

# F3 C: Coupling in Astrophysics

*Targeted Outcome: Spiral Phase 3: 2025-2035, Opening the Frontier*

## **Coupling in Astrophysics**

### **Required Understanding**

The location and 3D structure of the interaction region between the heliosphere and local galactic environment

Physical structure of bow shocks (termination shock) at heliopause, supernova remnants, binary star interaction regions, neutron star spheres, and black hole horizons.

Cross-scale coupling of galactic magnetic field between interstellar medium and heliosphere

Cosmic ray interaction with heliopause

### **Enabling Capabilities & Measurements**

Image heliopause using global sky maps of 83.4 O+

Image termination shock using energetic hydrogen atoms and radio detection (2-5 kHz)

Determine isotopic and elemental composition, flow directions, speed, and temperature of pickup ions and neutrals with in-situ stellar probes

Measure low-energy cosmic rays in situ with interstellar probes

Solar sail technology to enable interstellar spacecraft

### **Implementation Phase 3: 2025-2035**

**Heliospheric Imager & Galactic Observer(HIGO)**

To image the interaction between interstellar medium and heliopause

**Interstellar Probes, Explorers & Missions**  
To explore interstellar medium

**Stellar Imagers**  
To explore the magnetic activity and heliopause of other stars

**Theory/Modeling Program**  
To simulate shock waves in astrophysical environments