

# NINE

INTERNATIONAL FACILITY



John  
Jett  
2018



SOMETIME IN THE FUTURE...

HI,  
GUYS!

WELCOME TO  
LAWRENCE LIVERMORE  
NATIONAL LABORATORY,  
HOME TO THE  
NATIONAL IGNITION  
FACILITY!

NIF IS  
THE WORLD'S  
LARGEST AND  
MOST ENERGETIC  
LASER!

WHOA--

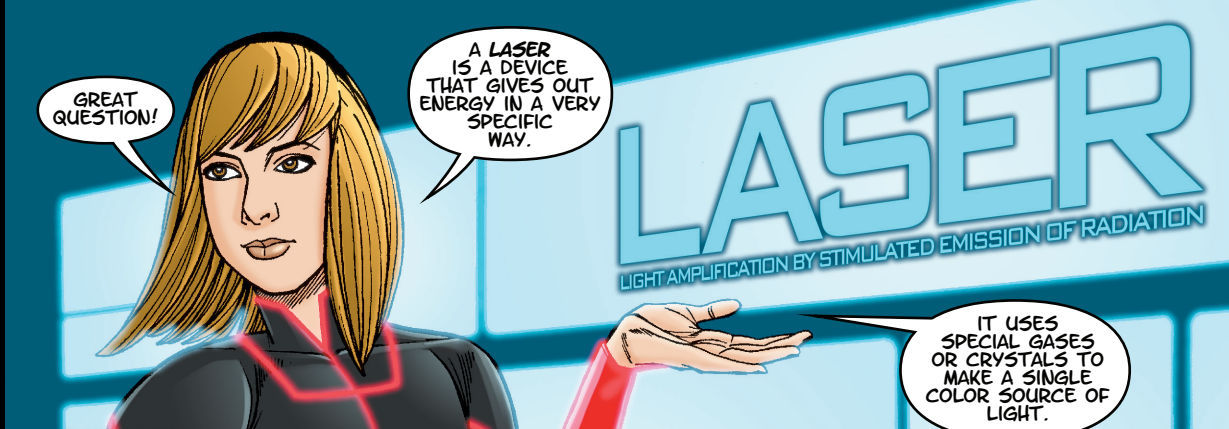
WAIT A MINUTE...

I DIDN'T  
UNDERSTAND  
ANYTHING YOU  
JUST SAID.

YEAH, WHAT  
DO YOU MEAN  
BY "MOST  
ENERGETIC"?

UM,  
YEAH--

AND WHAT  
EXACTLY IS  
A "NIF"?



GREAT QUESTION!

A LASER IS A DEVICE THAT GIVES OUT ENERGY IN A VERY SPECIFIC WAY.

# LASER

LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION

IT USES SPECIAL GASES OR CRYSTALS TO MAKE A SINGLE COLOR SOURCE OF LIGHT.



OH, LIKE A FLASHLIGHT!

NOT REALLY.

HERE, LET ME SHOW YOU.



ORDINARY LIGHT, LIKE FROM A FLASHLIGHT, IS RANDOM AND DIRECTIONLESS.

LASER LIGHT TRAVELS IN ONE DIRECTION AS A SINGLE, NARROW BEAM.

A LASER'S ENERGY IS FOCUSED, INSTEAD OF SPREADING OUT EVERYWHERE LIKE THIS FLASHLIGHT.

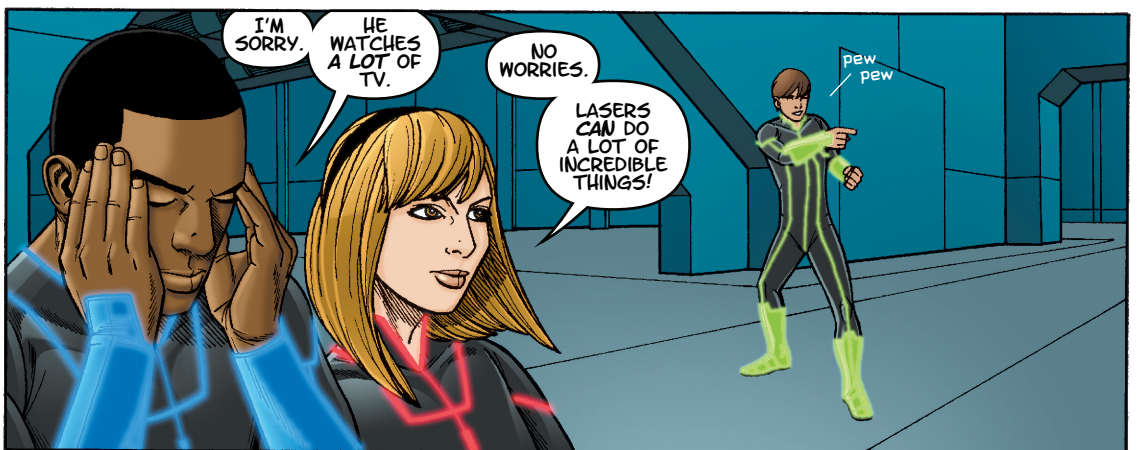
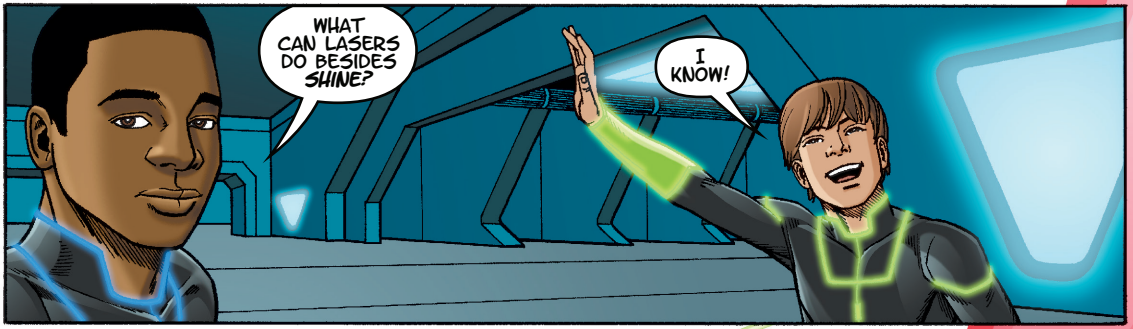


A FLASHLIGHT CAN REALLY ONLY BE USED AS A LIGHT.

