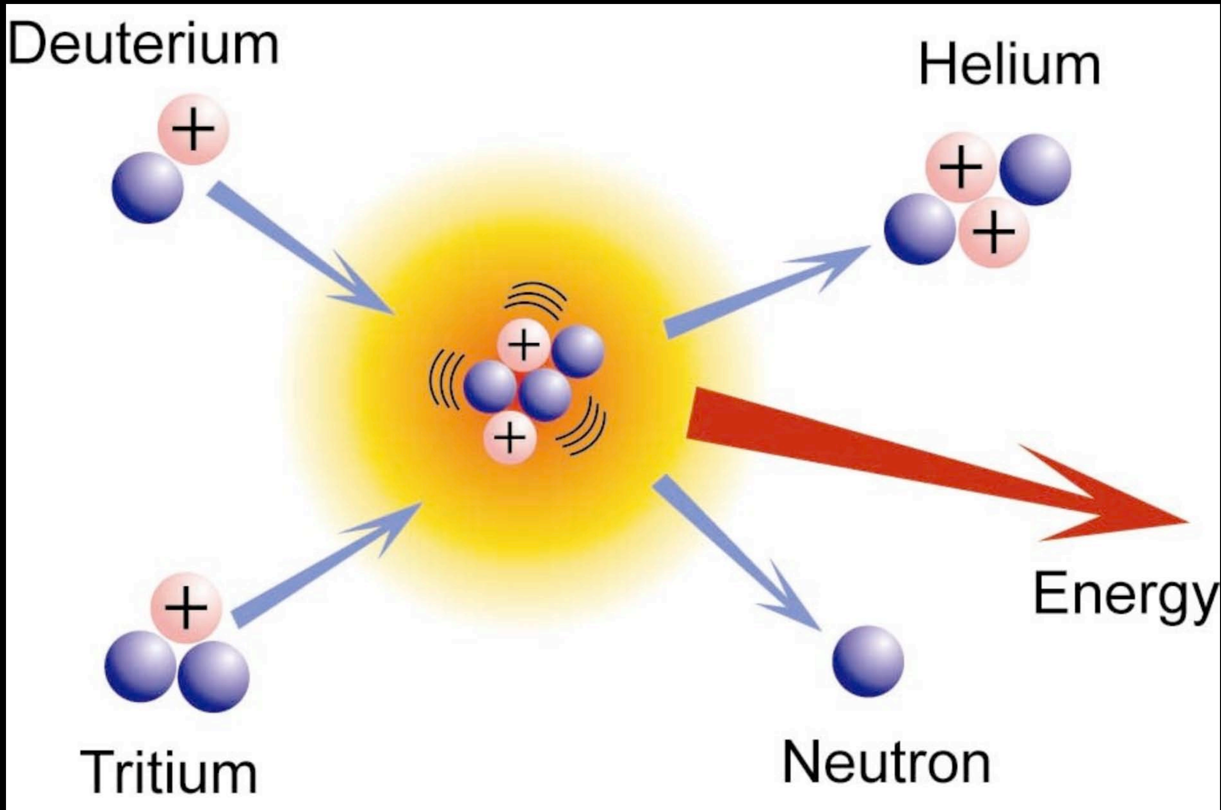
Plasmas... future energy resource (via **nuclear fusion**)



cf.
$T_{\text{solar center}} \sim 1.5\times10^{7}$ K
$n_{\text{solar center}} \sim 10^{26}$ cm^{-3}

Temperature... **10^{8}** K
Density... **10^{14}** cm^{-3}

↔

Surface of the Earth
T ～ **300** K,
Density ～ **10^{19}** cm^{-3}

How can we confine a 100,000,000 K plasma?

