GENERATING HIGH-INTENSITY, ULTRASHORT OPTICAL PULSES

Donna Strickland

NOBEL PRIZE LECTURE

IS LIGHT A PARTICLE OR A WAVE?

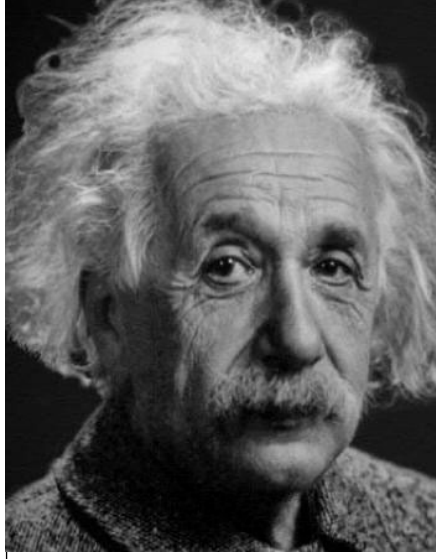
Red Light
No electron ejected

Green Light
Electron ejected at low speed

Violet Light
Electron ejected at high speed

PHOTOELECTRIC EFFECT

Red Light
No electron ejected



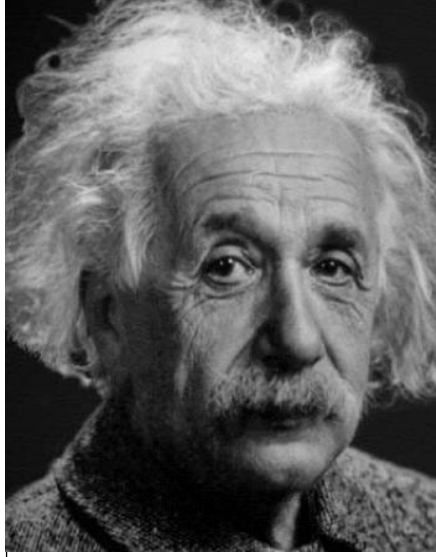
ALBERT EINSTEIN
Photo courtesy AFP

1905

PHOTOELECTRIC EFFECT

Green Light

Electron ejected at low speed



ALBERT EINSTEIN

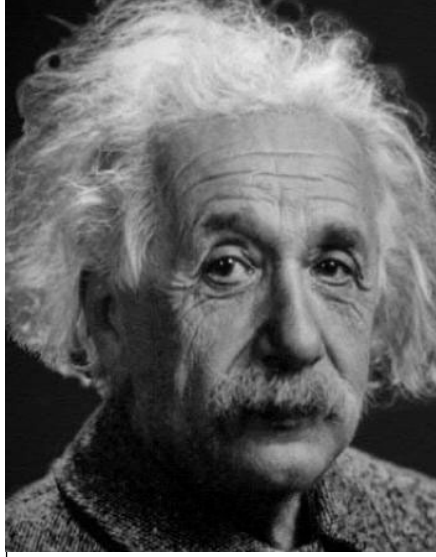
Photo courtesy AFP

1905

PHOTOELECTRIC EFFECT

Violet Light

Electron ejected at high speed



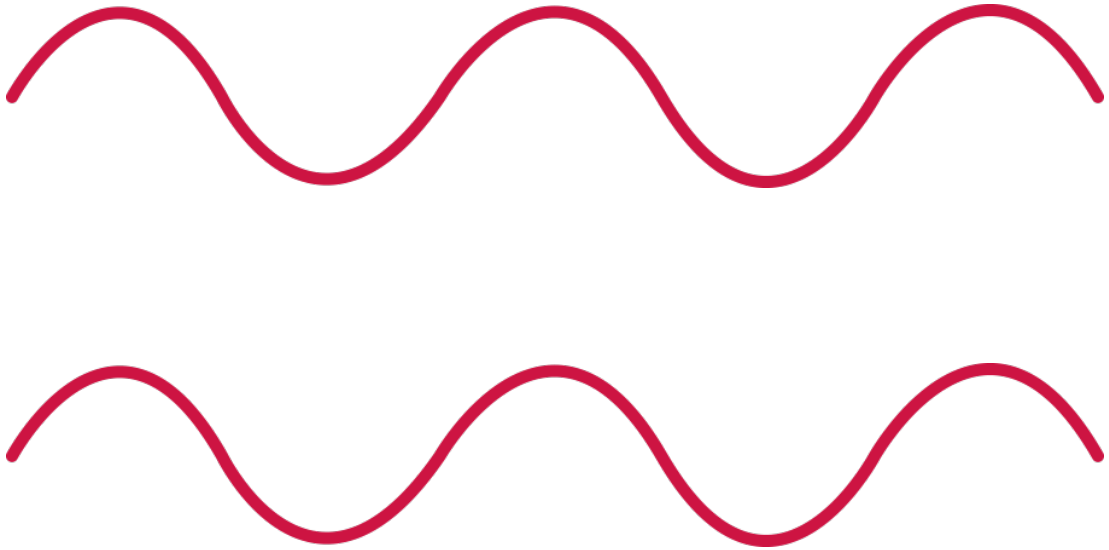
ALBERT EINSTEIN

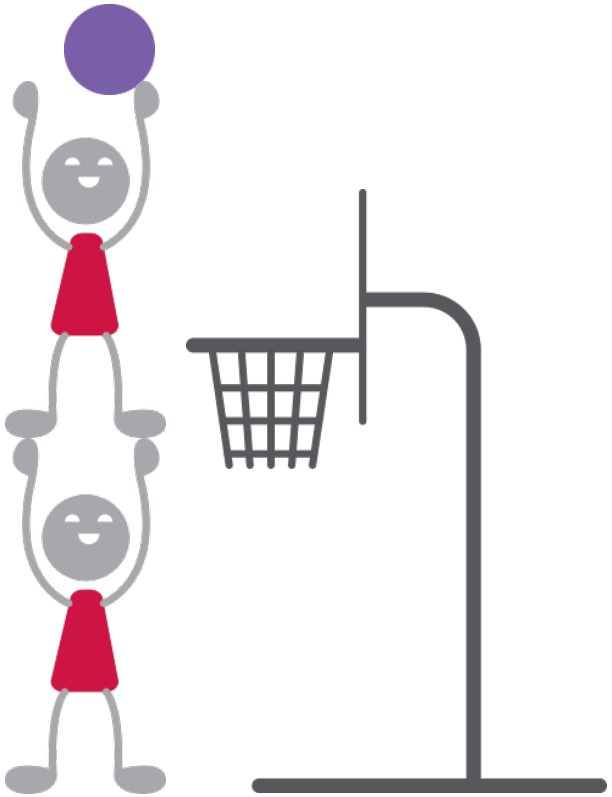
Photo courtesy AFP

1905

MULTIPHOTON PHYSICS

Two Red Photons Working Together = One Violet Photon

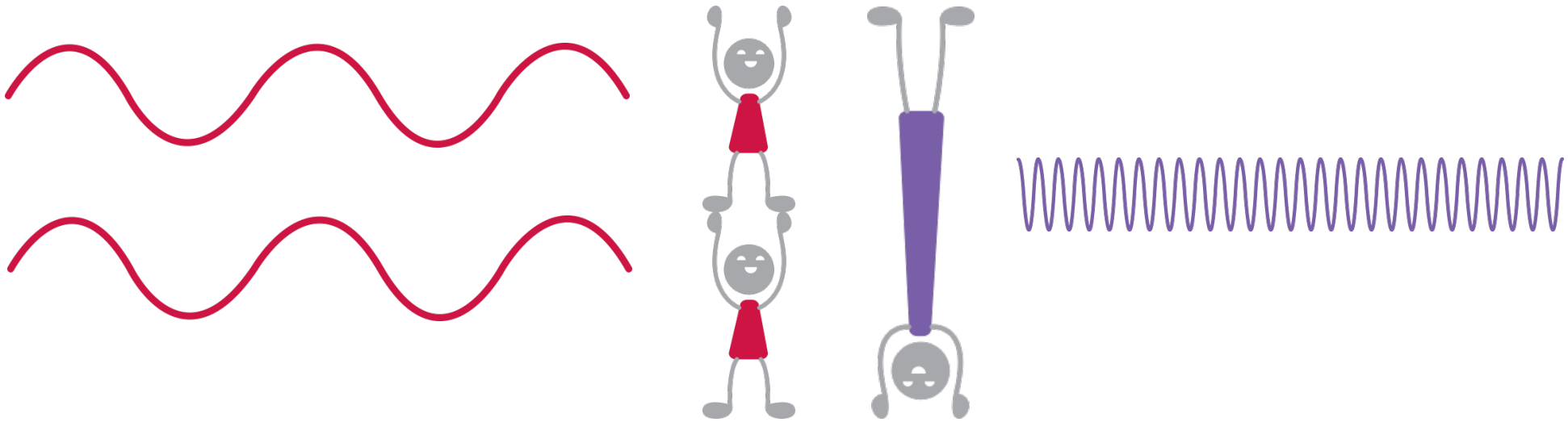




MARIA GOEPPERT MAYER

1931

NONLINEAR INTERACTION

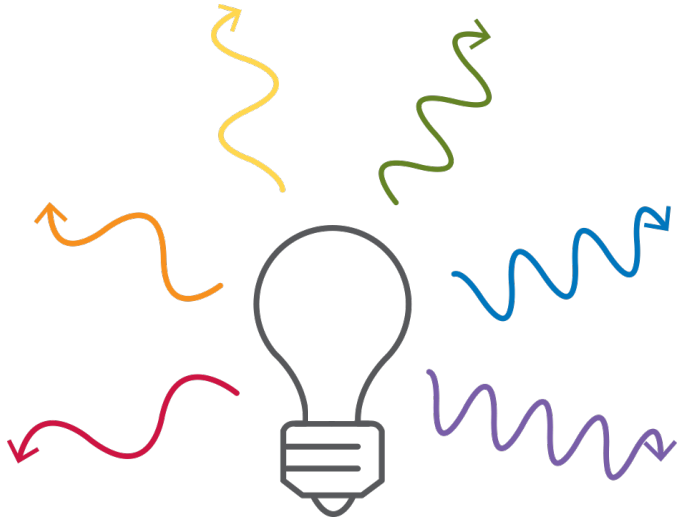


PETER A. FRANKEN

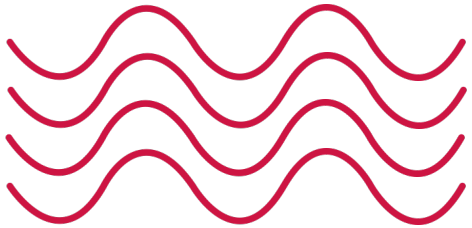
1961

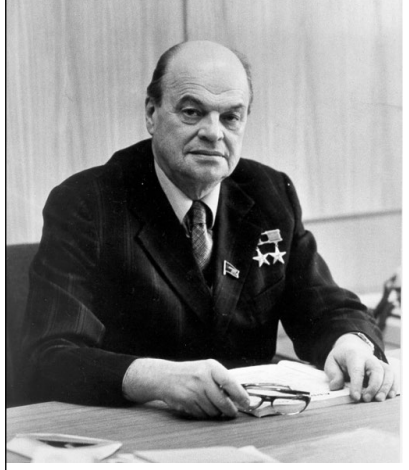
LASER DEMONSTRATION

LIGHT BULB



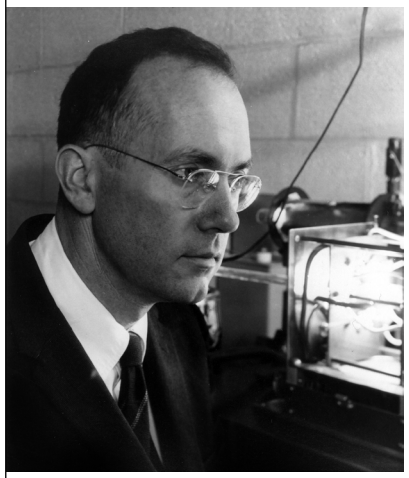
LASER





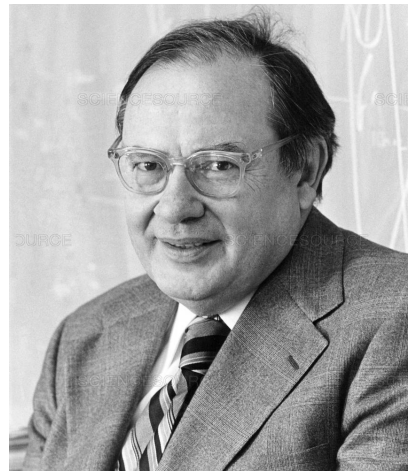
NICOLAY G. BASOV

ALEKSANDR M. PROKHOROV



CHARLES H. TOWNES

Credit: From the Caltech Archives image collection

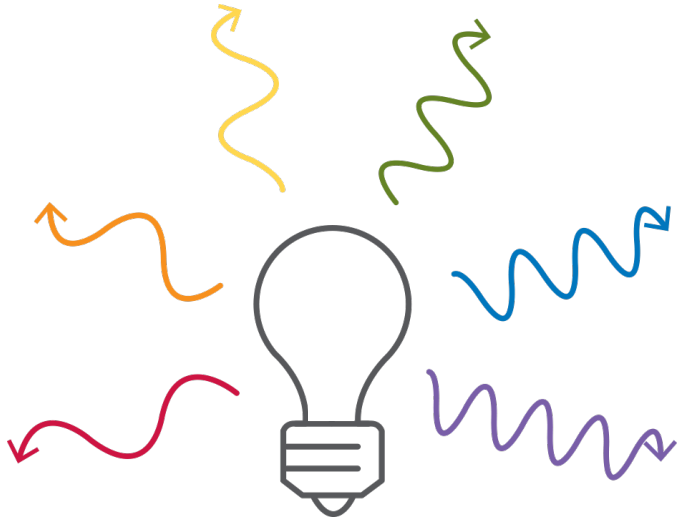


ARTHUR L. SCHAWLOW

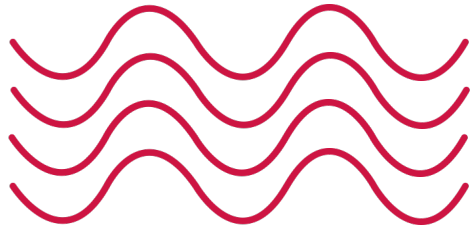
Credit: Emilio Segrè Visual Archives/American Institute of Physics/Science Source

