SAMNet: Solar Activity Monitor Network
Flare & CME forecasting in 3D solar ARs
From theory to SAMNet facility

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Weighted horizontal magnetic gradient – $WG_M$ – method

From 61 ARs with above M5 flare:
- estimate the expected largest flare intensity
- flare onset time estimation
- One or more flares?
Sheffield Solar Catalogue (SSC)

http://sp2rc.group.shef.ac.uk
http://ssc.shef.ac.uk
Photospheric discovery
AR 11166 for the X-class case

<table>
<thead>
<tr>
<th>AR</th>
<th>Flare</th>
<th>Date</th>
<th>Time</th>
<th>TGc [%]</th>
<th>$W_G$ [Wh/m²]</th>
<th>D$_{em}$ [h]</th>
<th>T$_{Dec}$ [h]</th>
<th>T$_{Flare}$ [h]</th>
<th>$W_G^0$ [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>11166</td>
<td>X.5</td>
<td>09/03/11</td>
<td>23:23</td>
<td>3111%</td>
<td>$3 \times 10^6$</td>
<td>64%</td>
<td>17</td>
<td>31</td>
<td>96%</td>
</tr>
</tbody>
</table>
WG_M method in the lower solar atmosphere

X2.2 flare at 01:56 on 15/02/2011

1st δ-spot
2nd δ-spot

Automatic PIL recognition program
Horizontal gradient of the longitudinal magnetic field is larger than |50| G/Mm

MONAMI tool: http://sp2rc.group.shef.ac.uk
Synoptic solar telescope based on Magneto Optical Filter (MOF) technology: **SAMM**

**MOF technology**
- Dopplergrams
- Magnetograms

**Fixed wavelength but high stability and sensitivity**
- 2 observation lines at 2 altitudes in the solar atmosphere:
  - Na D2 (600-700 km)
  - K I (300-400 km)
  - Future: Ca I (1000 km), He 1083

**Synoptic**
- Full-disk or near-full-disk monitoring of solar activity
Synoptic solar telescope based on Magneto Optical Filter (MOF) technology: SAMM

\[ B_{LOS} \propto \frac{(R^+ - B^+)}{(R^+ + B^+)} - \frac{(R^- - B^-)}{(R^- + B^-)} \]

\[ v_{LOS} \propto \frac{(R^+ - B^+)}{(R^+ + B^+)} + \frac{(R^- - B^-)}{(R^- + B^-)} \]

**Cacciani** et al. 1990

**Stangalini** et al. 2018

**Heritage:** Jeffries et al, MOTH I, MOTH II
SAMM: Putting the technology into perspective...

Magnetograms
- MOF ground-based telescope
  - 2-5 G sensitivity
- HMI on SDO satellite
  - 8-15 G official sensitivity

Dopplegrams
- MOF ground-based telescope
  - Worst case: 1 m/s sensitivity
- Scientific requirements
  - 10 m/s sensitivity
SAMM: Realisation

Hungarian Solar Physics Foundation
www.hspf.eu
SAMM: Realisation – Gyula SO

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Near Future

SAMM+:

- 4x observation lines at 4 altitudes in the solar atmosphere:
  - Na D2 (589 nm, 600-700 km)
  - K I (770 nm, 300-400 km)
  - Ca I (422 nm, 1000 km)
  - He 1083 nm (1900 km)
Thank you for your attention!

SAMNet Team