

## Enhancement of laser material processing using periodical modulation of laser light intensity

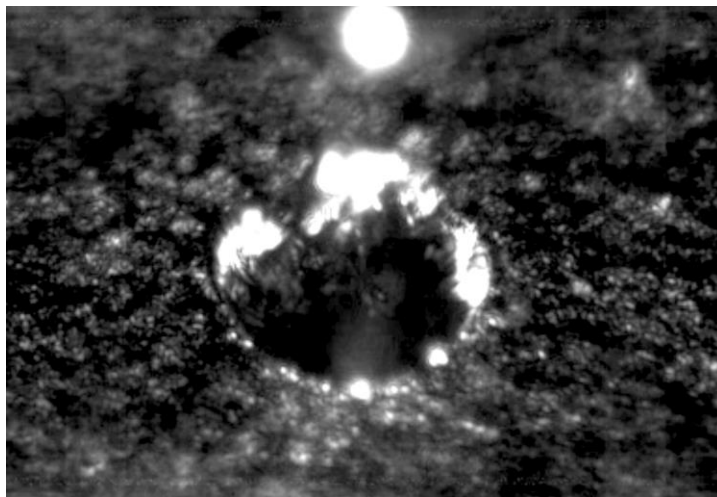
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### Description

The research team at Lawrence Livermore National Laboratory has studied how melt pool dynamics, droplet ejections and hole drilling are influenced by periodically modulated laser intensity.

The researchers used ultra-high speed imaging to reveal that melt pool oscillations, when excited at the natural oscillation frequency, can drive larger removal of material. Figure 1 shows laser hole drilling with sinusoidal power modulation at 8 khz, near the peak of the resonance.

Detailed explanation of the removal effects at different modulation can be found in Nature Scientific Reports 9, Article number: 8152 (2019) under the title “Resonance excitation of surface capillary waves to enhance material removal for laser material processing”. The article can be found from: <https://www.nature.com/articles/s41598-019-44577-6>.



*Figure 1 – Laser hole drilling of Al with sinusoidal modulation at 8khz.*

## Measurement setup

Ablation Laser: 1064nm, 600W power stationary beam  
Material: Aluminum  
Camera: 100 kfps  
Illumination: CAVILUX HF with 100ns pulse length

## Imaging technology

Camera up to 100 kfps: Photron SA-X2  
Camera up to 1 Mfps: Shimadzu HPV-2  
Illumination: CAVILUX HF System by Cavitar

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## Auspices Statement

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