LASER DEMONSTRATION

LIGHT BULB



LASER

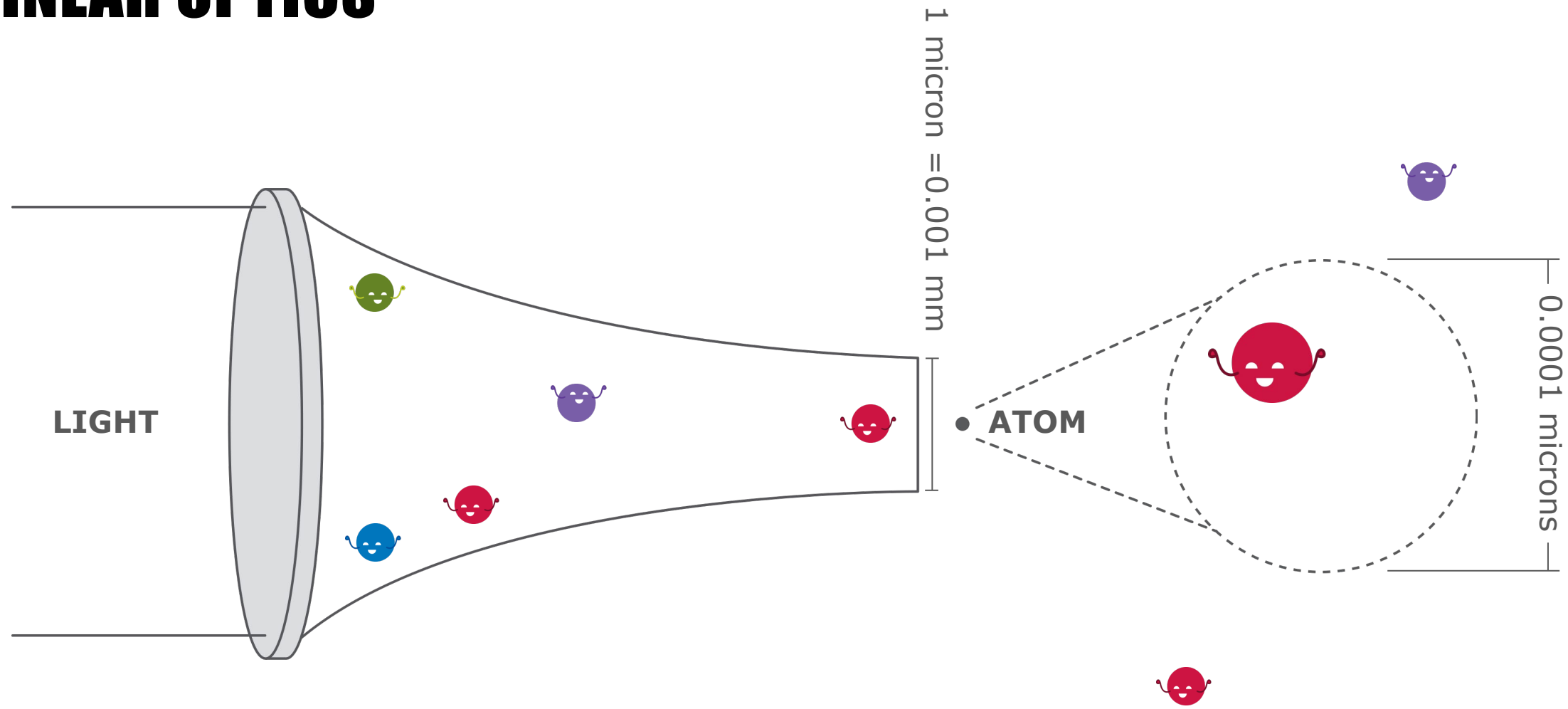


THEODORE H. MAIMAN

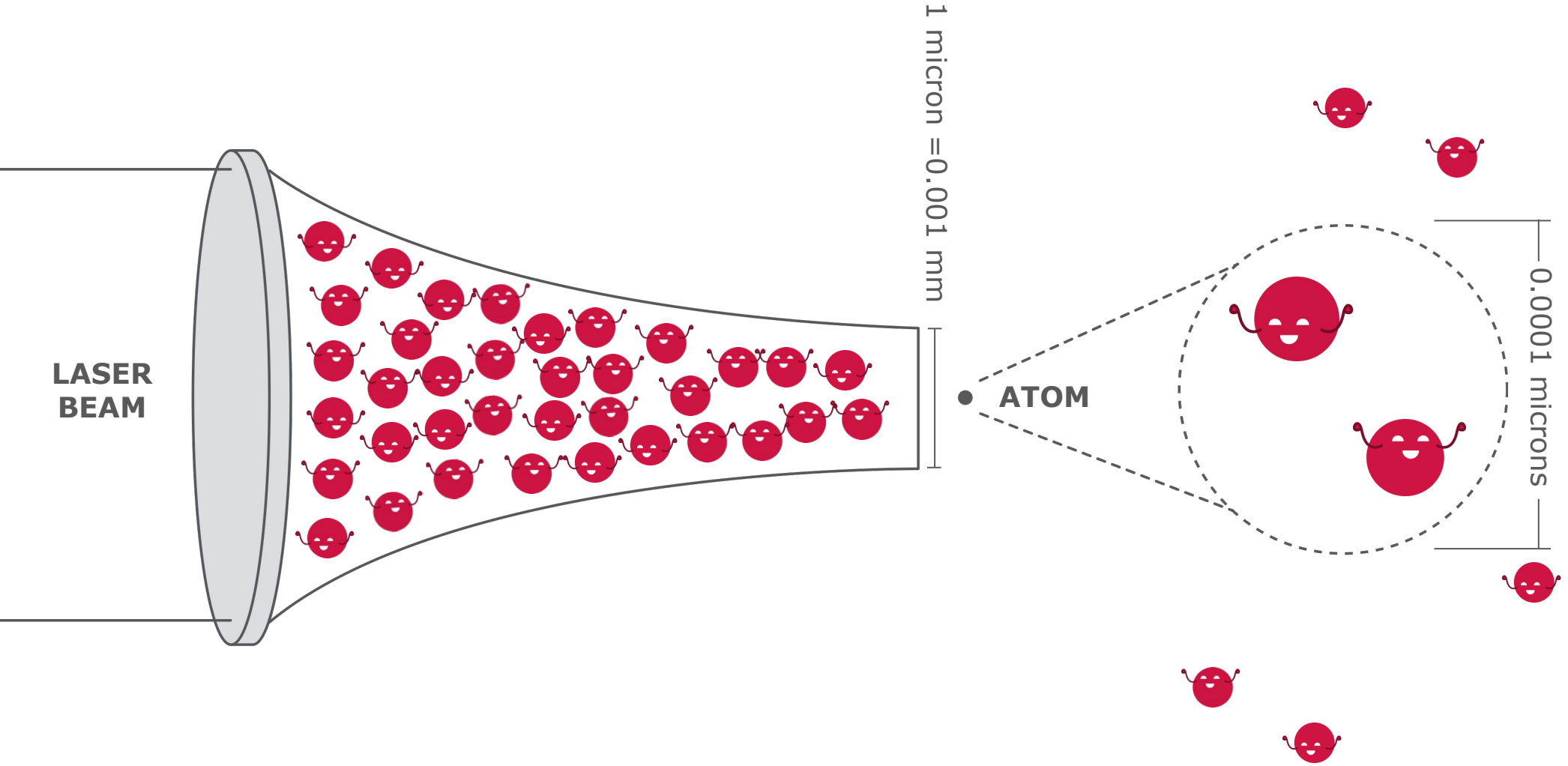
Credit: American Institute of Physics

1960

LINEAR OPTICS



LASER MADE NONLINEAR OPTICS POSSIBLE



NICOLAAS BLOEMBERGEN

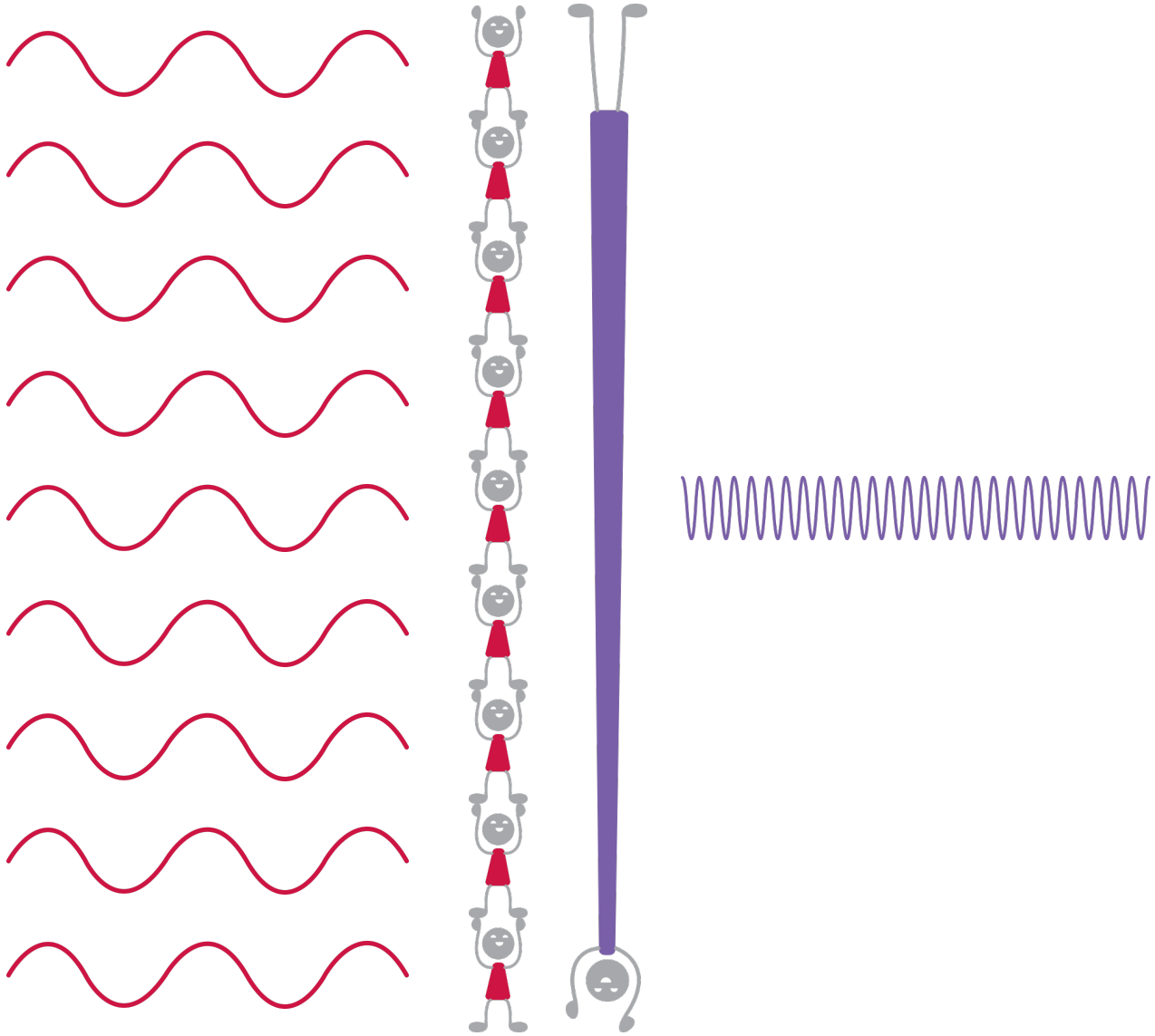
Credit: Emilio Segrè Visual Archives/American Institute of Physics/Science Photo Library

