Compact Stellarators will Help Clarify Why Axisymmetric Low-A Tokamaks and High-A Stellarators Differ - 1

Global Scaling differences are significant

- *R* scaling strong for tokamaks, *a* scaling for stellarators
- Isotope scaling strong for tokamaks, weak for stellarators
- Will tokamak κ scaling appear in NCSX?

Profile rigidity is pronounced in tokamaks

- Absent in stellarators

Heat pulse propagation χ anomalous in tokamaks

- Consistent with power balance χ in stellarators

Density limit is clear in tokamaks, unrelated to radiation

- Stellarator density limited by radiative collapse

Compact Stellarators will Help Clarify Why Axisymmetric Low-A Tokamaks and High-A Stellarators Differ - 2

Stellarators have **soft β limits**.
Tokamaks have **hard β limits**.

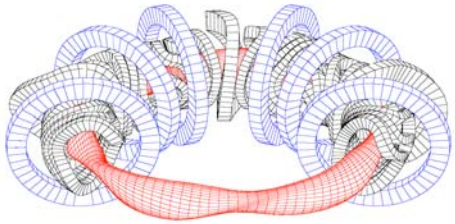
Stellarators often **violate ideal β limits**
Tokamaks do not (except for $q \leq 1$)

Ballooning modes have been seen on tokamaks
– riding on saturated n = 1 modes
Why not in stellarators?
Stellarators have different curvature and shear alignment
Stellarators do not have continuous symmetry

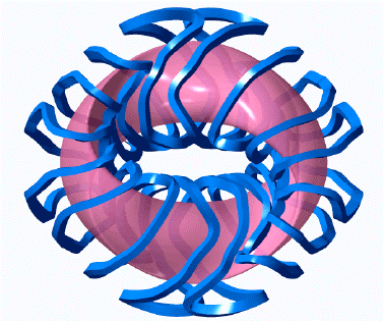
(Low A reduces cost for high performance.)

Low A Stellarators will Tell us Where the Physics Properties Change

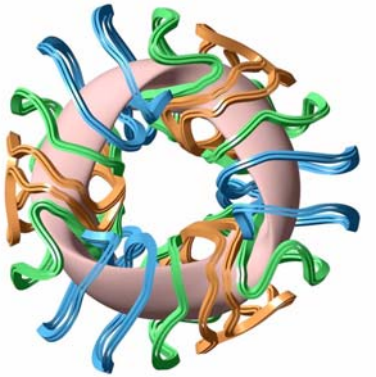
W7-AS, ~QP



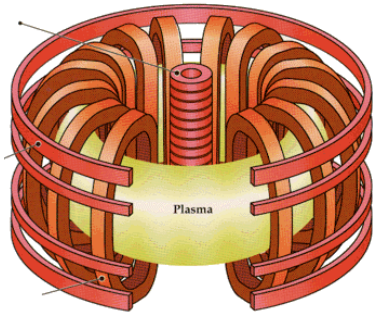
QPS, QP



NCSX, QA



Tokamak



High A | ← Low A →

Substantial ι_{vac}

← Common A/N, ι/N →

| N = 0

← Trapped particles circulate poloidally →

| ← Trapped particles circulate toroidally →