

Magnetic Fusion Energy

Highlights and Challenges

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remarkable progress



fusion power is scientifically feasible

*The challenge is to **do it**, and to make
fusion power **attractive***

Goals

- smaller size
(better confinement, higher pressure)
- continuous operation
- materials to handle high heat flux
- simpler magnets
- well-behaved burning plasmas

Two challenges:

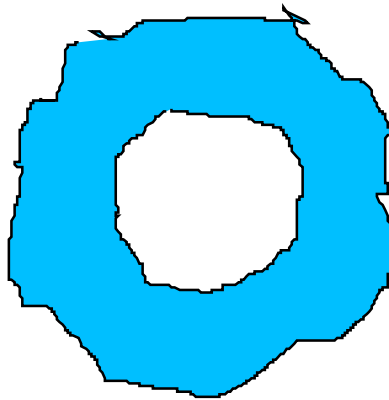
- Fundamental physics and engineering
- Evolution of confinement concepts

These challenges are coupled

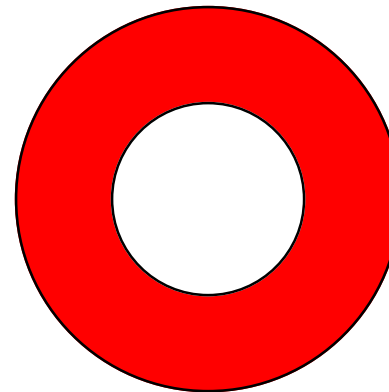
Two examples of physics highlights

Problem: turbulence cools plasma,
thought uncontrollable, like weather

Breakthrough: techniques developed to control
turbulence



turbulent,
cold



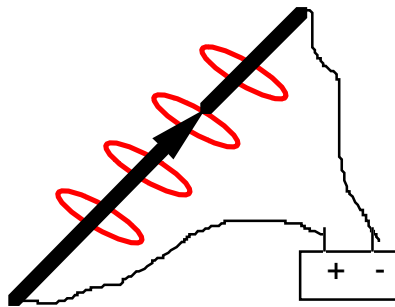
less turbulent
hot

related to: **pervasiveness of turbulence in nature**

Problem: how to maintain magnetic field?

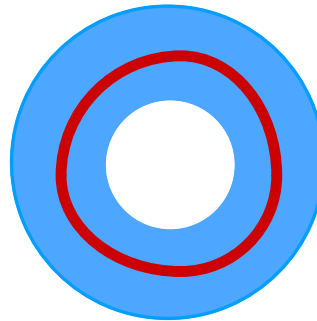
Breakthrough: some plasmas do it spontaneously

Wire



Voltage -> field

some plasmas

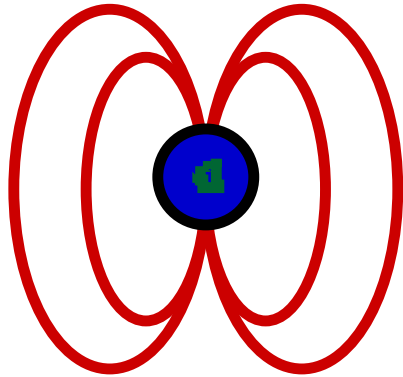


spontaneous

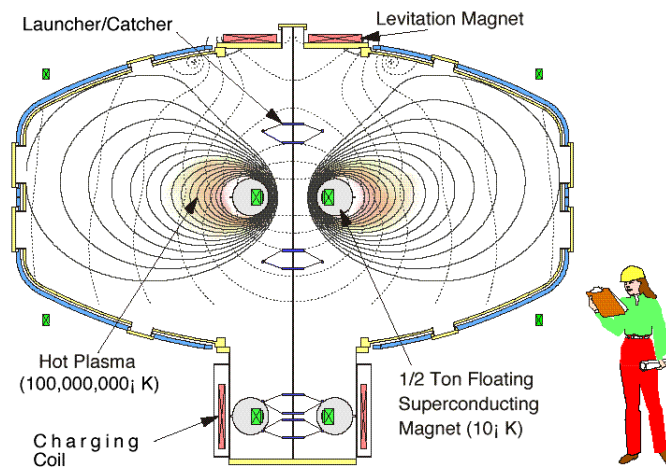
related to: **why is the universe magnetized?**