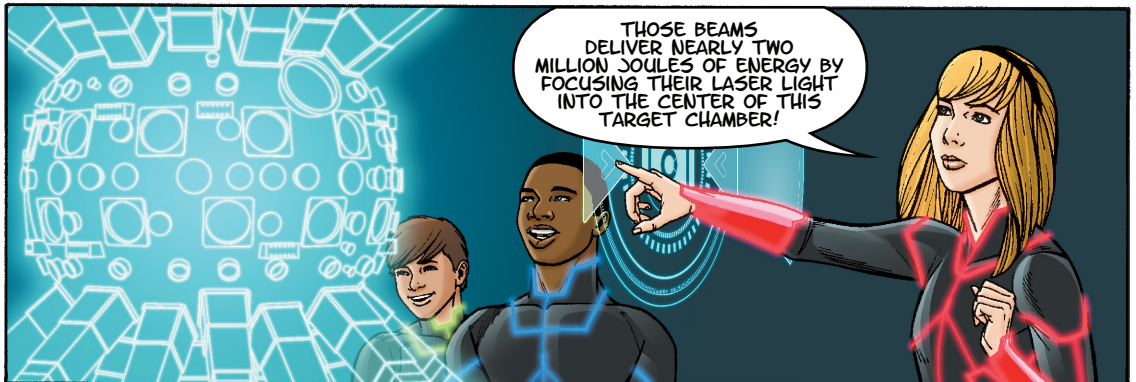
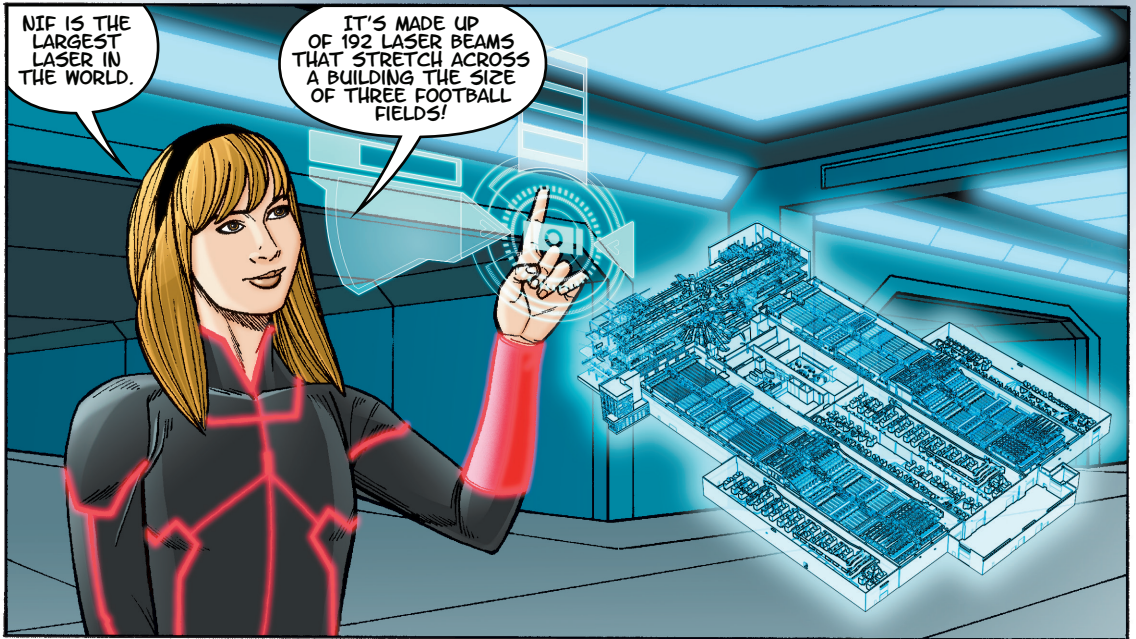
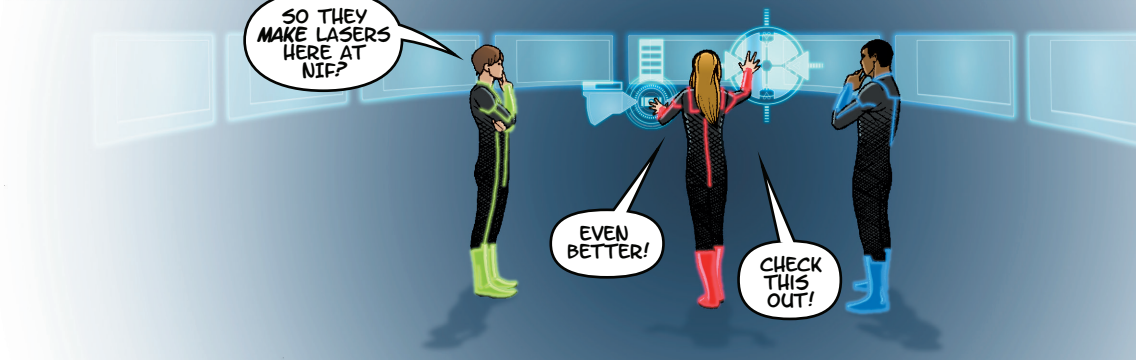
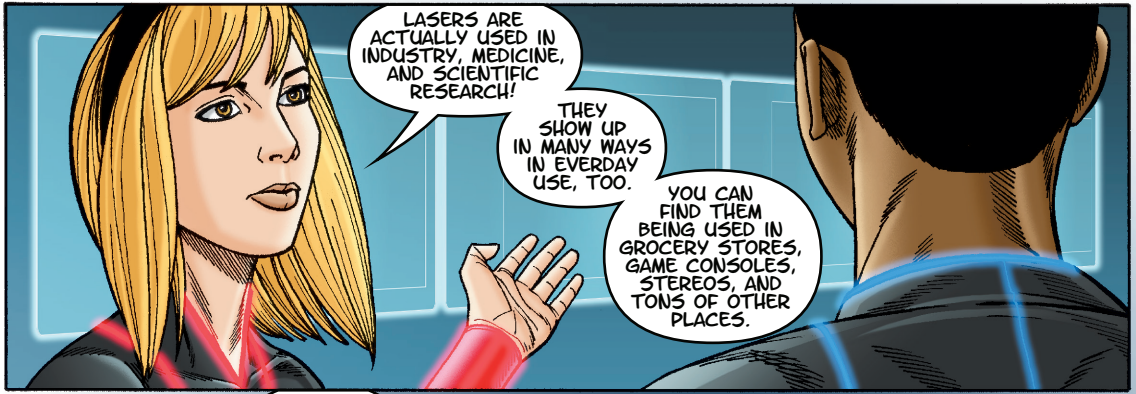
LASERS EXCITE ATOMS SO THAT THEY GIVE OUT ENERGY AS LIGHT.

