Conversations about
Space Weather and High-Energy Astrophysics

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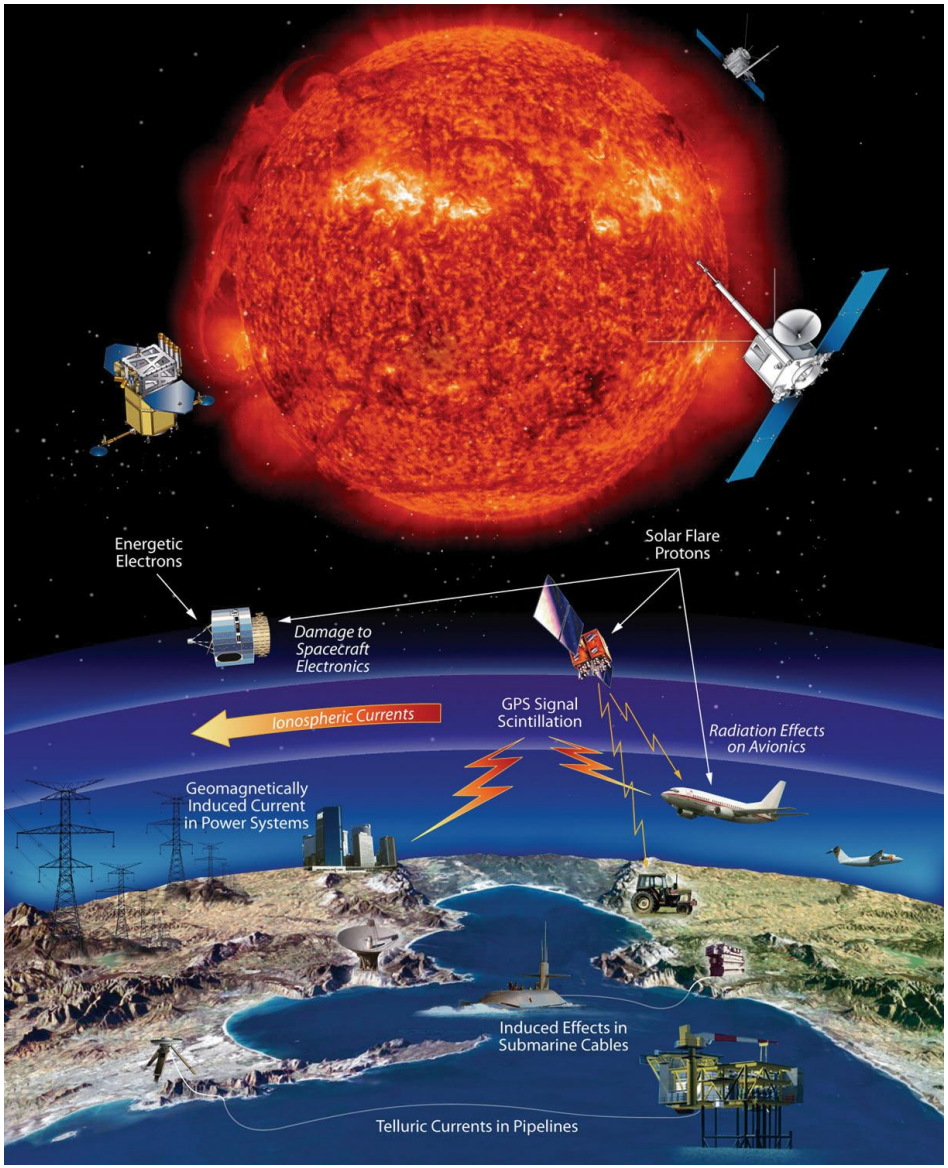
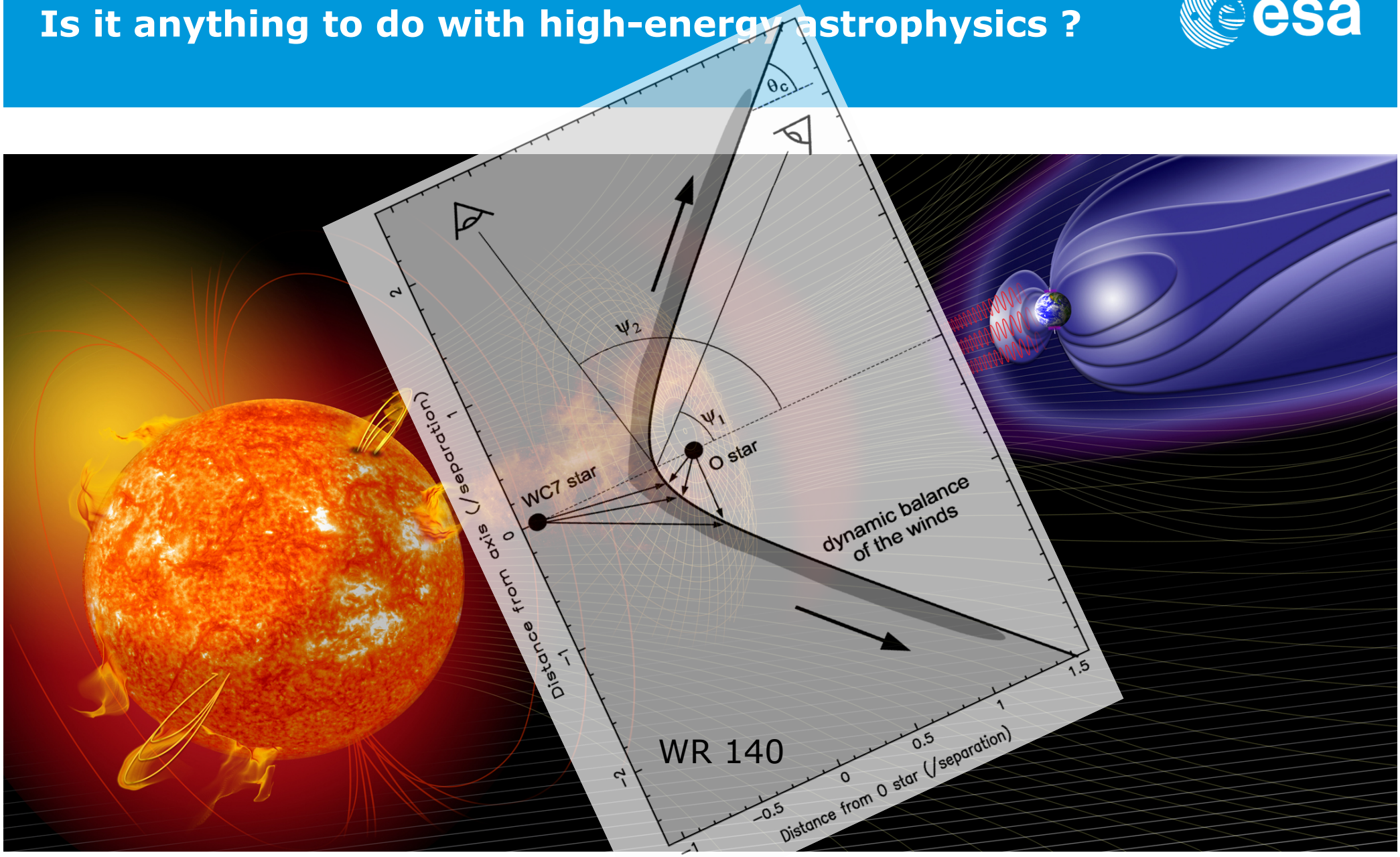
What is space weather ?



