HST imaging of the Crab
during the March 2013 flare
a quick-look analysis

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The Crab as seen by HST

Perhaps the most visited field by HST

Most of our knowledge due to early WFPC2 results. Now, we use ACS
Variability of the Crab PWN

Movie (12 epochs) based on ACS monitoring campaign in 2005
Variability of the PWN at different time scales

Difference images
Variability of the PWN at different time scales

Distribution of differences/pixel
Variability of the inner knot

Hester J.J. (2008) ARAA notes that the knot is 'somewhat variable in both position and brightness'.

Indeed, we see variations in position and flux.

2005 Sept 09 vs. 2005 Oct 30
Variability of the inner knot

Displacement by $\sim 0.1''$

Large flux change

2005 Sept 09 vs. 2005 Oct 30
Inner knot: photometry

Compared to 7 non-saturated reference stars, $V \sim 18 - 21$

To appear in Moran et al, MNRAS
Inner knot: photometry

60% variability on 60d time scale

To appear in Moran et al, MNRA
HST observations in the gamma-ray flare era

HST follow-up after Sept 2010 flare discovered by AGILE

Sept. 2010 flare
HST observations after September 2010 flare

Lack of any recent pre-flare image

New Monitoring campaign with ACS + TOOs
8 epochs / year (every 1-1.5 month, no visibility in Apr-Aug)
Similar strategy with Chandra
Waiting for a new flare...

April 2011 flare: no HST observations

July 2012 flare: no HST observations

March 2013 flare: HST TOO triggered

TOO performed close to peak of flare
Monitoring obs collected 9 days before

We also got a DD obs 25 days after flare; monitoring obs 41 days after flare
46 days before the flare
9 days before the flare
The flaring Crab
25 days after the flare
41 days after the flare
Difference image: (on flare) vs. (pre-flare)
Difference image: post-flare evolution
Difference image: post-flare evolution
Variability of the PWN (10 days)
Variability of the PWN (30 days)
Variability of the inner knot

Flux, position, shape
After a quick analysis

The PWN does not display any peculiar/unusual behaviour in our monitoring + TOO images

Highest variability is seen in the anvil region

The knot does vary, but its properties are reasonably close to their "normal" range

A more thorough investigation, including HST-Chandra correlation, is ongoing

My feeling is that we are facing a gamma-ray only phenomenon