THAT'S WHY A LASER CAN BE USED FOR SO MANY DIFFERENT THINGS!

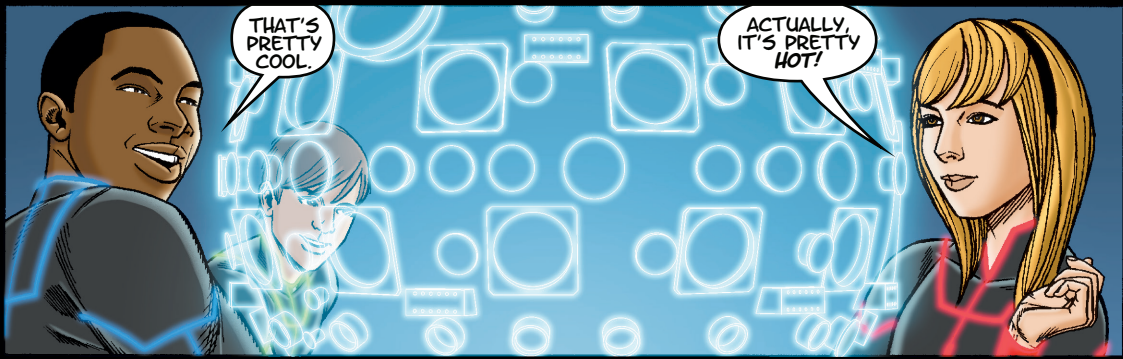






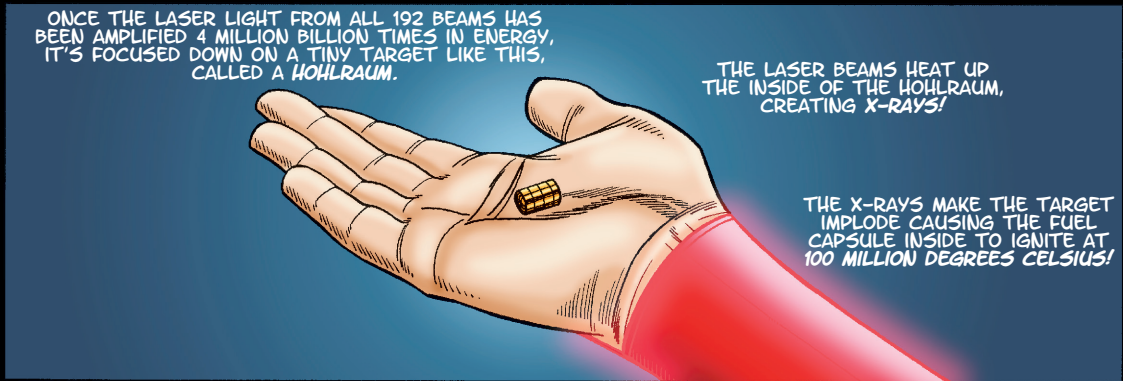






THAT'S PRETTY COOL.

ACTUALLY, IT'S PRETTY HOT!