Two examples of new concepts

The most simple: *mimics nature*

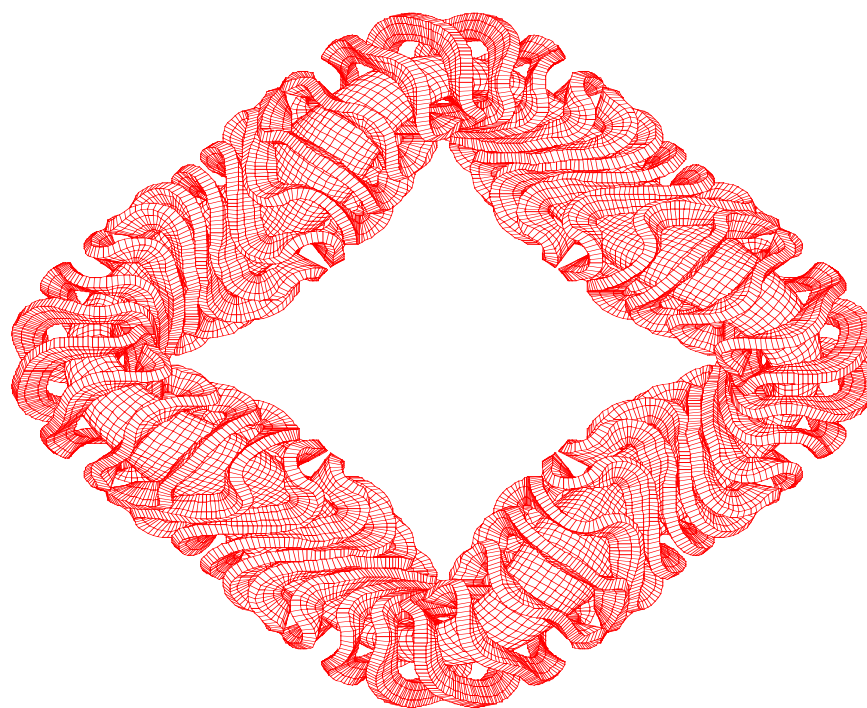


Earth



Laboratory dipole

The most complex:
from the minds of mathematicians



The next decade

understand basic science issues

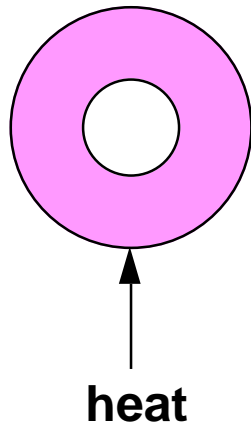
*can turbulence be eliminated?
what is the plasma pressure limit?
and many more....*

Evolve fusion concepts

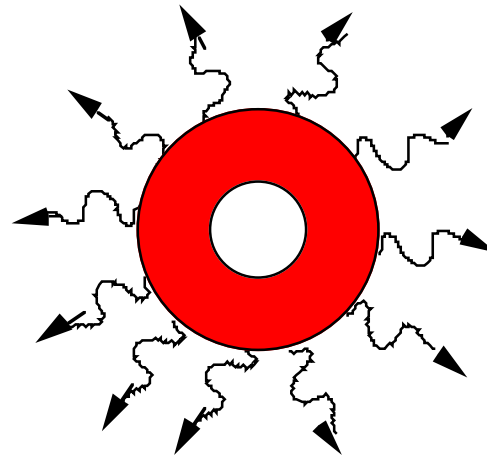
*a family of concepts, united by similar
principles of plasma physics*

A Burning Plasma: *a major next step for fusion physics*

existing plasmas



burning plasma



a burning plasma is a self-organized system

In summary,

the magnetic fusion science plan calls for

- ***fundamental science***
- ***fusion concept development***
- ***burning plasma science***

to deliver fusion energy for the world