HIGH ORDER HARMONIC GENERATION

Original PhD Thesis Topic

Generation of Vacuum-Ultraviolet and Soft–X-Ray Radiation Using High-Order Nonlinear Optical Polarizabilities

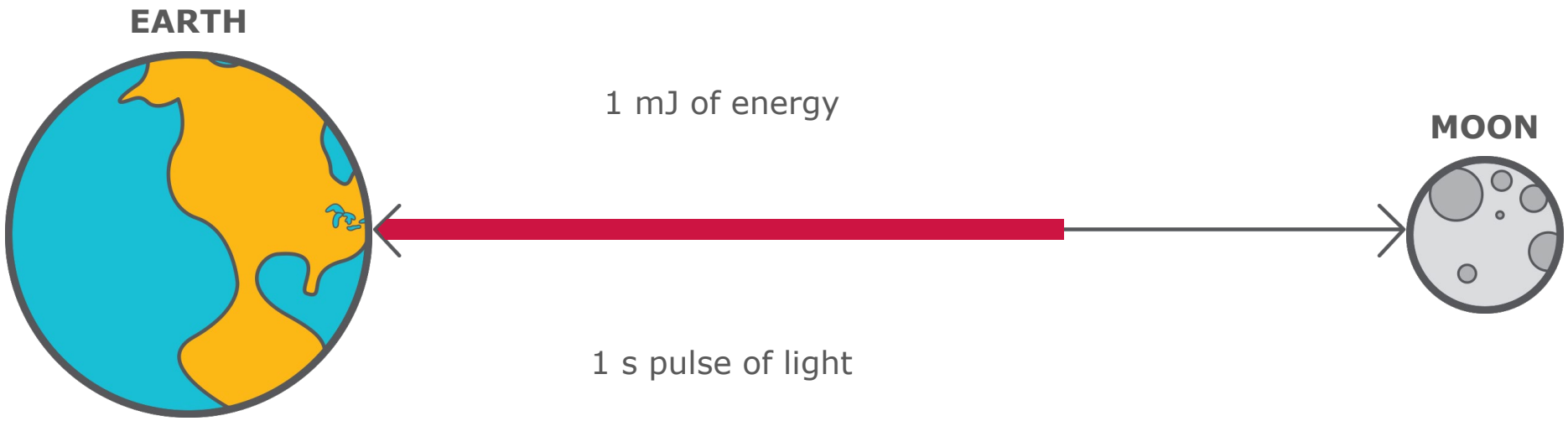
Physical Review Letters
Volume 31, 1973



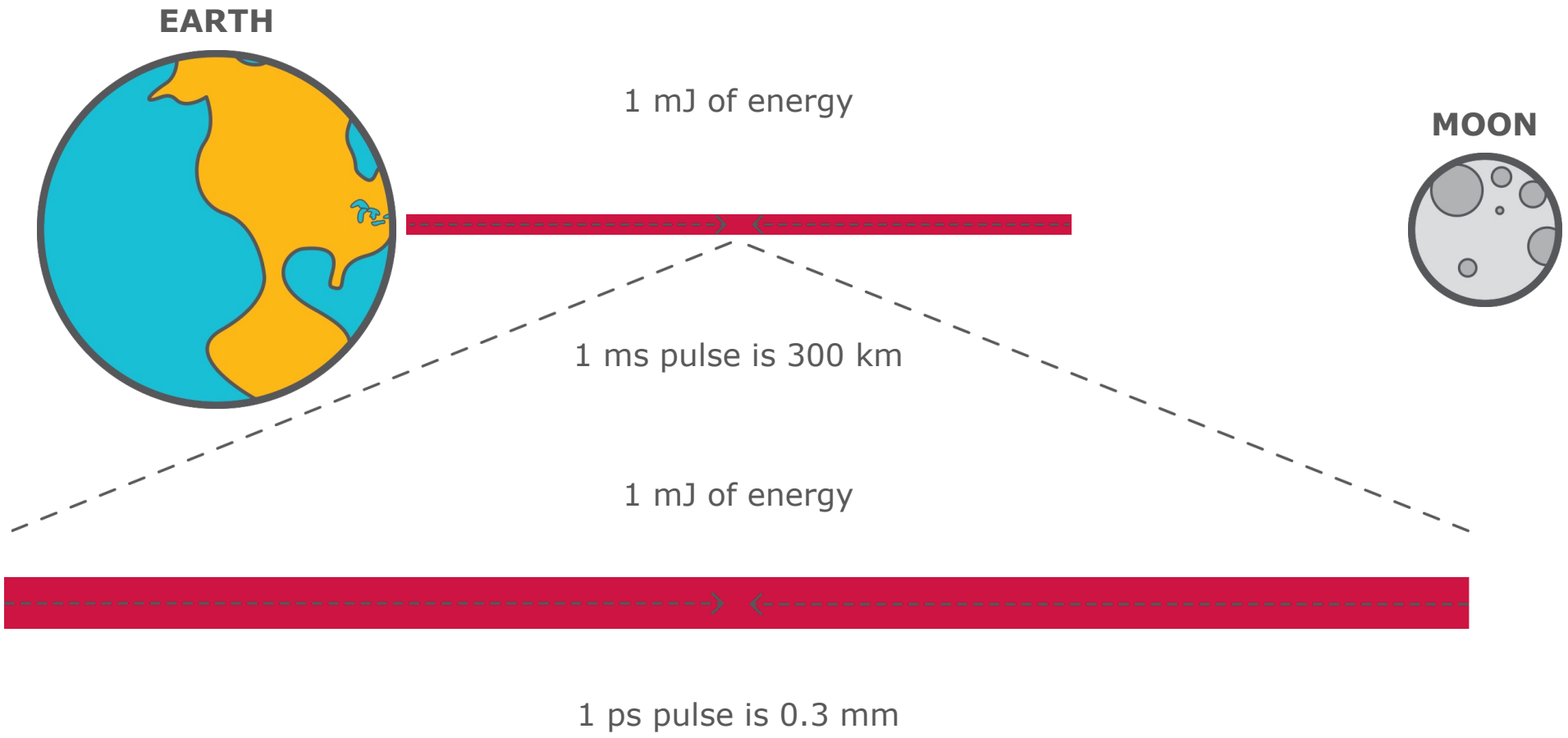
STEPHEN E. HARRIS

Credit: Ed Souza/Stanford News Service

HOW DO WE GET AN INTENSE LASER BEAM?

