Manipulation of single cells with sub-cellular precision using femtosecond laser pulses

Nan Shen
Chris B. Schaffer
Debajyoti Datta
Eric Mazur
Philip LeDuc
Donald E. Ingber

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Harvard University
Department of Physics
high intensity at focus
causes nonlinear ionization
producing microscopic bulk disruption
Introduction

experimental setup

1.4 NA objective

800 HR

UV lamp

Bandpass Filters

Dichroic Mirror

Imaging lens

CCD

laser
Introduction

experimental setup

- UV lamp
- CCD
- UV lamp
- 800 HR
- Dichroic Mirror
- Imaging lens
- 1.4 NA objective
- Bandpass Filters
- Laser
- CCD

Diagram showing the experimental setup with labeled components.
Introduction

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800 nm

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Imaging lens

laser

CCD
Experimental setup

- UV lamp
- 800 HR
- 1.4 NA objective
- Dichroic Mirror
- Bandpass Filters
- Imaging lens
- CCD
Results

5 μm
Results

5 µm channel
Results

5 µm channel
cavity
Results

5 µm channel cavity

5 µm
Results

5 \mu m channel
100 fs,  
2 nJ/pulse
Results

100 fs, 2 nJ/pulse
Results

100 fs, 2 nJ/pulse

before
100 fs, 2 nJ/pulse
Results

before

after
Results
Results

100 fs,
4 nJ/pulse

before
Results

100 fs,
4 nJ/pulse

before

after
100 fs, 4 nJ/pulse
100 fs, 2 nJ/pulse

before
100 fs, 2 nJ/pulse

before
Results

100 fs,
2 nJ/pulse

before

after
Results

Before:

100 fs,
2 nJ/pulse

After:
Results
disrupt sub-cellular structures inside live cells

maintain cell viability

use only nanojoules/pulse energy
Acknowledgements

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For a copy of this talk and additional information, please see:

http://mazur-www.harvard.edu