Working Group 6

Theory and Modeling of Flare Processes

Electron Acceleration

Primary electron acceleration in flares occurs in the downward reconnection jet

- Gottfried Mann
  - Particle acceleration in slow mode shocks
  - Most efficient conversion of magnetic energy to heat if angle to B-field is 54 deg.
- Mitsuo Oka
  - Why is electron spectral index > 4 in solar flares?
  - delta < 4 in shock and turbulent acceleration, heliosphere
- Ivan Zimovets
  - Electron acceleration by kinetic Alfven waves
  - 10 – 100 keV in converging flux tube (secondary)

Electron Propagation and Heat Deposition

- Meriem Alaoui
  - Application of return-current model to flare data.
  - Model works well in cases with strong spectral breaks, enhanced resistivity frequently required.
- Gordon Emslie
  - Turbulent suppression of both heat flux and conductivity.
  - Increase in resistivity and decrease in conduction expected together.

Accelerated Electron Pitch-Angle Distribution

- Victor Melnikov
  - Calculations of directivity and polarization along a flare loop
  - Sensitive to electron pitch-angle distribution
- Weiqun Gan (Wei Chen)
  - Hard X-ray polarization
  - Polar mission
- Diego Casadei
  - Stereo observations of coronal and footpoint sources for directivity measurements
  - STIX & MiSolFA (Micro Solar-Flare Apparatus)

Energy Flux in Nonthermal Electrons

- Eduard Kontar
  - Collisions in flare loop plasma (thermalization) determine lowest effective low-energy cutoff.
  - Warm target model fitting function available in OSPEX.

Interpretation of X-ray Spectra

- Jeffrey Reep
  - Non-thermal thick-target recombination
  - Important for steep spectra and low low-energy cutoffs (microflares)

Tests of the Thick-Target Model

- John Brown
  - HXR albedo echo delay
  - How does this affect time-of-flight results?
- Michal Varady
  - Hybrid simulations (PIC + Flarix) of HXR source lengths
  - Mirroring produces more extended X-ray sources

Thermal Response

- Tremendous progress has been made in simulating the thermal response of flare plasma to heating by energetic particles and direct heating.
- Application of numerical simulations to combined hard X-ray, soft X-ray, EUV, UV, and optical data is rapidly advancing.

Thermal Response

- Lucia Kleint
  - Emission from both photosphere and chromosphere
  - Not blackbody in NUV during flare (from chromosphere)
- Pavel Kotrc
  - Ondrejov observations of blue Balmer continuum
  - Paschen continuum in the future (480 – 920 nm)
- Jana Kasparova
  - Flarix code, comparison with RADYN results
- Petr Heinzel
  - Evolution of hydrogen continua in solar flares - Flarix and observations
  - White light has two contributions, direct ionization in chromosphere and back warming in photosphere, with different radiation signatures

Alternative to the Standard Flare Model

- Philippa Browning
  - Confined flares in twisted and interacting loops
  - Forward modeling of thermal & non-thermal emissions, microwaves (sensitive to **B**)

Miscellaneous

- Stephen White
  - Capabilities of Nobeyama observations
  - Dynamic range up to 1000
- Elena Kupriyanova
  - Origin of quasi-periodicities during a circular ribbon flare
  - 2.5 min quasi-periodicities found in H-alpha, HXR, and microwaves In outer and inner circular ribbons.

Presentations in Group 6 ranged from
models for electron acceleration
to electron propagation,
energy deposition,
pitch-angle distribution,
the thermal response to heating by energetic electrons,
and alternatives to the standard flare model.

Thank you to all presenters and participants!