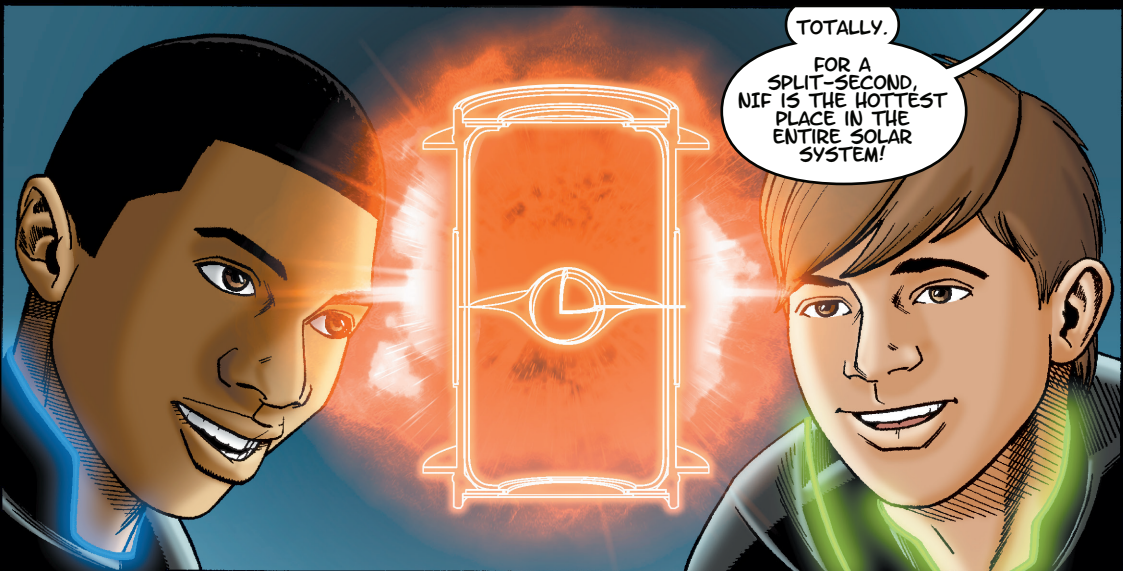
ONCE THE LASER LIGHT FROM ALL 192 BEAMS HAS BEEN AMPLIFIED 4 MILLION BILLION TIMES IN ENERGY, IT'S FOCUSED DOWN ON A TINY TARGET LIKE THIS, CALLED A HOHLRAUM.

THE LASER BEAMS HEAT UP THE INSIDE OF THE HOHLRAUM, CREATING X-RAYS!

THE X-RAYS MAKE THE TARGET IMplode CAUSING THE FUEL CAPSULE INSIDE TO IGNITE AT 100 MILLION DEGREES CELSIUS!

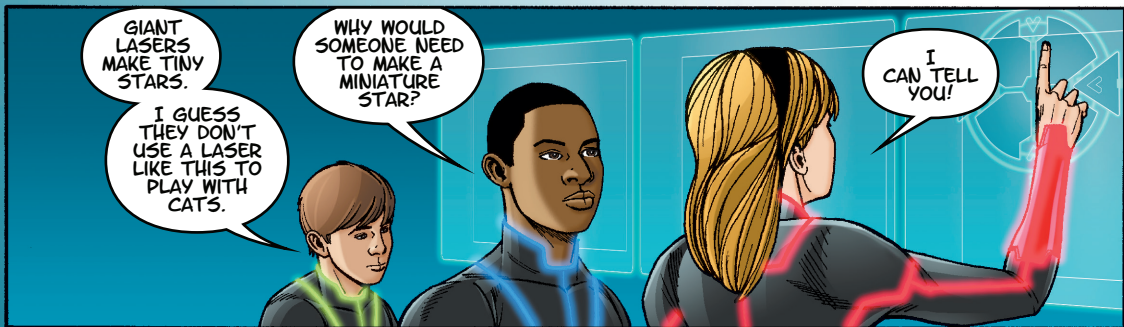


WILD. ALL OF THAT HAPPENS INSIDE OF THIS TINY LITTLE THING?



TOTALLY. FOR A SPLIT-SECOND, NIF IS THE HOTTEST PLACE IN THE ENTIRE SOLAR SYSTEM!