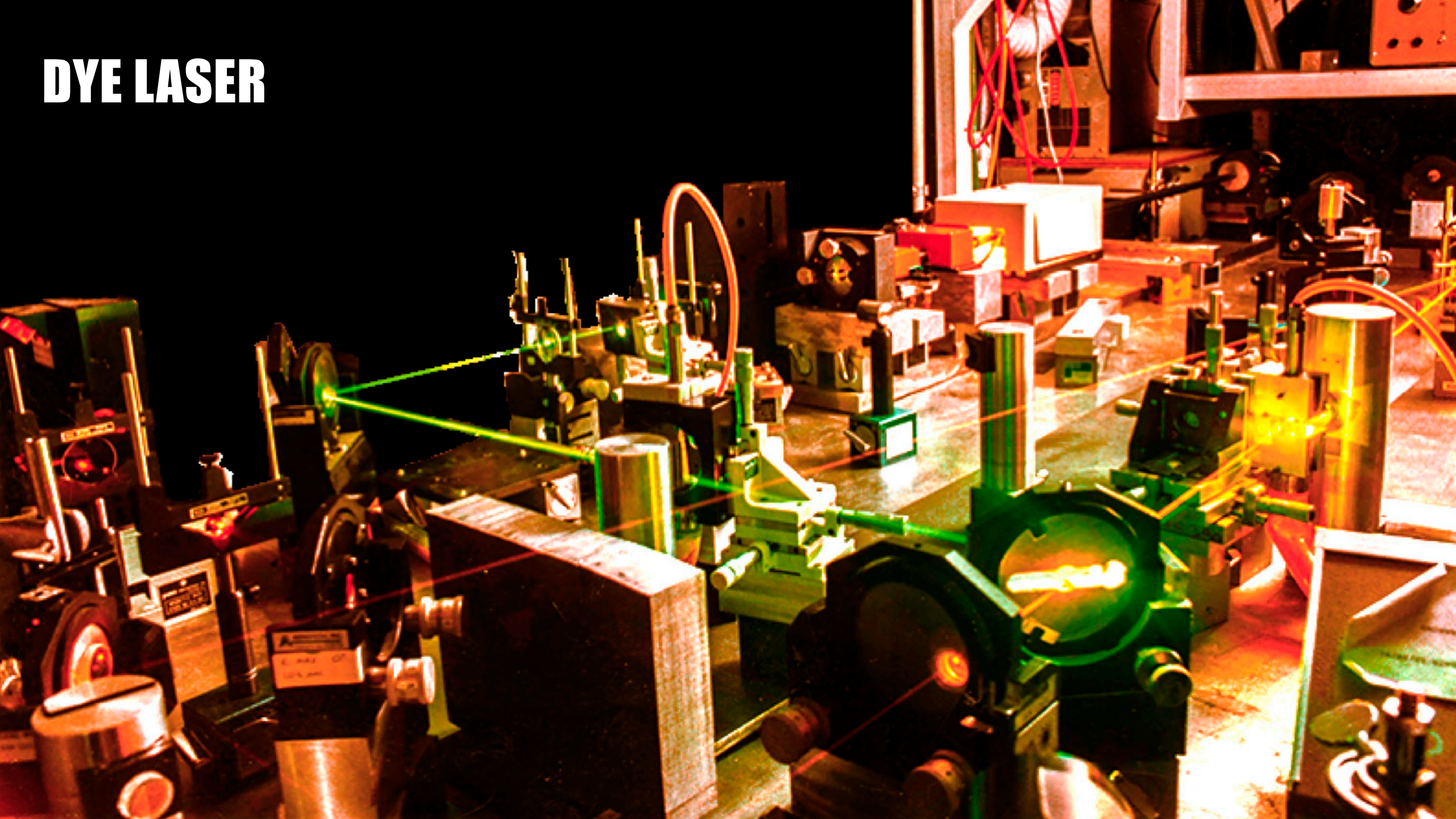


HOW DO WE GET AN INTENSE LASER BEAM?




