

CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

Name(s)	Project Number
Justin Nguyen	
	36341
Project Title	30341
Behavior of Toroidally Confined Plasmas in Sub-Fusion Conditions	
Objectives/Cools Abstract	
Objectives/Goals The objective of this study is to determine if a tokamak scaling law v	will still apply (in L-Mode) if reactor
size is scaled down. Some goals include building an ultra-high vacu	um capable chamber and producing a
ICP within it. Methods/Materials	\sim
Setup a Vacuum Chamber and pumped down to 10^-7 Torr. Using a	RF generator (bought online) and a
l ion source (built by me using a car ignition coil car battery and 355	times circuit) a plasma was generated
within the chamber. A Poloidal magnetic field was created with a cosolenoid. Used an langmuir probe (built by me with aluming tube, cosolenoid).	oil which wound around the center
filament) oscilloscope and multimeter to measure plasma characteris	opper wire and tungsten rightbulb
number density, and other plasma parameters. Applied the rau e sca	Ing law to my reactor to see if a
correlation exists. Results	
The tau e scaling law does not stay true for extremely small reactives. The confinement time for my	
reactor was 8.2x10^-17.	
Conclusions/Discussion	and do not no occasive hove to
Small fusion reactors face many engineering itsues that larger reactors do not necessarily have to encounter. In small reactors, magnetic confinement cannot be achieved to the same levels ass that of	
larger reactors due to the fact that there is superconducting material on earth that can handle the extreme	
larger reactors due to the fact that there is superconducting material on earth that can handle the extreme heat fluxes of being very close to the plasma. Additionally, small reacotr sizes may introduce new forms of turbulence to plasmas, increasing instability and the amount of energy required to contain the plasma.	
of turbulence to plasmas, increasing histability and the amount of en	ergy required to contain the piasma.
Summary Statement	
I built a small scale tokamak to see if tokamak scaling laws will still apply when scaling reactor size down.	
down.	
Help Received	