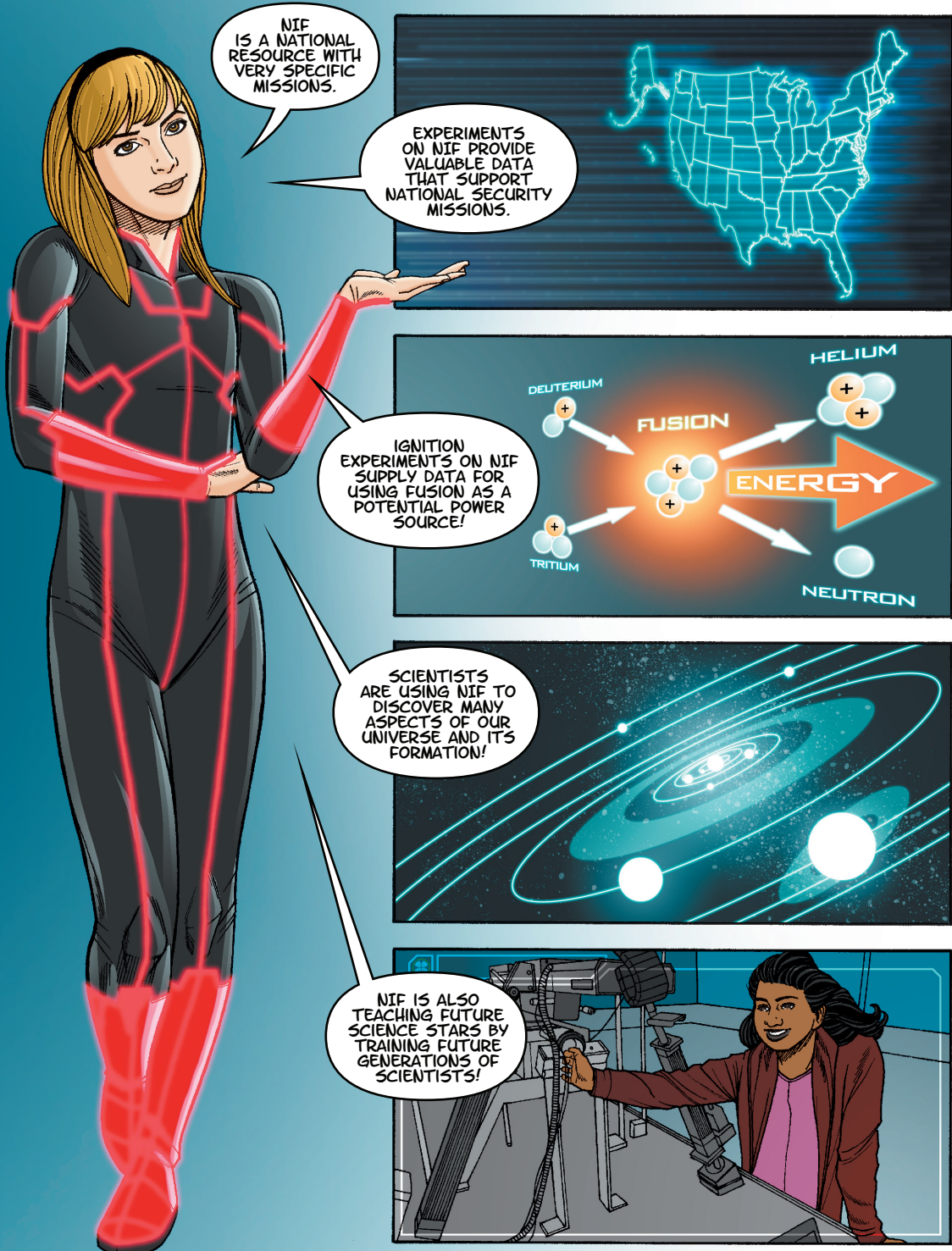


GIANT LASERS MAKE TINY STARS.

I GUESS THEY DON'T USE A LASER LIKE THIS TO PLAY WITH CATS.

WHY WOULD SOMEONE NEED TO MAKE A MINIATURE STAR?

I CAN TELL YOU!

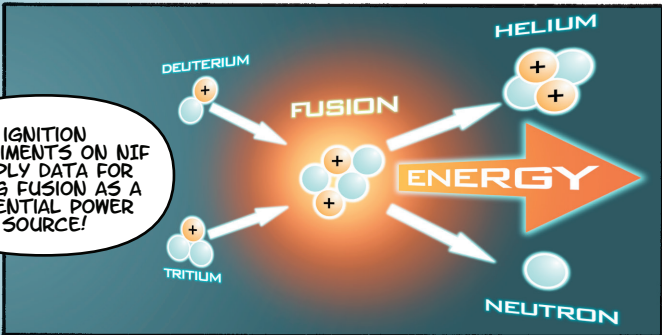


NIF IS A NATIONAL RESOURCE WITH VERY SPECIFIC MISSIONS.

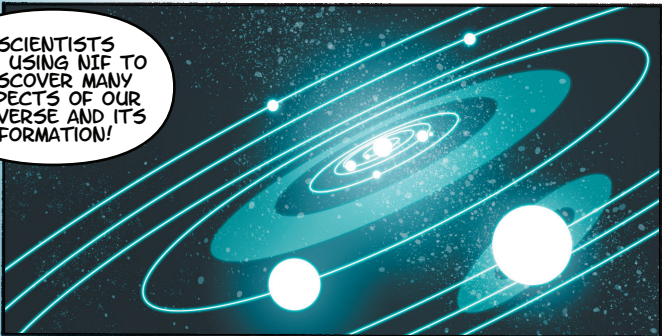
EXPERIMENTS ON NIF PROVIDE VALUABLE DATA THAT SUPPORT NATIONAL SECURITY MISSIONS.



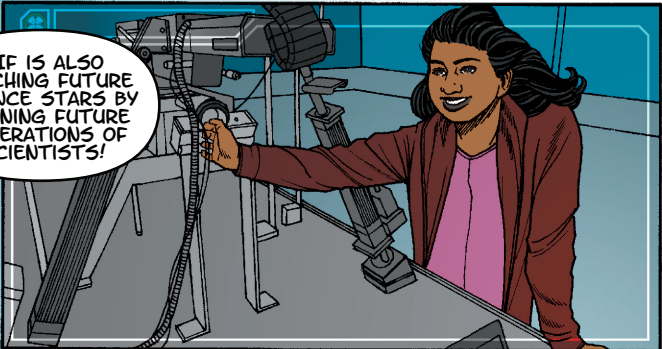
IGNITION EXPERIMENTS ON NIF SUPPLY DATA FOR USING FUSION AS A POTENTIAL POWER SOURCE!



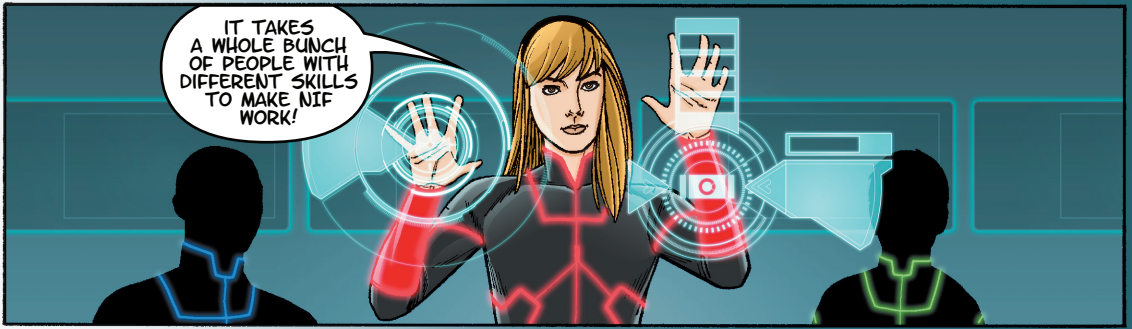
SCIENTISTS ARE USING NIF TO DISCOVER MANY ASPECTS OF OUR UNIVERSE AND ITS FORMATION!



