



HESPE  
High Energy Solar Physics Data in Europe

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michele piana  
dipartimento di matematica, università di genova  
cnr – spin, genova

# HESPE's rationale

- to formulate and implement computational methods for hard X-ray spectroscopy, imaging and imaging spectroscopy
- to utilize Information and Communication Technology tools to provide solar physics, heliophysics and space weather scientists with algorithms and science ready products

## description - 1

- framework programme: FP7
- theme: SPA.2010.2.1-03  
SPACE: exploitation of space science and exploration data
- specific program: cooperation
- funding scheme: collaborative project
- starting date: 01/12/2010
- duration: 36 months
- status: first year review positive

## description - 2

### crew:

- università di genova, italy (unige) (coordinator)
- fachhochschule nordwestschweiz, switzerland (fhnw)
- university of glasgow, uk (unigla)
- universitaet graz, austria (unigra)
- cnrs, observatoire de paris, france (cnrs)
- university of california at berkeley (ucb)

### third parties:

- cnr, italy (in unige, no cost)
- nasa goddard space flight center (in unige, no cost)

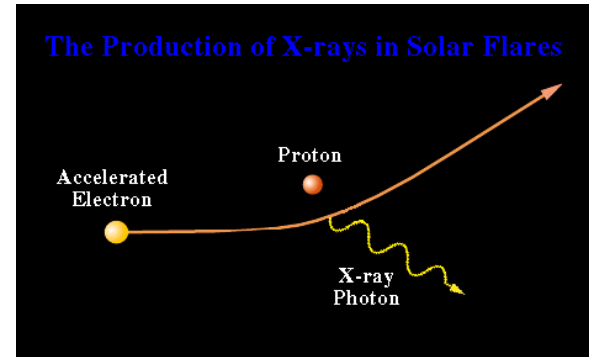
## description - 3

work packages:

- wp1: management
- wp2: other activities (dissemination)
- wp3: theory
- wp4: computation
- wp5: technology
- wp6: future

# physics, mathematics and computer science

models for energy transport, particle acceleration and x-ray emission aims to explain solar fares and their impact on the heliosphere



x-ray telescopes work by modulation rather than focusing; raw data (visibilities) reveal the image just after mathematical computation