Is it anything to do with high-energy astrophysics ?



Boundary and shock jump conditions

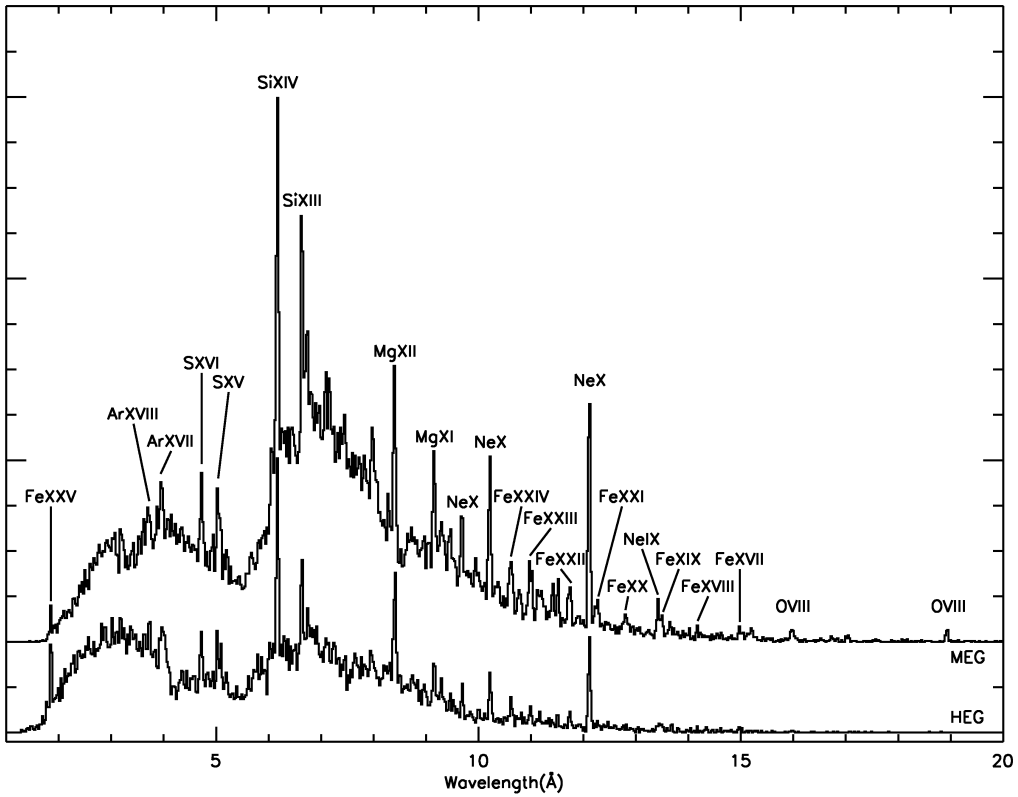
	Space Weather	WR 140
wind	solar	stellar
separation (AU)	1	1-20
velocity (km/s)	500	3000
mass-loss rate ($M_\odot$/yr)	10^{-14}	10^{-5}
obstacle	$B_\oplus$	O star

