and their interactions in magnetic materials. These fundamental studies can enable more efficient coupling between heat and magnetism with potential applications in energy harvesting and conversion, spintronics, and magnetic refrigeration.

**Accomplishments:** Within the award period, we have successfully acquired all major components budgeted in the proposal and are now in the process of developing the proposed femtosecond transient grating spectroscopy setup. The main optical paths have been built and we are conducting the final alignment and fine-tuning of the setup. We expect the transient grating spectroscopy to be fully operational by the end of 2021. A picture of the transient grating spectroscopy setup under construction is included in the attachment.

**Training Opportunities:** Although this grant does not provide direct personnel support, one postdoc scholar (Taeyong Kim) and one graduate student (Yujie Quan) at UCSB obtained the training experience to build, test and fine-tune the transient grating spectroscopy setup that is supported by this DURIP grant. In the process, they were trained on the principles of ultrafast optical spectroscopy, optical design and instrumentation, control software development, and the properties of magnetic materials.

**Results Dissemination:** We expect the proposed setup to be fully functional by the end of 2021 and we will start disseminating results from this setup by publishing papers and giving conference presentations.

**Honors and Awards:** Nothing to Report

**Protocol Activity Status:**

**Technology Transfer:** Nothing to Report

**PARTICIPANTS:**

**Participant Type:** PD/PI

**Participant:** Bolin Liao

**RPPR Final Report**  
as of 04-Aug-2021

**Person Months Worked:** 1.00  
Project Contribution:  
National Academy Member: N

**Funding Support:**

**Participant Type:** Postdoctoral (scholar, fellow or other postdoctoral position)

**Participant:** Taeyong Kim

**Person Months Worked:** 1.00  
Project Contribution:  
National Academy Member: N

**Funding Support:**

**Participant Type:** Graduate Student (research assistant)

**Participant:** Yujie Quan

**Person Months Worked:** 1.00  
Project Contribution:  
National Academy Member: N

**Funding Support:**

**International Collaboration:**

JPN

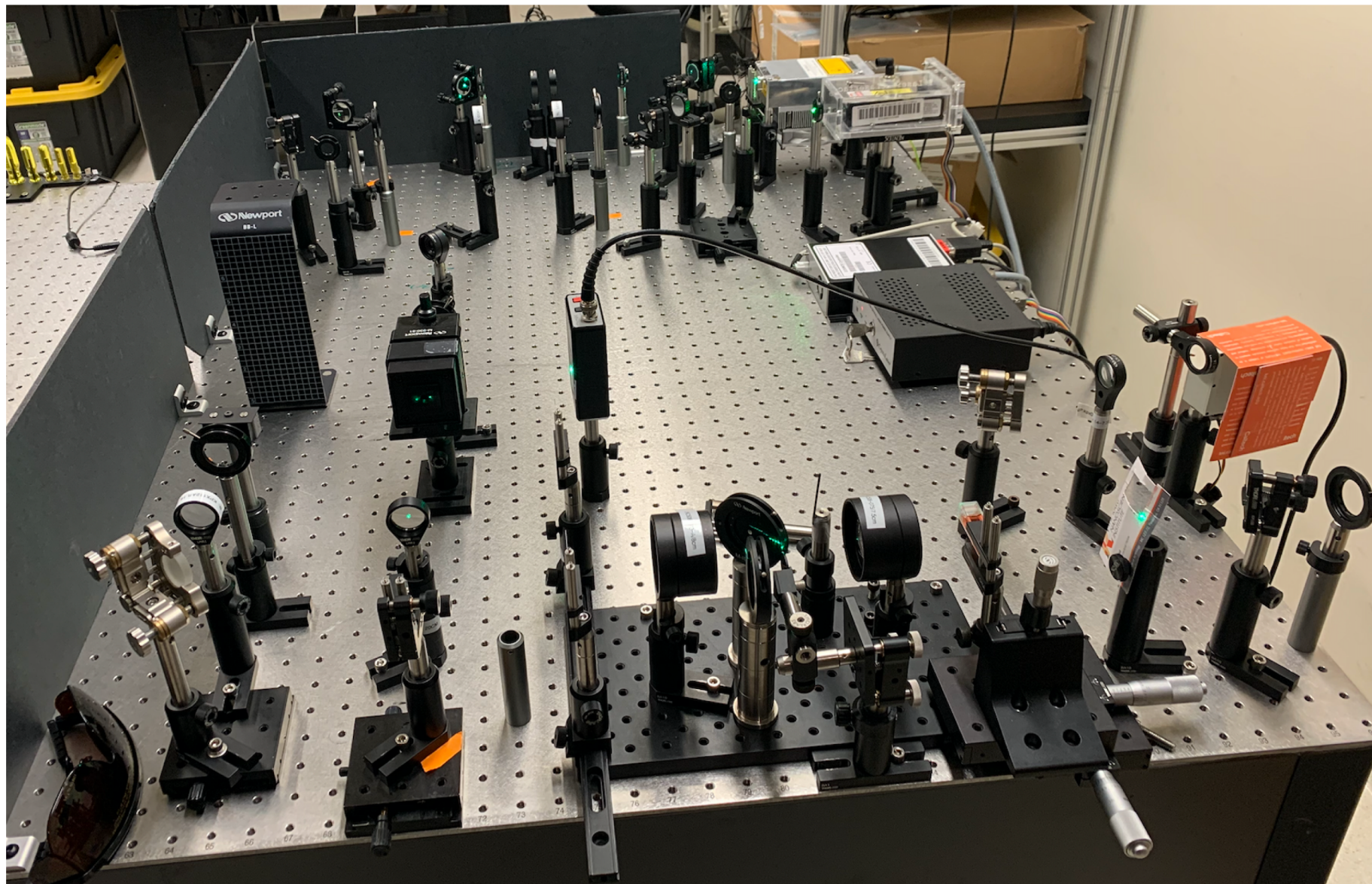
**Partners**

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I certify that the information in the report is complete and accurate:

Signature: Bolin Liao

Signature Date: 8/3/21 5:32PM



**Figure 1.** A Section of the Transient Grating Spectroscopy Setup under Construction in PI Liao's Lab.