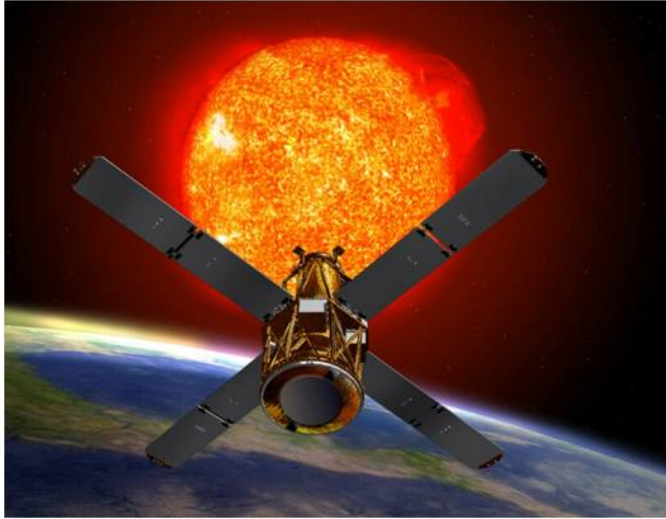


ICT methods allow fast and intelligent retrieval of data and science products



two satellites

## reuben ramaty high energy solar spectroscopic imager (RHESSI)



launch: 5 febbraio 2002

two more years support

high spectral resolution

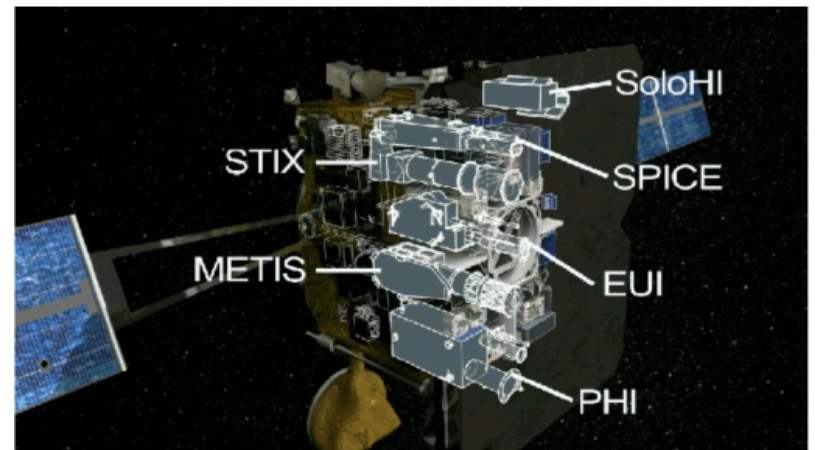
good spatial resolution

## spectrometer/telescope for imaging hard x-rays (stix)

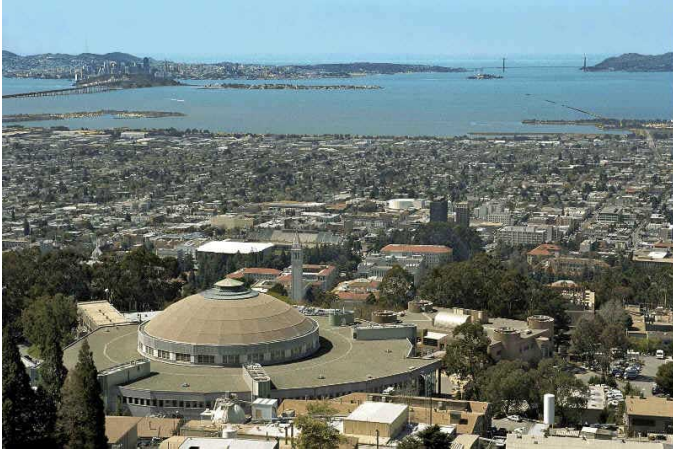
launch: 2017

'in situ' measurements

integration with other kinds of data



# HESPE crew - 1



data understanding:

space science lab, berkeley



data retrieval:

fachhochschule nordwestschweiz



## HESPE crew - 2



data integration:  
observatoire de paris



data interpretation:  
universitaet graz

## HESPE crew - 3

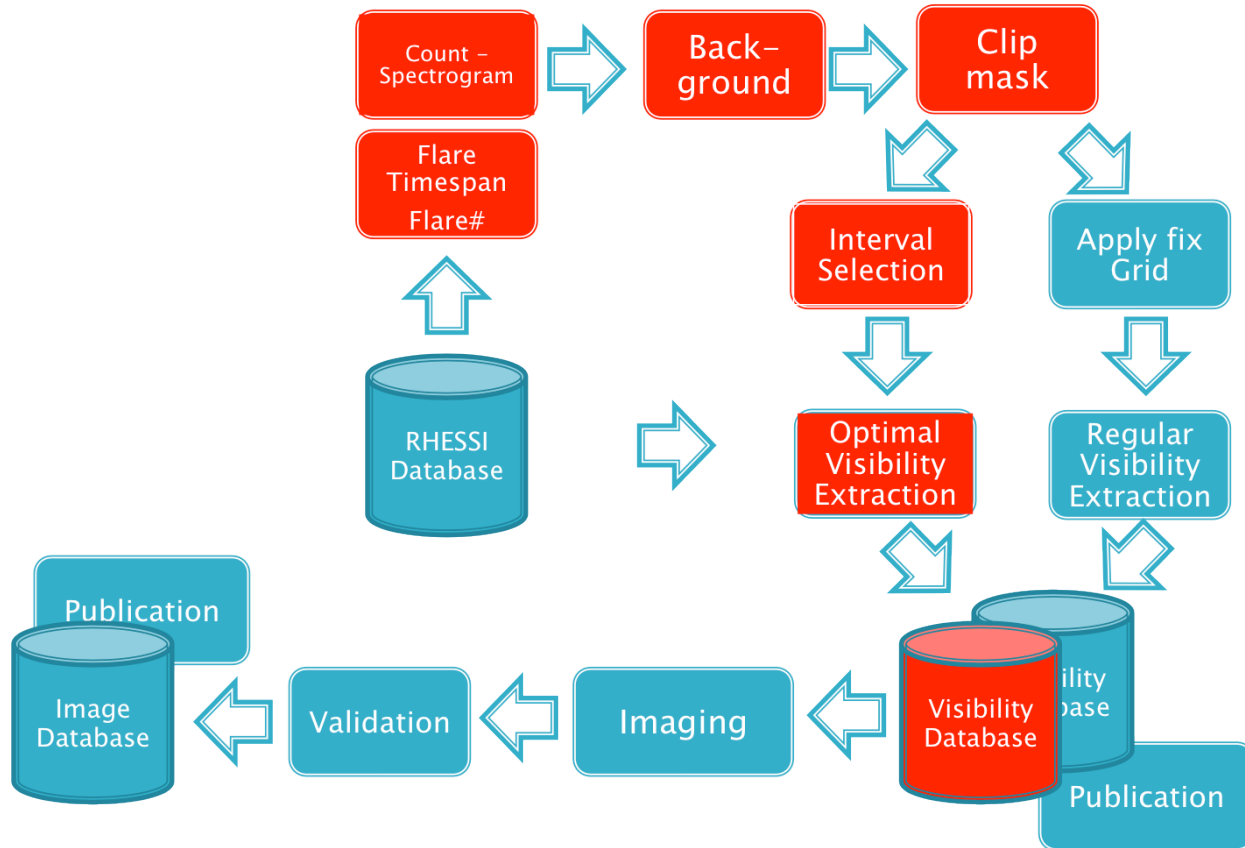


data modeling:  
university of glasgow

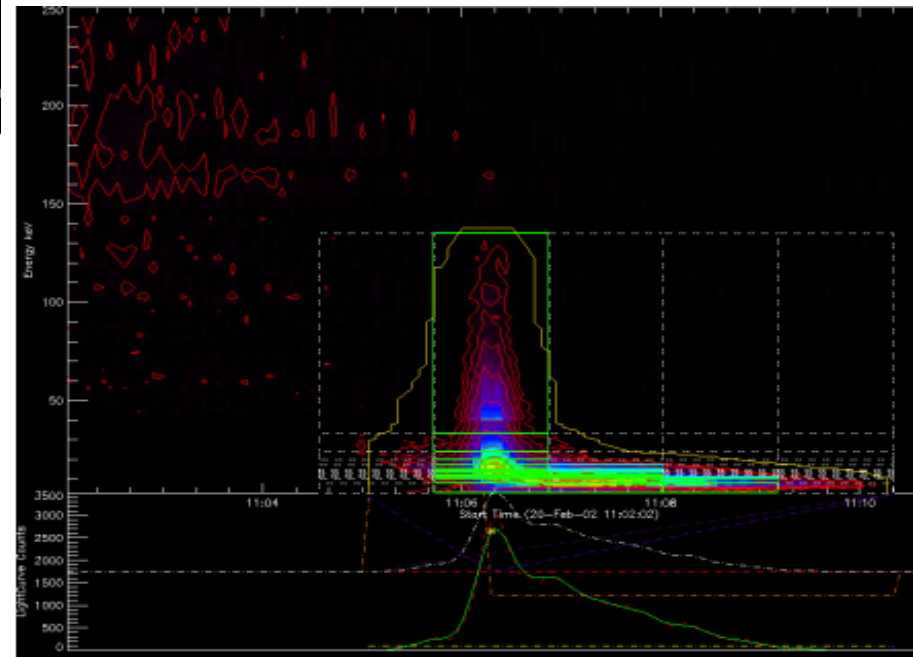
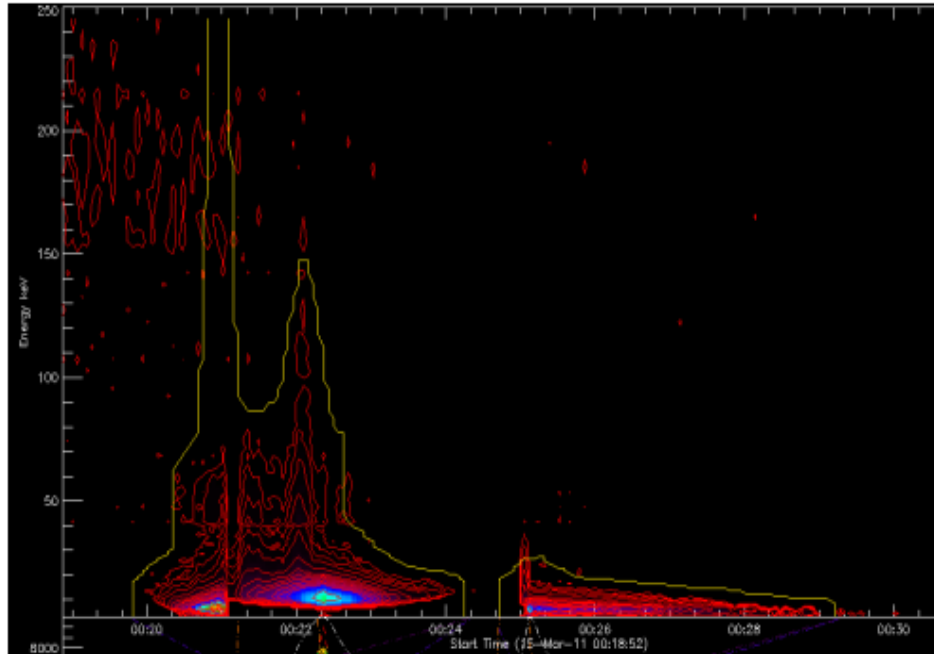