LABORATORY
for
LASER ENERGETICS
UR
LLE
UNIVERSITY of ROCHESTER

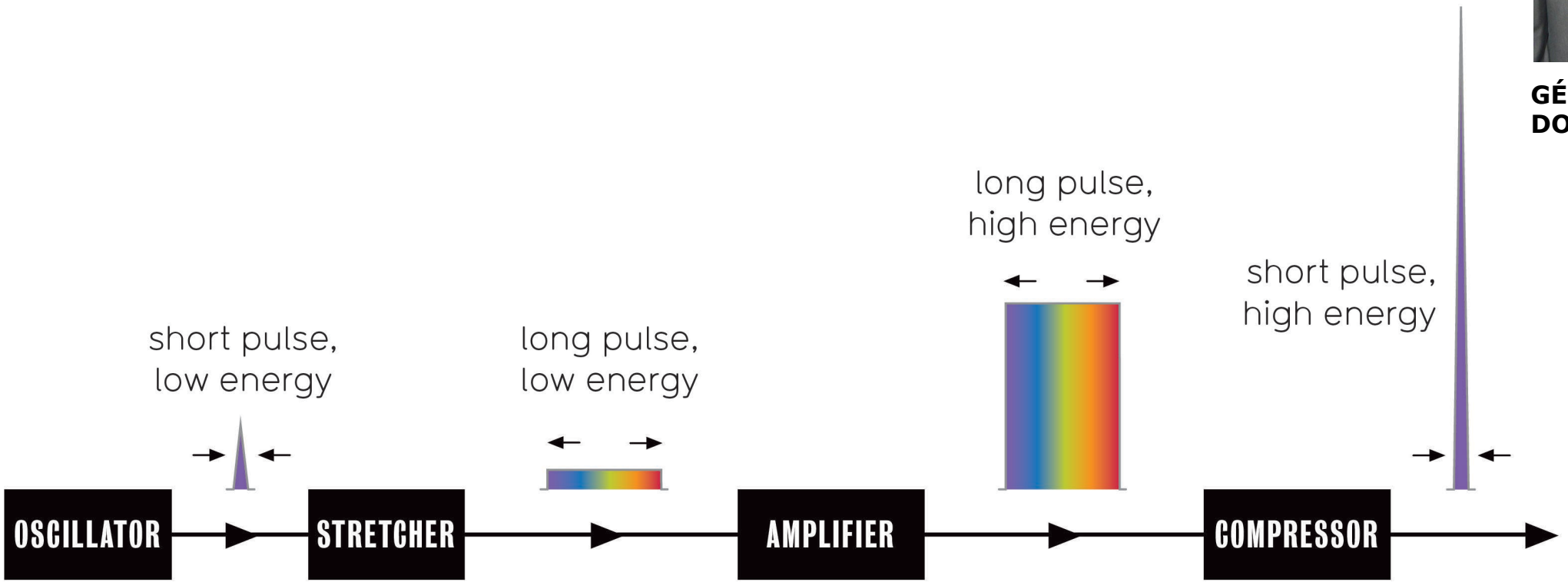
DYE LASER



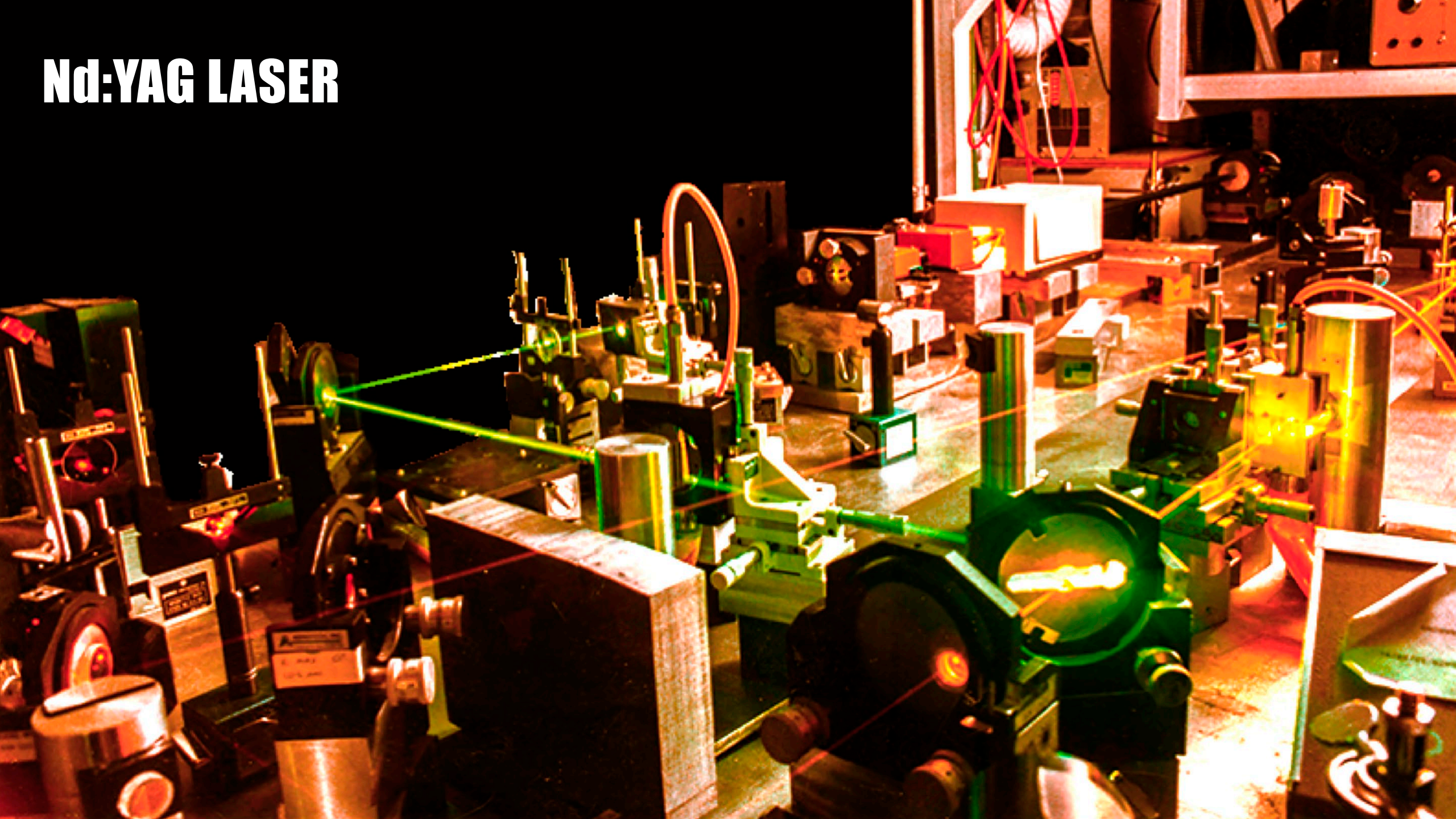
OMEGA LASER

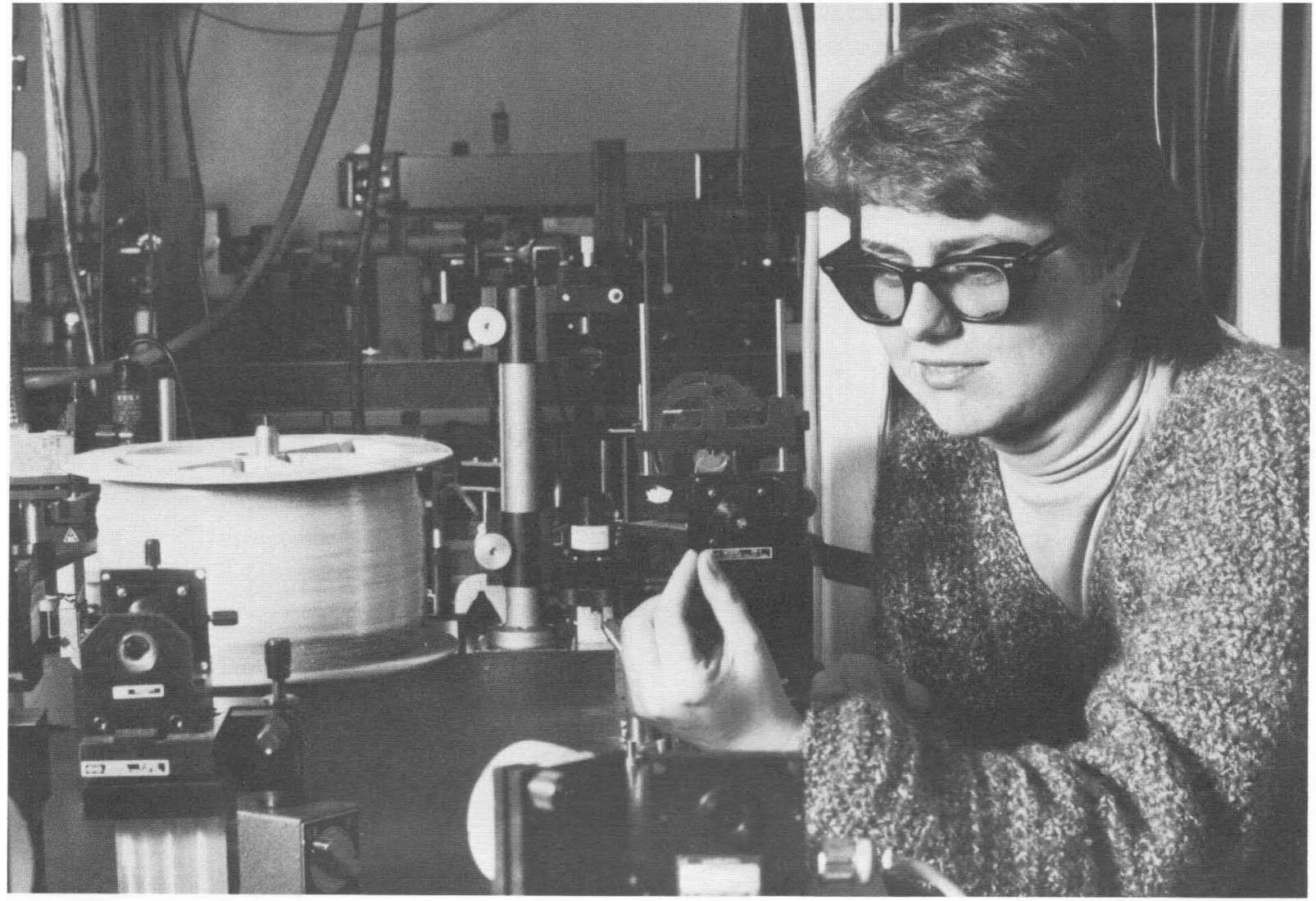
CHIRPED PULSE AMPLIFICATION (CPA)