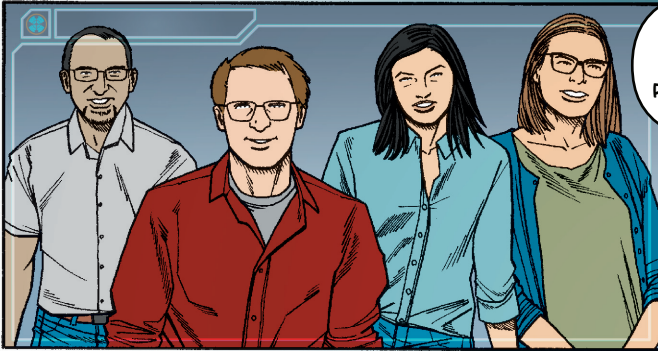
NIF IS ALSO TEACHING FUTURE SCIENCE STARS BY TRAINING FUTURE GENERATIONS OF SCIENTISTS!



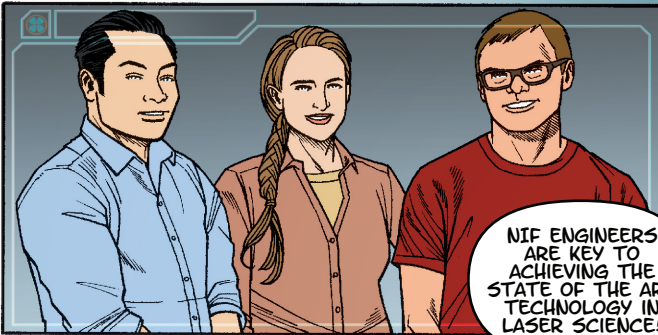




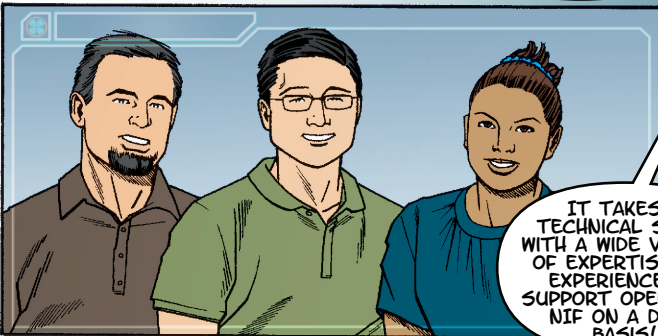
IT TAKES A WHOLE BUNCH OF PEOPLE WITH DIFFERENT SKILLS TO MAKE NIF WORK!



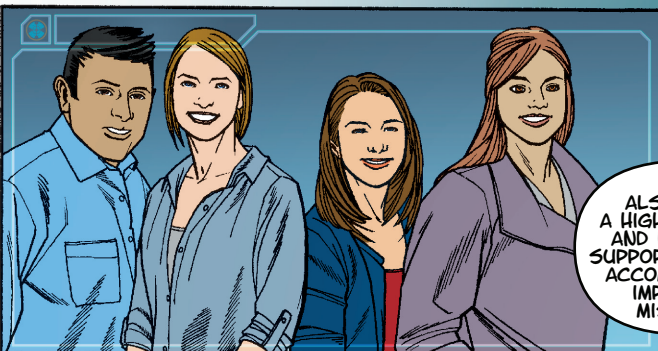
THE SKILLS USED BY THE SCIENTISTS THAT OPERATE NIF RANGE FROM CHEMISTRY TO PHYSICS, FROM BIOLOGY TO ROBOTICS, AND MORE!



NIF ENGINEERS ARE KEY TO ACHIEVING THE STATE OF THE ART TECHNOLOGY IN LASER SCIENCE!



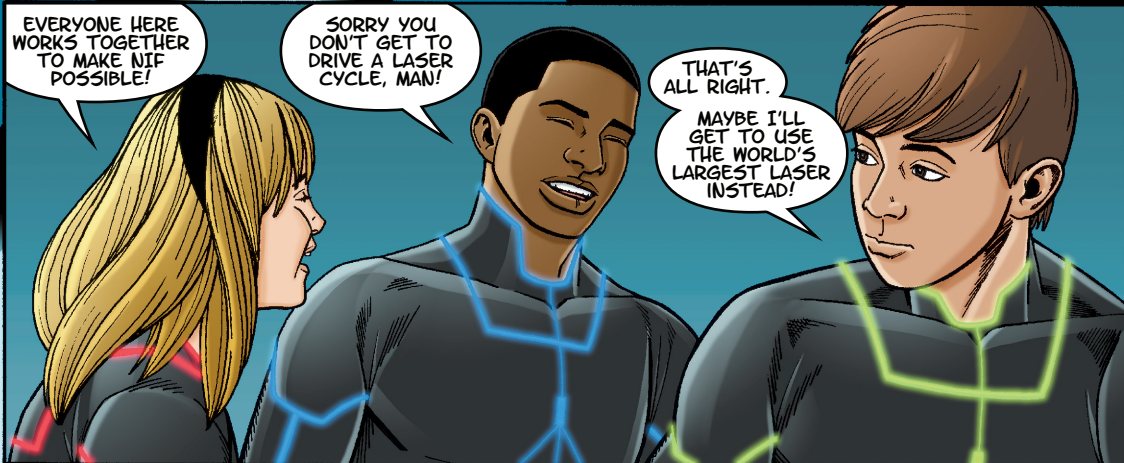
IT TAKES A TECHNICAL STAFF WITH A WIDE VARIETY OF EXPERTISE AND EXPERIENCE TO SUPPORT OPERATING NIF ON A DAILY BASIS!