data processing:  
università di genova

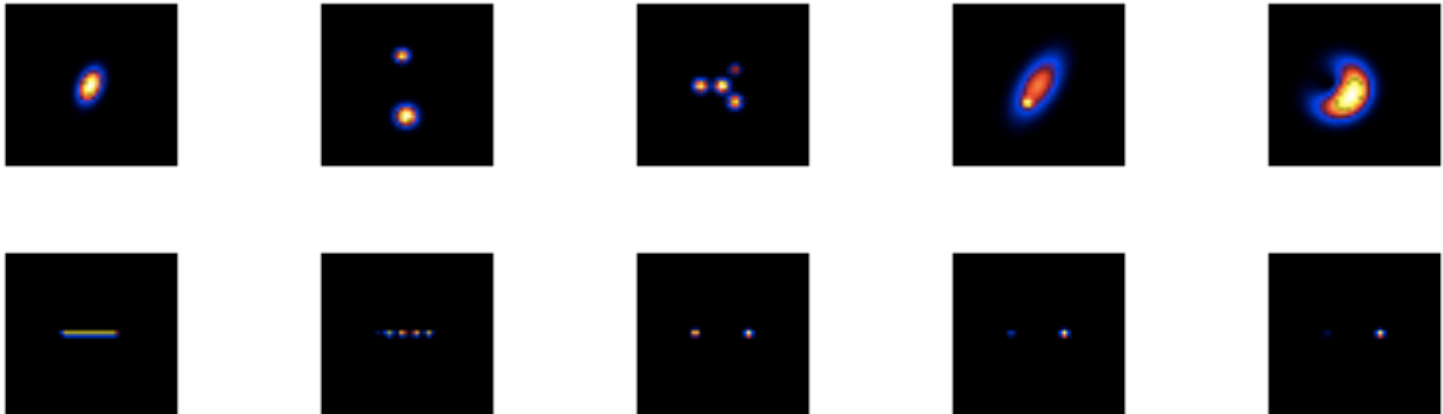
# the HESPE framework



# interval selection algorithm



# imaging test



RHESSI Imaging Algorithm Evaluation Framework							
Criteria		Back projection	CLEAN	PIXON	MEM-NJIT	VIS_FWDFIT	UV_SMOOTH
General Characteristics							
Robustness		Green	Green	Yellow (slower)	Yellow (can crash)	Red	Green
Need for parameter optimization		Green	Yellow	Yellow	Green	Red	Green
Error estimation		Yellow (Only for single sources)	Red	Yellow	Red	Green	Red
Relative Speed		Green	Yellow	Red	Yellow	Green	Green

# papers acknowledging HESPE - 1

Allavena S, Piana M, Benvenuto F and Massone A M 2011 An interpolation/extrapolation approach to X-ray imaging of solar flares *Inverse Problems and Imaging* (in press)

Battaglia M and Kontar E P 2011 Height structure of X-ray, EUV, and white-light emission in a solar flare *Astronomy and Astrophysics* **533** L2

Battaglia M and Kontar E P 2011 Hard X-ray footpoint sizes and positions as diagnostics of flare accelerated energetic electrons in the low solar atmosphere *Astrophysical Journal* **735** 42

Bian N, Kontar E P and MacKinnon A 2011 Turbulent cross-field transport of non-thermal electrons in coronal loops: theory and observations *Astronomy and Astrophysics* **535** A18

Fleishman G D, Kontar E P, Nita G M and Gary D E 2011 A cold, tenuous solar flare: acceleration without heating *Astrophysical Journal Letters* **731** L19

Hudson H S, Fletcher L, Fisher G H, Abbett W P and Russell A 2011 Momentum distribution in solar flare processes *Solar Physics* 10.1007/s11207-011-9836-0

Hudson H S, Fletcher L, MacKinnon A L and Woods T N 2011 EVE limits on low-energy alpha particles in solar flares *Solar Physics* (in press)

## papers acknowledging HESPE - 2

Hudson H S, Woods T N, Chamberlin P C, Fletcher L, Del Zanna G, Didkovsky L, Labrosse N and Graham D 2011 The EVE Doppler sensitivity and flare observations *Solar Physics* **273** 69

Joshi B, Veronig A M, Lee J, Bong S C, Tiwari S K, Cho K S 2011 Pre-flare activity and magnetic reconnection during the evolutionary stages of energy release in a solar eruptive flare *Astrophysical Journal* (in press)

Kontar E P, Hannah I G and Bian N H 2011 Acceleration, Magnetic Fluctuations, and Cross-field Transport of Energetic Electrons in a Solar Flare Loop *Astrophysical Journal Letters* **730** L22

Massone A M and Piana M 2011 The use of electron maps to constrain some physical properties of solar flares *Solar Physics* (in press)

Schwartz R, Kontar E P, Jeffrey N and Massone A M 2011 Accounting for the albedo flux in RHESSI image reconstructions *SPD Meeting 2011*, Las Cruces, NM USA, June 12-16 2011

Vilmer N 2011 Solar flares and energetic particles *Philosophical Transactions of the Royal Society A* (in press)