GÉRARD MOUROU AND DONNA STRICKLAND

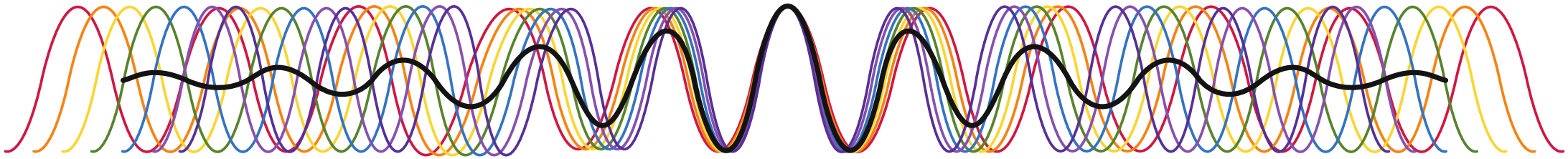


Nd:YAG LASER

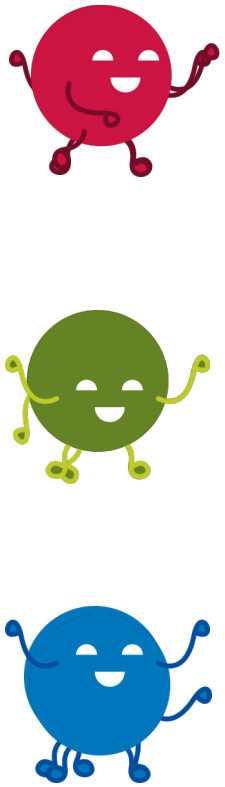




YOU NEED A LOT OF COLOR TO MAKE A SHORT PULSE



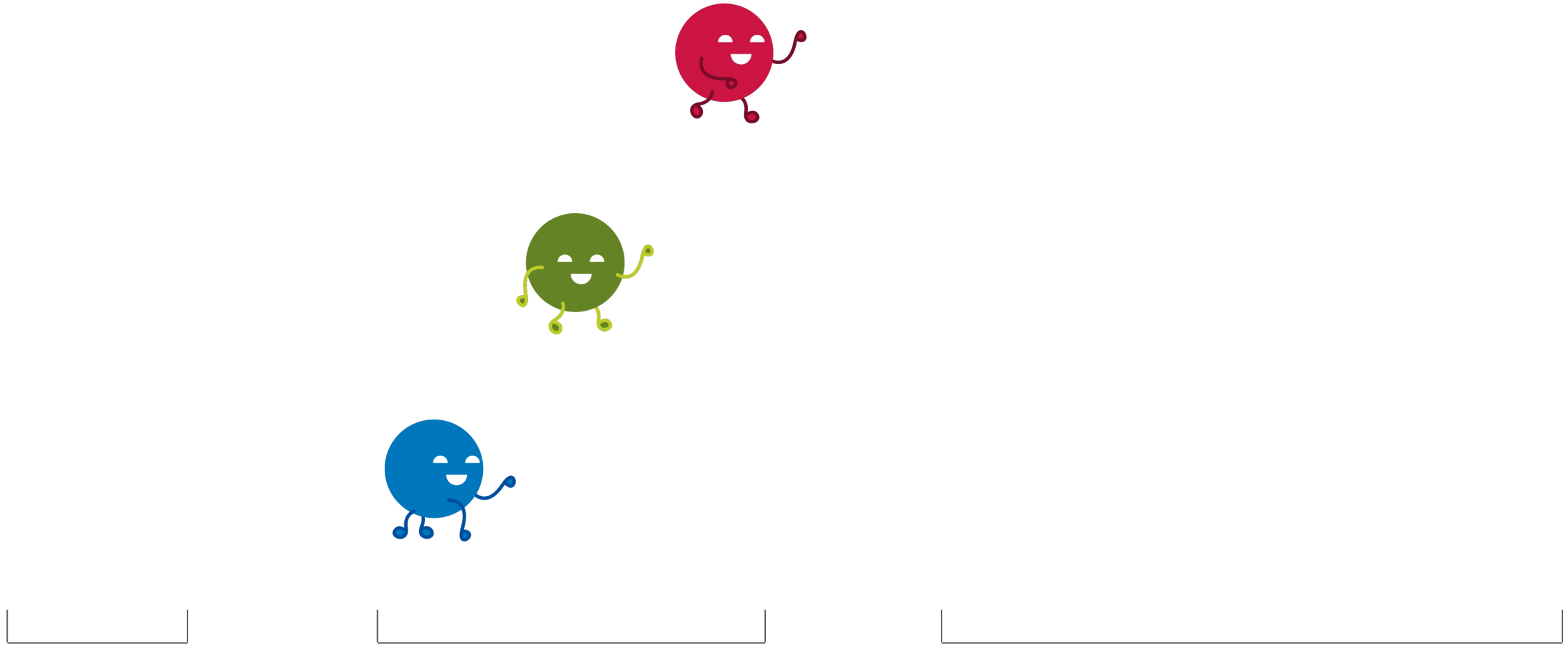
PULSE STRETCHING



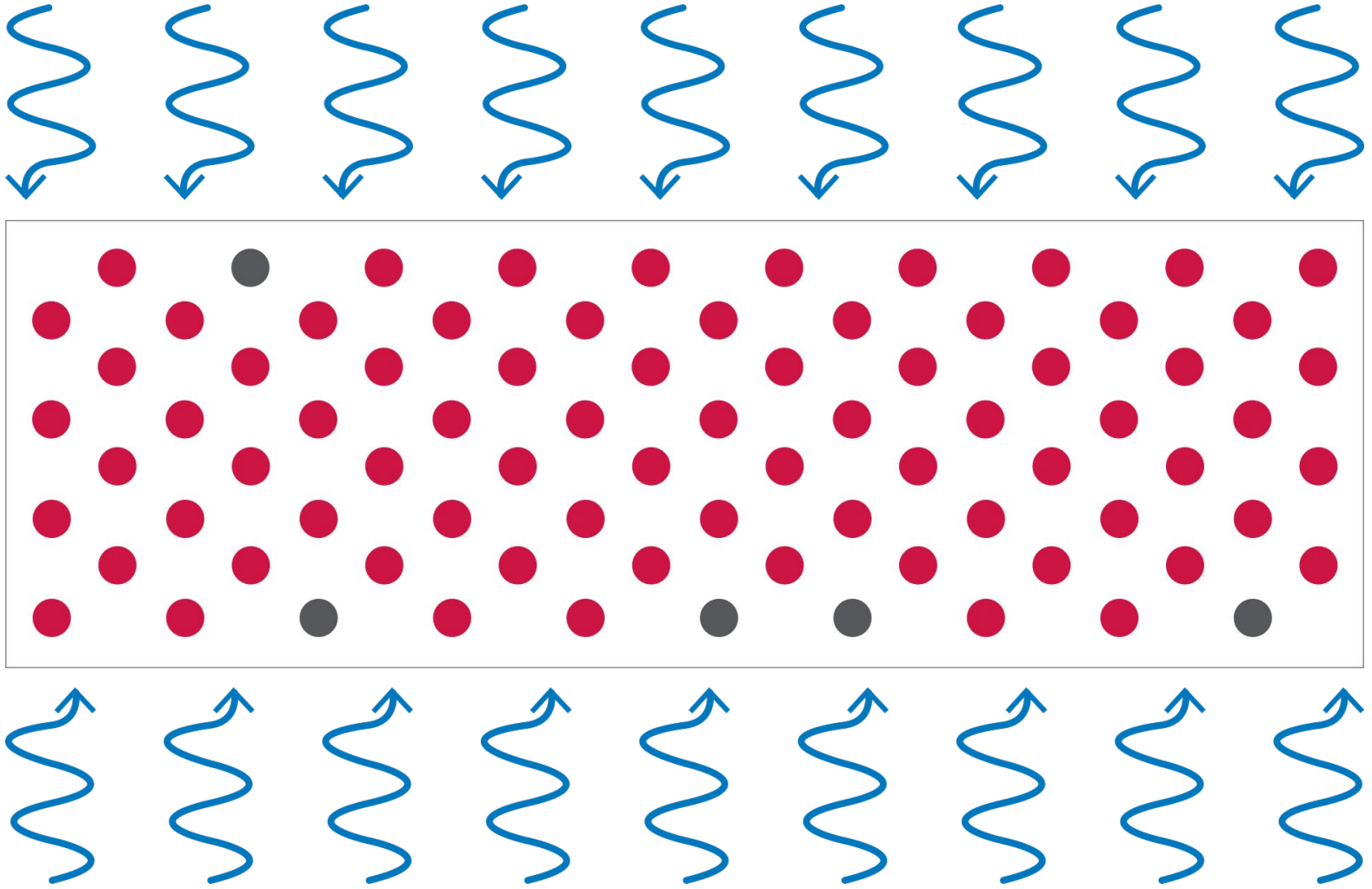
SHORT PULSE

LONG PULSE

PULSE STRETCHING



LASER AMPLIFICATION



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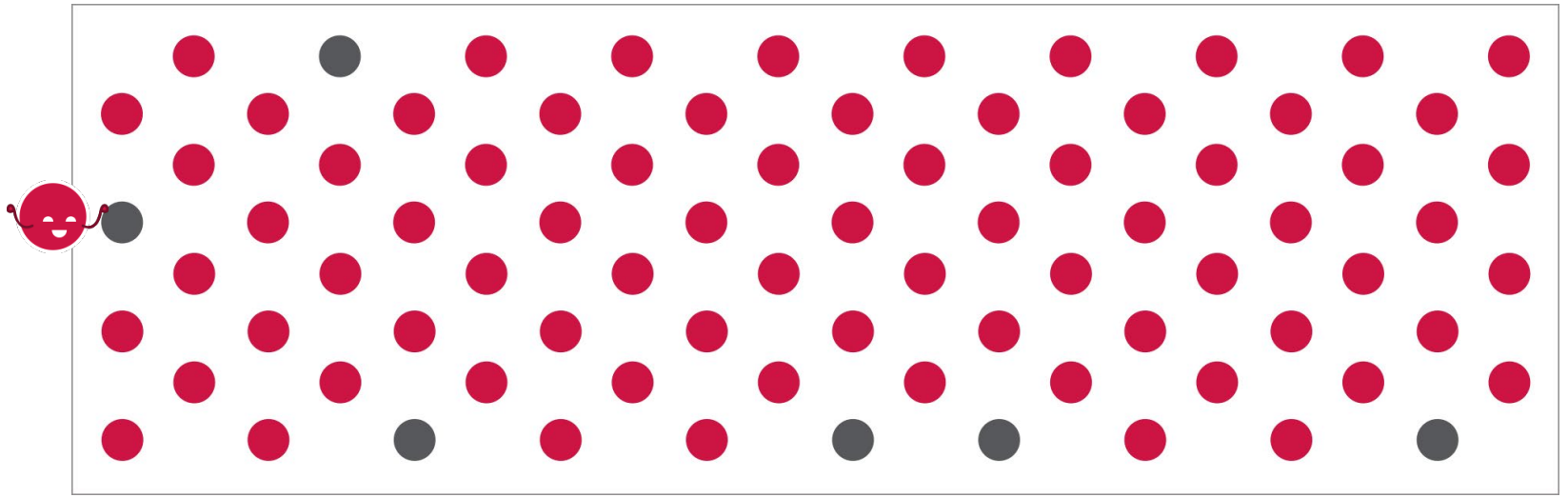

