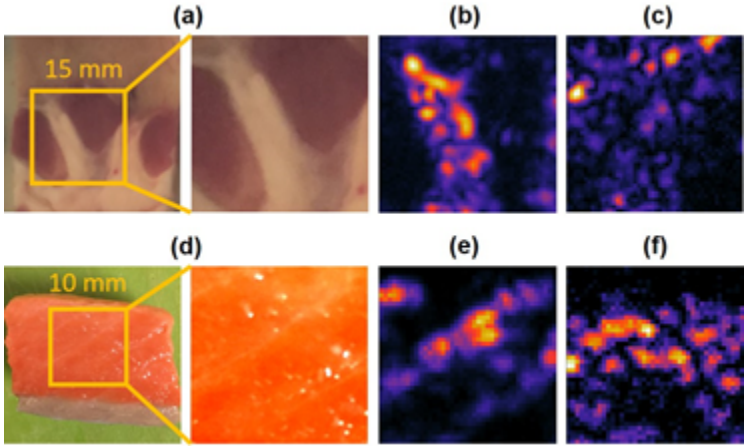
**Docket #:** S17-395

# Non-linear contrast for high resolution ultrasound imaging

Researchers in Prof. Steven Chu's laboratory have developed a fundamentally new method of acoustic imaging to improve resolution of ultrasound diagnostics. This system employs nonlinear difference frequency mixing, which provides different contrast information compared to conventional linear scattering of acoustic waves. The acoustic difference-frequency is generated when sound at two frequencies interacting in a non-linear medium. This information can then be used to create 2D or 3D images which could greatly improve medical diagnostics, particularly when visualizing cancer or cirrhosis.




*Optical images of portions of pig kidney (a) and salmon (d), with the corresponding non-linear contrast (b) and (e) compared to linear contrast (c) and (f) ultrasound images.*

**Stage of Research**

*Proof-of-principle:* The inventors have used this technique to generate non-linear contrast images of pig kidney and salmon tissue, revealing features that were not visible in conventional linear contrast images.

*Prototype:* The inventors are building a prototype capable of producing real-time

nonlinear contrast images.

## Applications

- **Ultrasound imaging** - particularly in medical diagnostics for cancer and cirrhosis

## Advantages

- **Improved resolution:**
  - new nonlinear contrast mechanism has 1.4x improvement in resolution compared to linear images
  - sub-millimeter resolution at different frequencies

## Patents

- Published Application: WO2018222502
- Published Application: 20180338744
- Published Application: 20200237339
- Issued: 10,555,721 (USA)
- Issued: 11,369,343 (USA)

## Innovators

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