NIF ALSO NEEDS A HIGHLY SKILLED AND DEDICATED SUPPORT STAFF TO ACCOMPLISH ITS IMPORTANT MISSIONS!



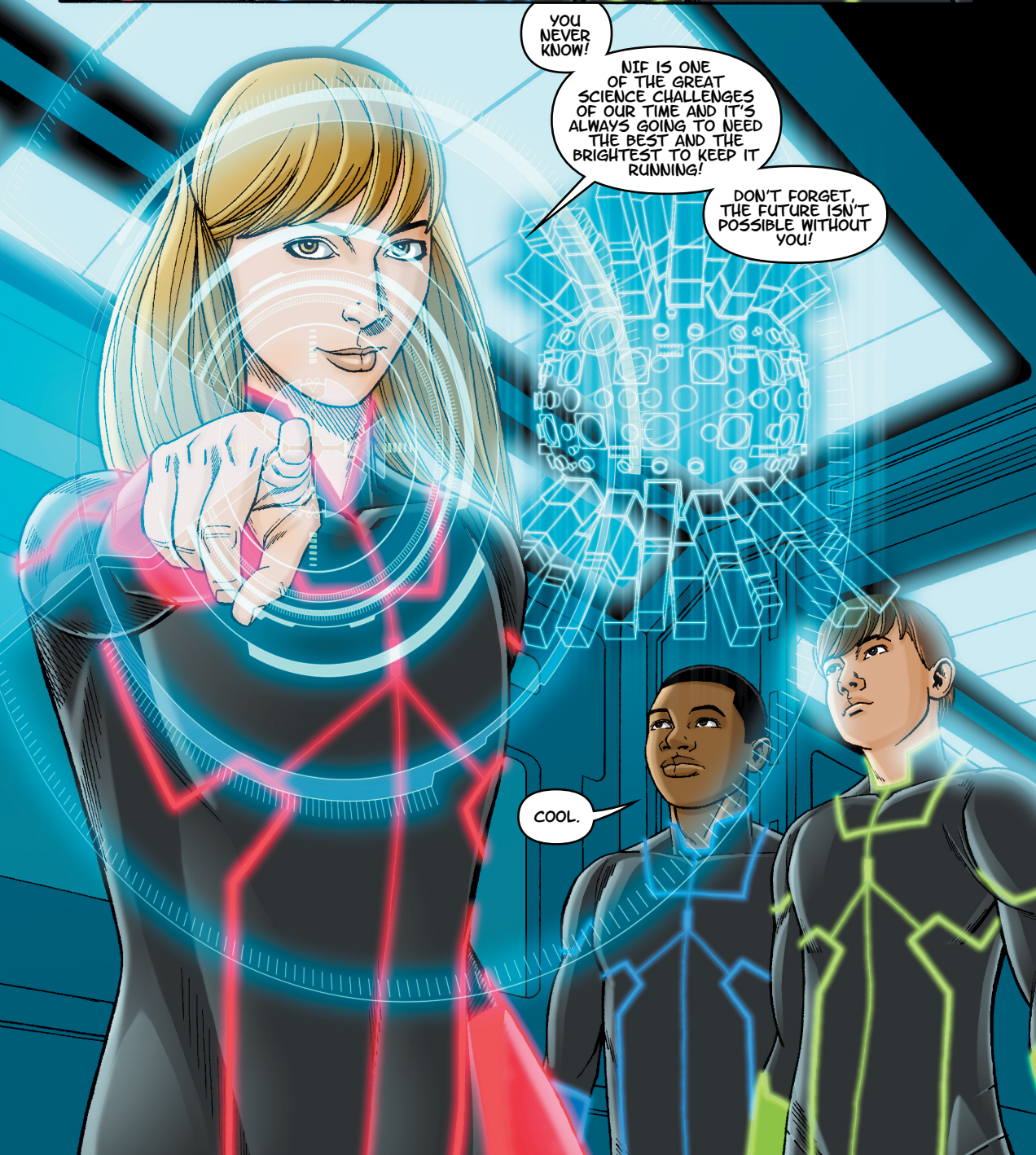




EVERYONE HERE WORKS TOGETHER TO MAKE NIF POSSIBLE!

SORRY YOU DON'T GET TO DRIVE A LASER CYCLE, MAN!

THAT'S ALL RIGHT.  
MAYBE I'LL GET TO USE THE WORLD'S LARGEST LASER INSTEAD!



YOU NEVER KNOW!

NIF IS ONE OF THE GREAT SCIENCE CHALLENGES OF OUR TIME AND IT'S ALWAYS GOING TO NEED THE BEST AND THE BRIGHTEST TO KEEP IT RUNNING!

DON'T FORGET, THE FUTURE ISN'T POSSIBLE WITHOUT YOU!

COOL.