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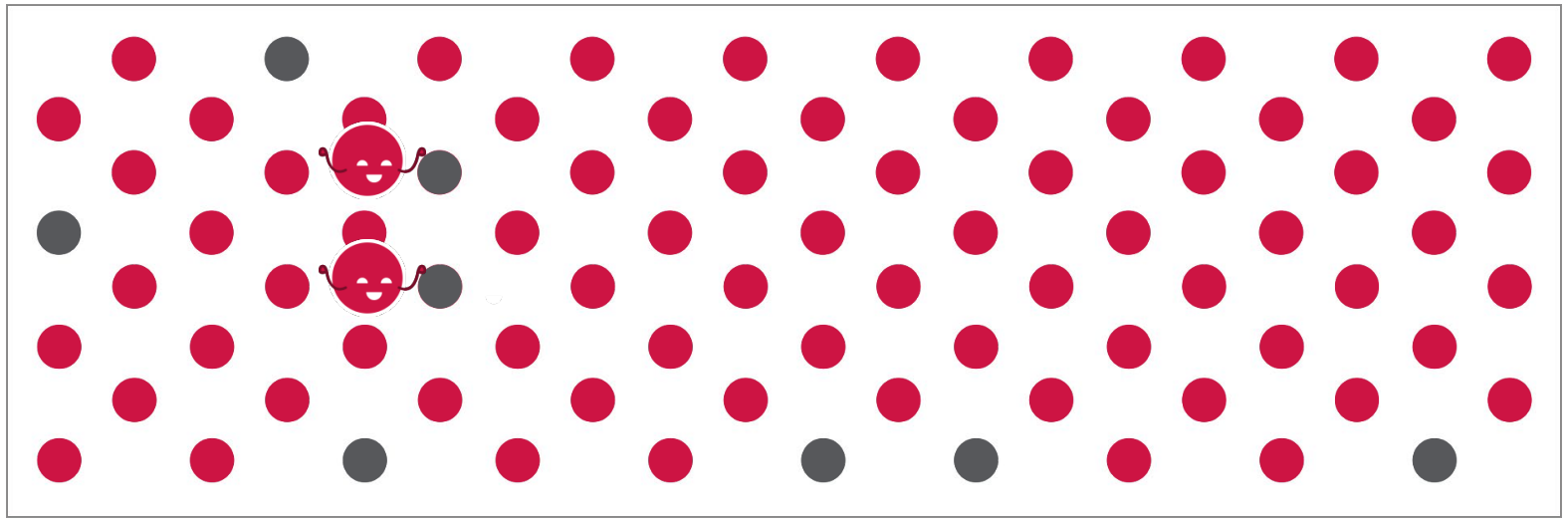
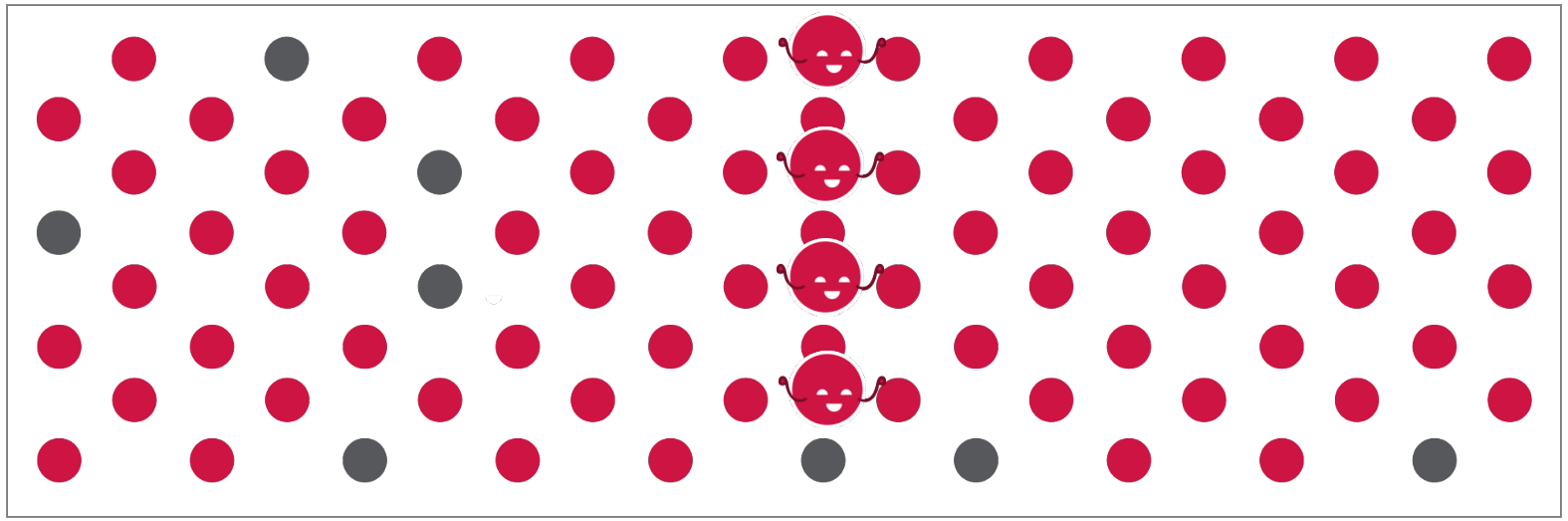
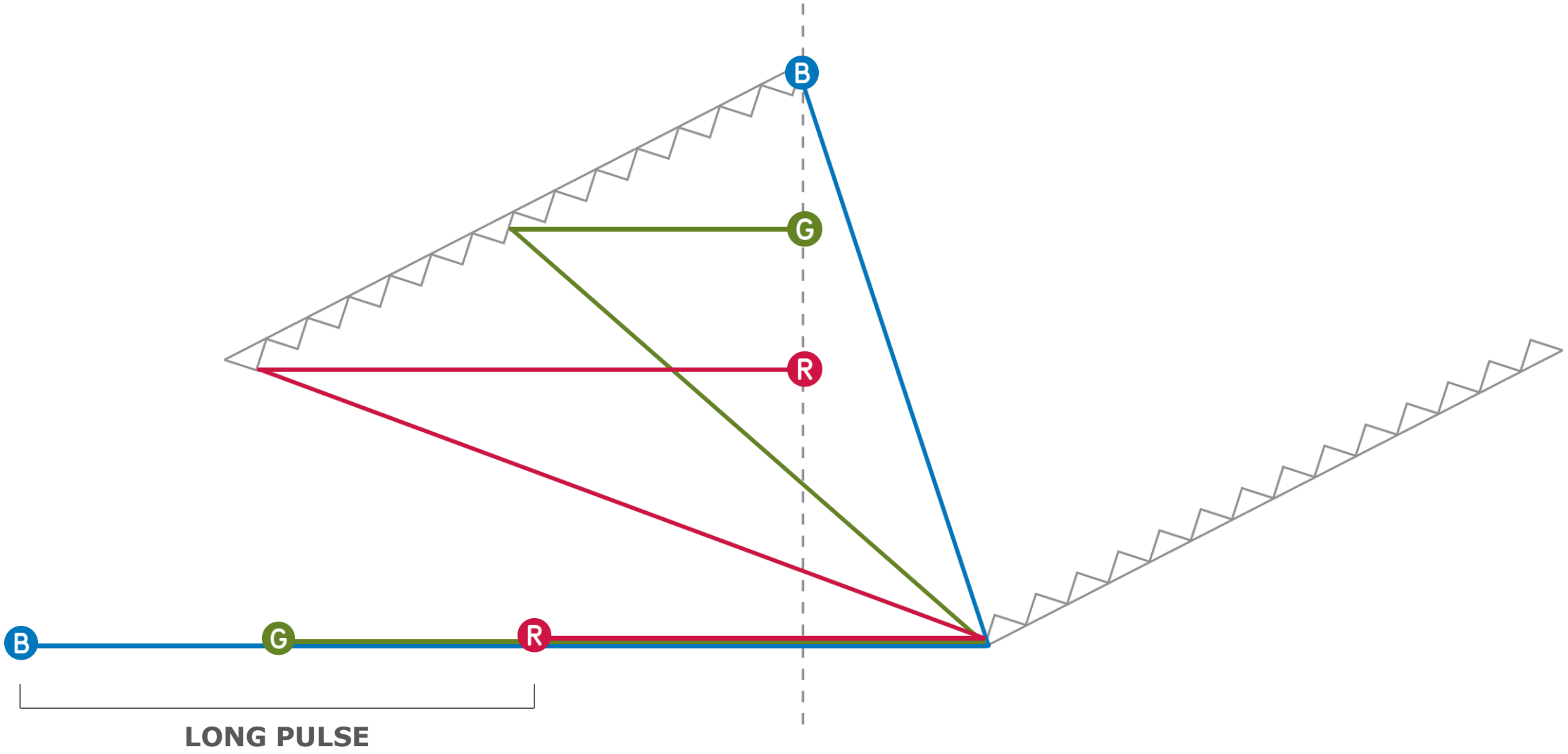