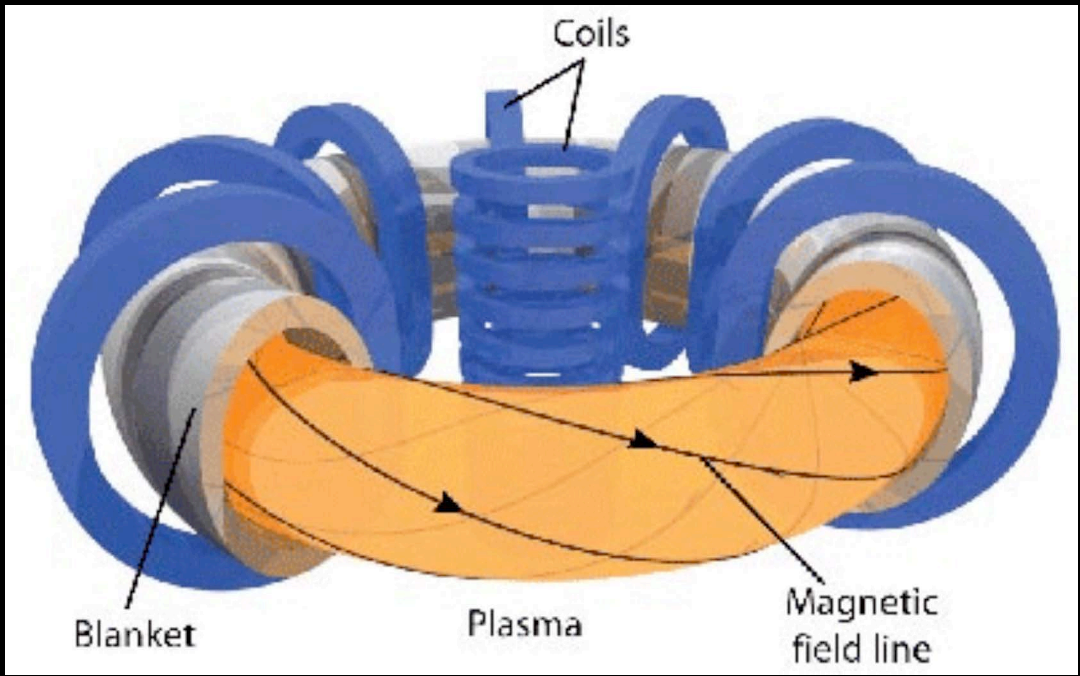
Even for the matter that has the highest melting point, this is less than 4000 K ('***tungsten***' whose melting point is about 3695 K).

This means that even if ***tungsten*** is used for the confinement of a plasma, it will be melted and vaporized immediately.

Therefore, we <u>cannot use any solid material</u> to confine the plasma.

Instead, we use ***magnetic field*** to confine the plasma.

Magnetic field is used to confine a hot plasma...



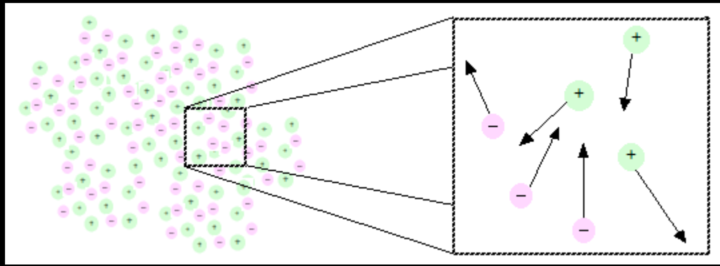
Iron... melting point ～ 1808 K

Tungsten... melting point ～ 3695 K

↔ **Plasma... T > 10000 K**

Basic properties of plasmas

1. Local charge neutrality

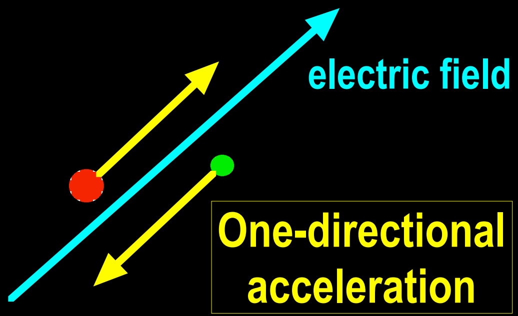


The numbers of positive charges and negative charges are almost the same in every local region.

2. Interaction with electric field (Coulomb force: $F_c = q\,E$)

Magenta... particle's property

Red... ion (+)
Green... electron (–)



Charged particles are accelerated along electric field.

$$\frac{d\boldsymbol{v}}{dt} = \frac{q}{m}\boldsymbol{E}$$

Magnitude of *v* is changed.