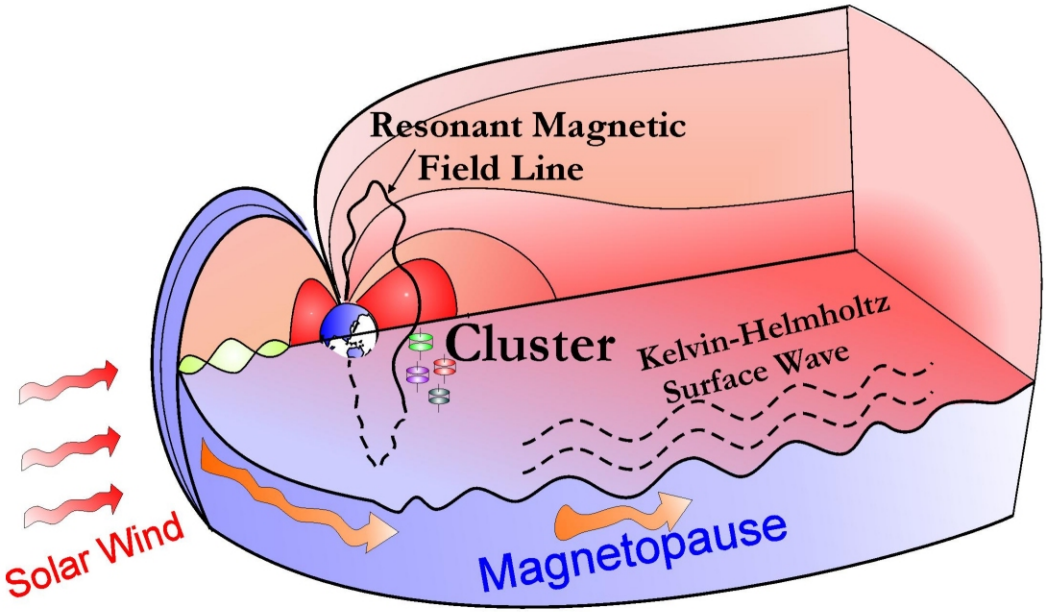
$$[\rho v_\parallel] = 0$$
$$[B_\parallel] = 0$$
$$[v_\parallel \mathbf{B}_\perp - B_\parallel \mathbf{v}_\perp] = 0$$
$$[\rho v_\parallel^2 + P + B_\perp^2/8\pi] = 0$$
$$[\rho v_\parallel \mathbf{v}_\perp - B_\parallel \mathbf{B}_\perp/4\pi] = 0$$
$$[v_\parallel(\rho v^2/2 + P + u) + (B_\perp^2 v_\parallel - B_\parallel \mathbf{B}_\perp \cdot \mathbf{v}_\perp)/4\pi)] = 0$$

Raymond 2012

Collisionless Shocks

WR 140 remote radiation ⇔ SW *in situ* plasma





macrophysics ⇔ microphysics

X-ray N_e N_i ⇔ T_e T_i n_e $\underline{n_i}$ ×2

radio N_e×B ⇔ **<u>E</u>** **<u>B</u>** reconnection SEPs tail

pre-shock UV ⇔ waves instabilities turbulence

<u>consistent but wrong</u> ⇔ ion-reflection pick-up-ions

Common physical themes

- Magnetic fields
- Plasma physics
- Instabilities
- Mixing
- Prompt electron heating
- No equilibrium

Call for future cooperation
space weather ⇔ astrophysics

- X-ray flaring statistics of nearby stars
  - Stellar cycles established
- Quiescent GOES X-rays ?
- Remote sensing of the magnetosphere
- Plasma physics for dummies
  - MHD models of WR 140 et al.

Outline model of space weather

- Sun
- Heliosphere
- Magnetosphere
- Ionosphere
- Geomagnetism

Provision of Services
space weather ⇔ astrophysics

availability ⇔ standard protocols
suitability ⇔ “tailored” science-ready products
completeness ⇔ integrity of the historical record
timeliness ⇔ PI missions are toast

services ⇔ standards