Axions are hypothetical particles that presumably solve the strong CP problem in the standard model of physics.

- Axions are amongst the most promising dark matter candidates in modern cosmology.
- " Invisible" particles, but convert to and from photons in the presence of a strong magnetic field.
- Two possible angular alignments for the telescopes: "area dominated" or "field dominated" arrangement.

- Lay-out optimization favors the "area dominated" alignment.

The main design parameters of the IAXO superconducting toroidal magnet are as follows:

- **Electrical circuit and quench protection**
  - Adiabatic temperature rise due to a uniform quench spread is ~100 K
  - Based on an active system and an internal dump of the stored energy
  - Two dump modes
    - High-T, current leads
    - Flexible superconducting cables
  - Each coil is equipped with multiple quench heaters
  - Quench detection relies on an optical growth across the magnet

- **Cryogenics**
  - Concept
    - Cold mass cooled to 4.5 K via conduction
    - Total load is 150 W at 4.5 K and 1.6 kW at 80-80 K
  - Based on cooling with a forced flow of sub-cooled liquid helium at supercritical pressure, to avoid two-phase flow
  - Coolant lines in a piping system attached to the coil casings, allowing for conduction cooling
  - Total heat load is 150 W at 4.5 K and 1.6 kW at 80-80 K

- **Operation scheme**
  - Helium compression and gas managed at ground station.
  - Refrigerator cold box, current leads and a 4.5 K helium bath mounted on the rotating disk
  - 4.2 K helium bath connected to the magnet cryostat
  - New design for the IAXO toroidal superconducting magnet features an increase of the detection potential of the apparatus

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  - Operation scheme
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    - New design for the IAXO toroidal superconducting magnet to increase the sensitivity to axion-photon coupling by 1 order of magnitude, with respect to the current state-of-the-art