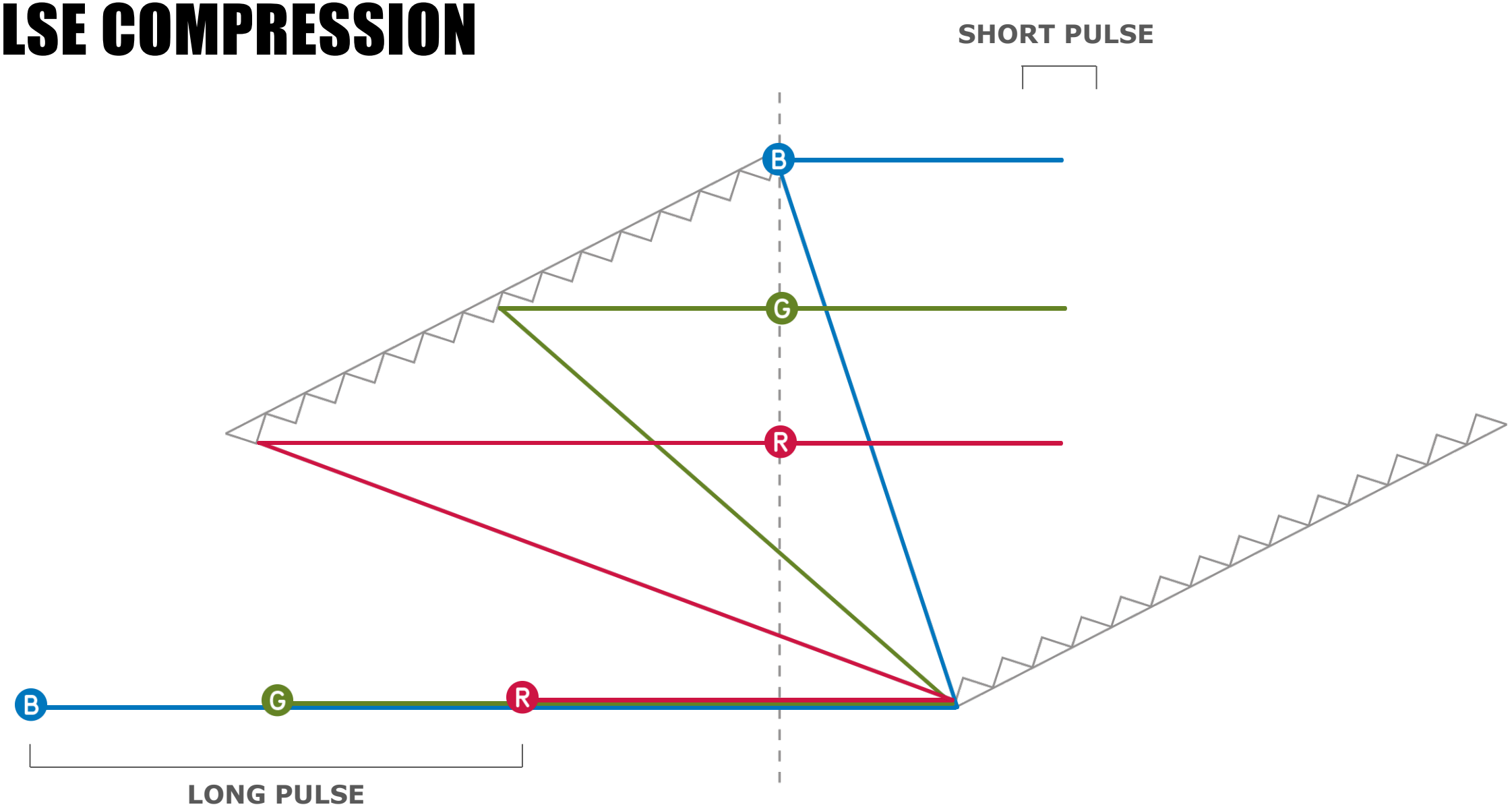
LASER AMPLIFICATION



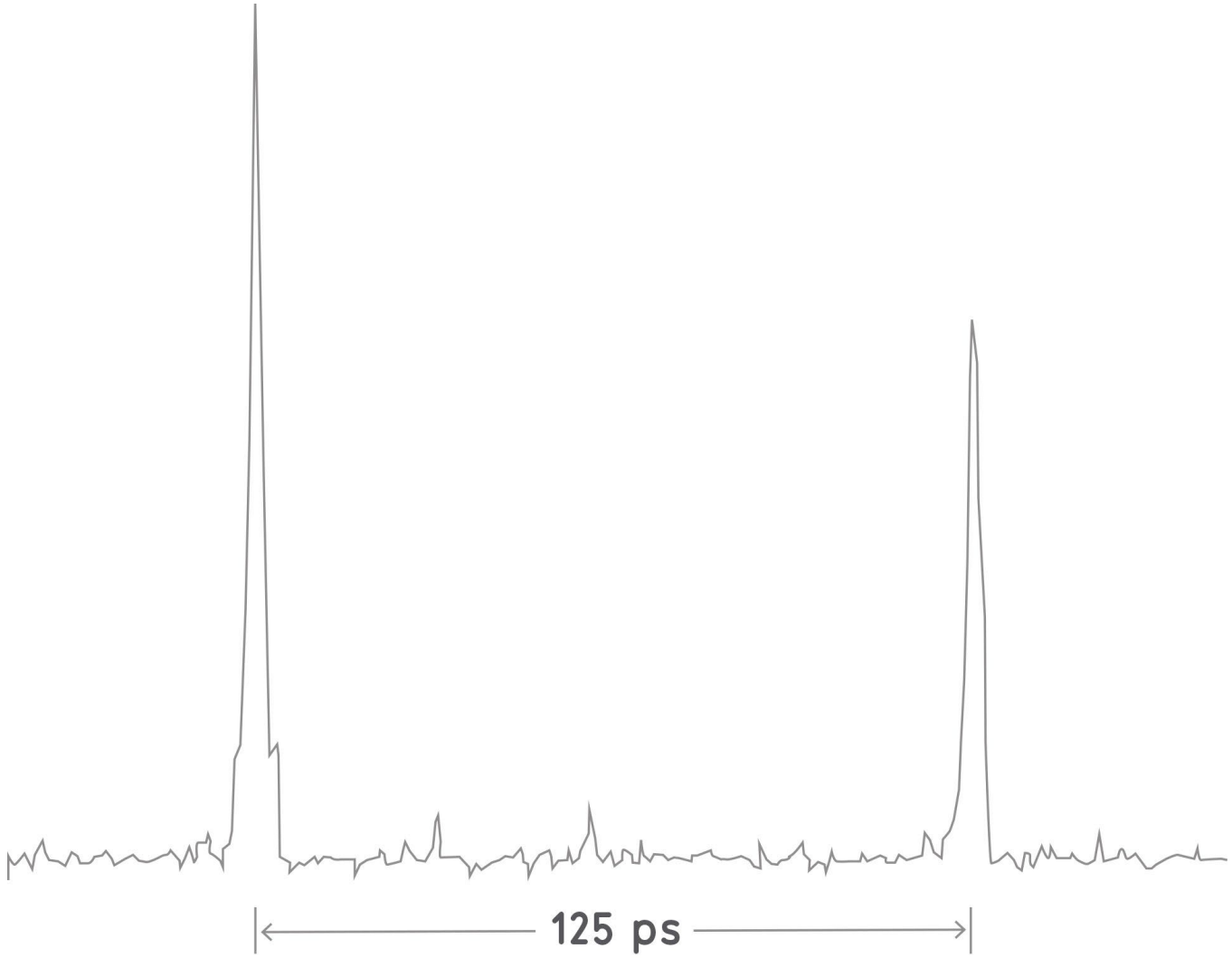
PULSE COMPRESSION



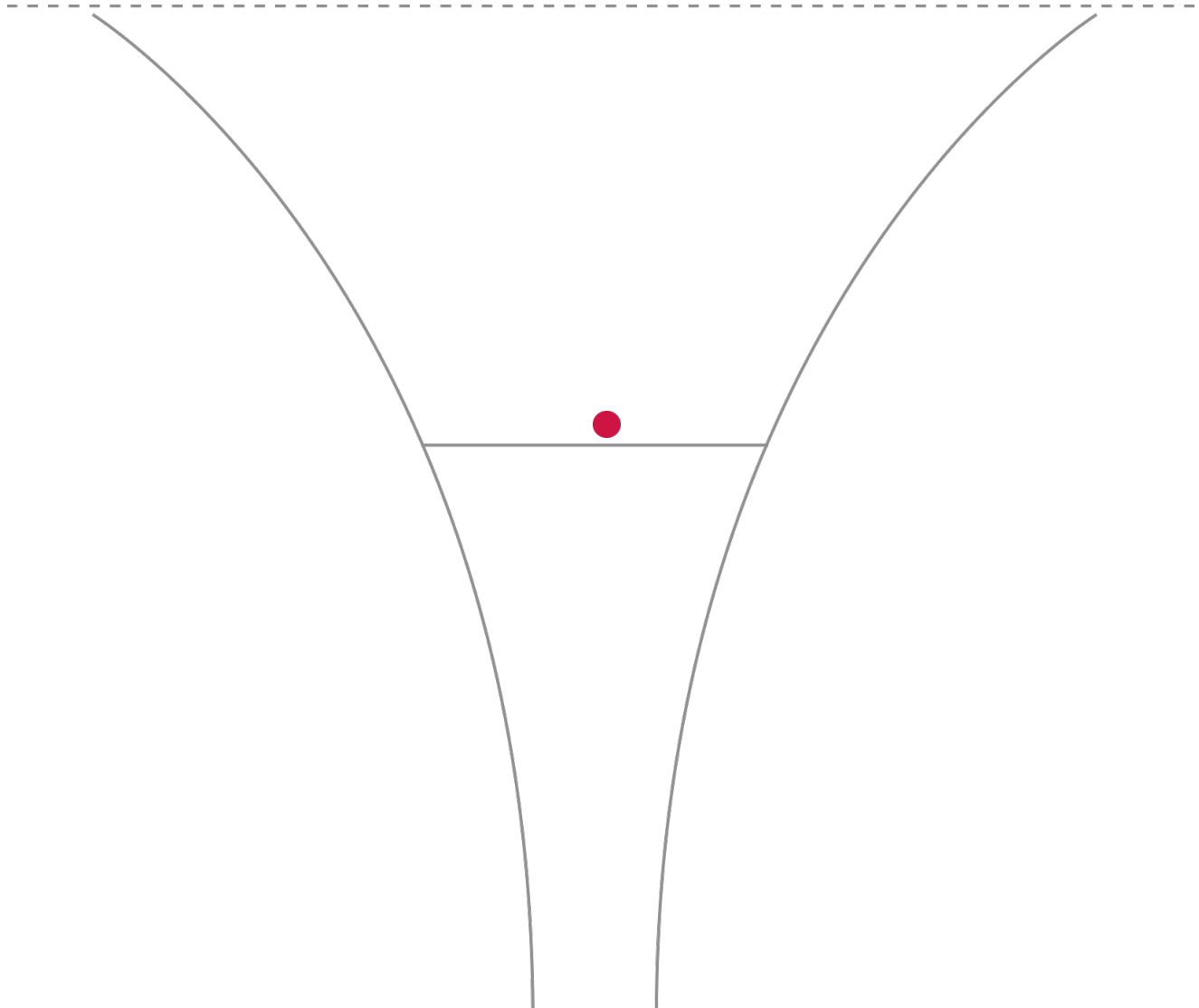
PULSE COMPRESSION



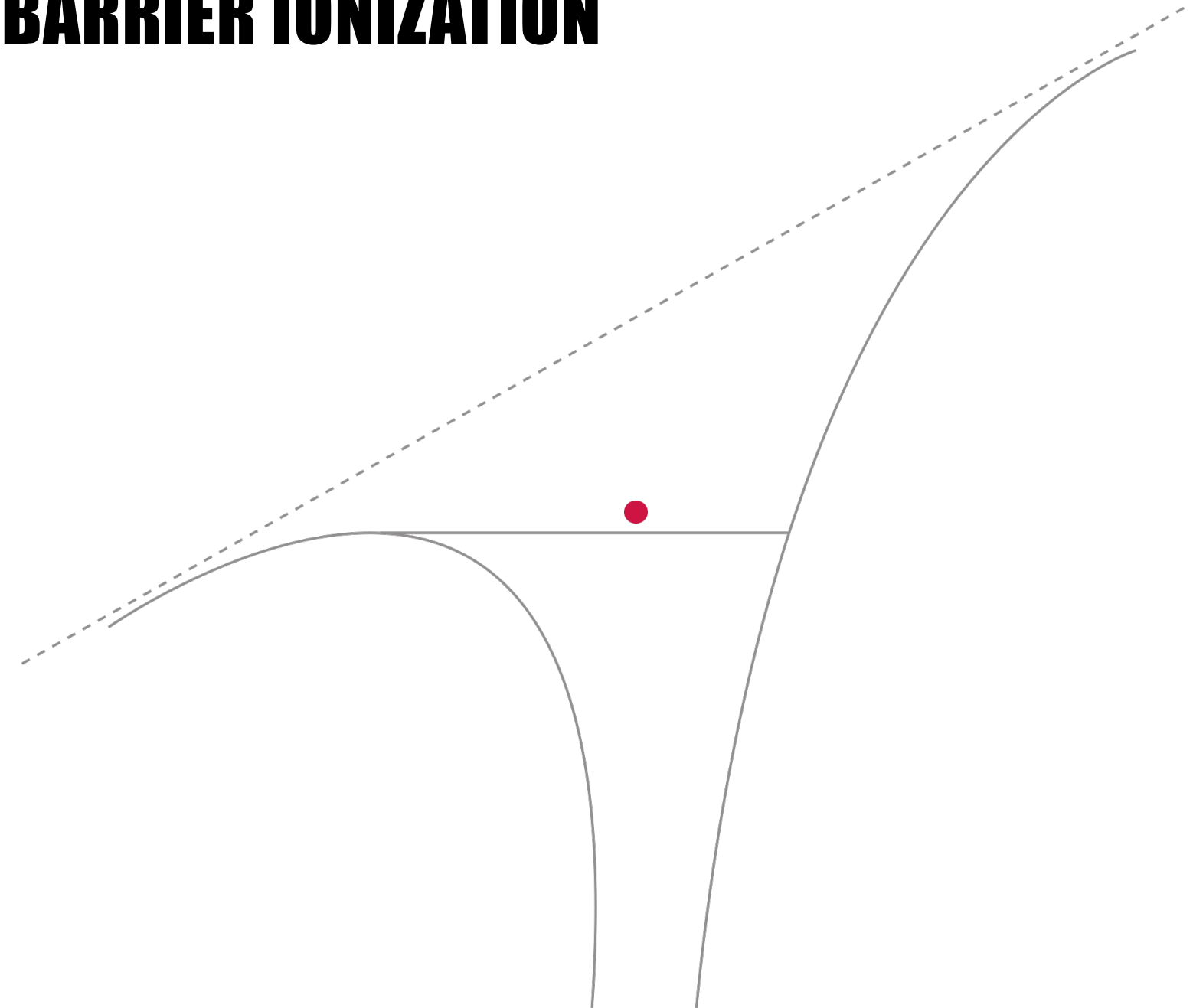
MEASUREMENT SHOWING CPA WORKED



MULTIPHOTON IONIZATION



OVER-THE-BARRIER IONIZATION



ACKNOWLEDGEMENTS

Development of First CPA Laser

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- Steve Williamson
- Marcel Bouvier

Multiphoton Ionization

- See Leang Chin
- Joe Eberly
- David Meyerhofer
- Steve Augst

Presentation Development

- Heather Bettridge
- Christine Goucher
- Sara LeBlanc
- Pamela Smyth