# THANK YOU FOR VISITING NIF!

THE NATIONAL IGNITION FACILITY (NIF) IS THE WORLD'S LARGEST AND HIGHEST-ENERGY LASER SYSTEM. BY PROVIDING THE CAPABILITIES TO ACHIEVE FUSION IGNITION AND BURN IN A LABORATORY SETTING, NIF IS A CRITICAL EXPERIMENTAL FACILITY FOR THE NATIONAL NUCLEAR SECURITY ADMINISTRATION'S STOCKPILE STEWARDSHIP PROGRAM AND IS A KEY INTERNATIONAL SCIENTIFIC RESOURCE. NIF IS USED TO UNDERSTAND ISSUES ABOUT HIGH ENERGY DENSITY SCIENCE AND TO EXPLORE ASPECTS OF ASTROPHYSICS, MATERIAL SCIENCE, PLASMA PHYSICS, AND MANY OTHER AREAS OF DISCOVERY SCIENCE.

ADDITIONAL INFORMATION IS AVAILABLE ON THE NIF & PHOTON SCIENCE WEB SITE AT [LASERS.LLNL.GOV](http://LASERS.LLNL.GOV).

# NIF

## NATIONAL IGNITION FACILITY

WRITTEN AND DRAWN BY

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# WANT TO KNOW MORE ABOUT NIF?

## **WHAT IS NIF?**

THE NATIONAL IGNITION FACILITY (NIF), LOCATED AT LAWRENCE LIVERMORE NATIONAL LABORATORY, IS THE WORLD'S LARGEST LASER. NIF'S 192 POWERFUL LASER BEAMS, HOUSED IN A 10-STORY BUILDING THE SIZE OF 3 FOOTBALL FIELDS, CAN DELIVER NEARLY 2 MILLION JOULES OF ULTRAVIOLET LASER ENERGY IN BILLIONTH-OF-A-SECOND PULSES ONTO A TARGET ABOUT THE SIZE OF A PENCIL ERASER. NIF BECAME OPERATIONAL IN MARCH 2009.

## **WHAT IS NIF USED FOR?**

NIF ENABLES SCIENTISTS TO CREATE EXTREME STATES OF MATTER, INCLUDING TEMPERATURES OF 100 MILLION DEGREES AND PRESSURES THAT EXCEED 100 BILLION TIMES EARTH'S ATMOSPHERE. NIF SUPPORTS NATIONAL SECURITY, FUNDAMENTAL SCIENCE, ENERGY SECURITY, AND NATIONAL COMPETITIVENESS MISSIONS.

## **HOW MUCH POWER AND ENERGY DO NIF'S 192 BEAMS PRODUCE?**

ON JULY 5, 2012, NIF MADE HISTORY WHEN ITS 192 BEAMS DELIVERED MORE THAN 500 TRILLION WATTS OF PEAK POWER AND 1.85 MEGAJOULES OF ULTRAVIOLET LASER LIGHT TO ITS TARGET. THAT'S 1,000 TIMES MORE POWER THAN THE UNITED STATES USES AT ANY INSTANT IN TIME.

## **WHO USES NIF?**

NIF USERS INCLUDE RESEARCHERS FROM DEPARTMENT OF ENERGY NATIONAL LABORATORIES, UNIVERSITIES, AND OTHER U.S. AND FOREIGN RESEARCH CENTERS.

## **WHAT IS IGNITION?**

IGNITION OCCURS WHEN THE ENERGY LIBERATED FROM THE EXTREME HEATING AND COMPRESSION OF THE NIF FUSION FUEL EQUALS OR IS GREATER THAN THE AMOUNT OF ENERGY THE 192 LASER BEAMS DELIVER TO THE TARGET TO START THE FUSION REACTIONS. ACHIEVING IGNITION AND ENERGY GAIN IS ONE OF NIF'S CHIEF MISSIONS. IGNITION WILL PROVE THE SCIENTIFIC FEASIBILITY OF INERTIAL CONFINEMENT FUSION AS A CLEAN SOURCE OF ENERGY.

## **CAN I GET A JOB, SUMMER INTERNSHIP, OR POSTDOC POSITION WITH NIF?**

WE ARE ALWAYS INTERESTED IN ATTRACTING GREAT TALENT TO JOIN OUR TEAM. YOU CAN FIND INFORMATION ABOUT CURRENT JOB OPENINGS, INTERNSHIPS, AND POSTDOCTORAL OPPORTUNITIES ON THE LLNL CAREERS SITE.

## **STUDENT INTERNSHIP PROGRAM**

THE NIF AND PHOTON SCIENCE DIRECTORATE OFTEN HAS OPPORTUNITIES FOR UNDERGRADUATE AND GRADUATE-LEVEL STUDENTS TO ENGAGE IN CUTTING-EDGE SCIENTIFIC RESEARCH TO FURTHER THEIR EDUCATIONAL AND RESEARCH GOALS. THE STUDENT INTERNSHIP PROGRAM CAN PROVIDE UNDERGRADUATE AND GRADUATE STUDENTS RESEARCH OPPORTUNITIES IN LASERS, PLASMA PHYSICS, ELECTRO-OPTICS, SOFTWARE DEVELOPMENT, AND OPTICAL, X-RAY, AND NUCLEAR INSTRUMENT DEVELOPMENT AND TESTING. STUDENTS WORK ALONGSIDE SCIENTISTS AT ON-SITE LASER AND NUCLEAR FACILITIES IN THE AREAS OF ADVANCED LASER DEVELOPMENT, LASER PLASMA INTERACTIONS, HYDRODYNAMICS, MATERIAL SCIENCE, RADIATION PHYSICS, AND VARIOUS DIAGNOSTIC SYSTEMS. TO LOOK FOR OPPORTUNITIES, GO TO THE LLNL CAREERS PAGE AND SEARCH FOR NIF!

**PLEASE VISIT [LASERS.LLNL.GOV](http://lasers.llnl.gov) FOR MORE INFORMATION ON LASERS AND NIF!**



lasers.llnl.gov