Fantastic Fermi-GBM Data, Where to Find It, How to Use It

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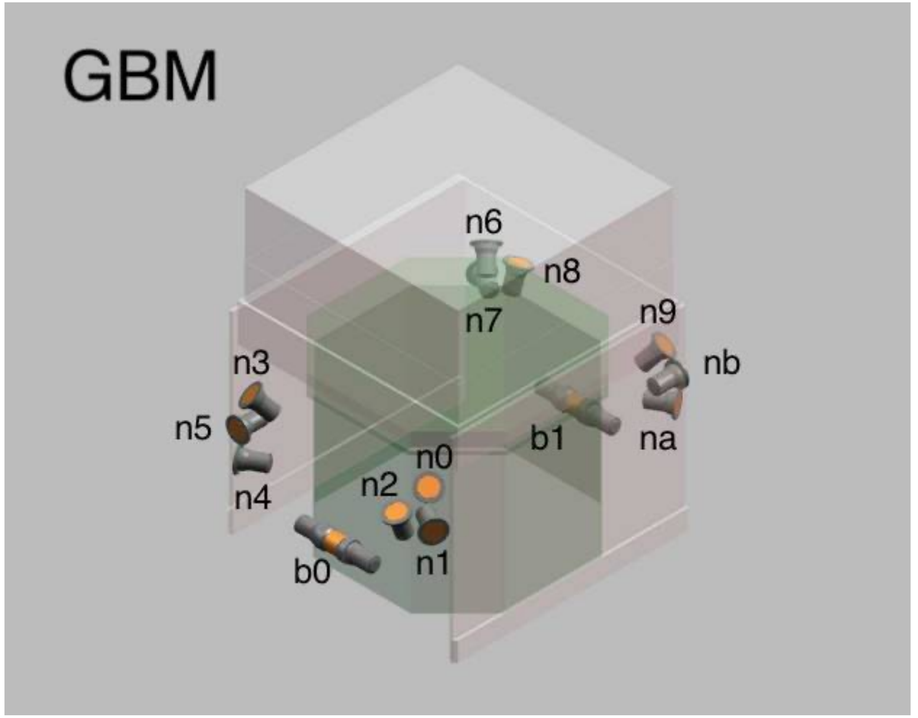
2022 Fermi Summer School

What *is* GBM Data?

- Measured photons in each detector as a function of time
- There are 14 detectors total:
  - 12 NaI(Tl) detectors labeled n0-nb
    used for triggering and localizing sources (8 keV - 1 MeV)
  - 2 BGO detectors labeled b0, b1
    used for spectral measurements at high energy (200 keV - 40 MeV)
- Each detector gets its own data file
- Data files only contain photon times and energies, no directional information (non-imaging detectors)
- Source direction needs to be reconstructed from the relative counts in each detector using the detector response matrices (DRMs) + spacecraft position



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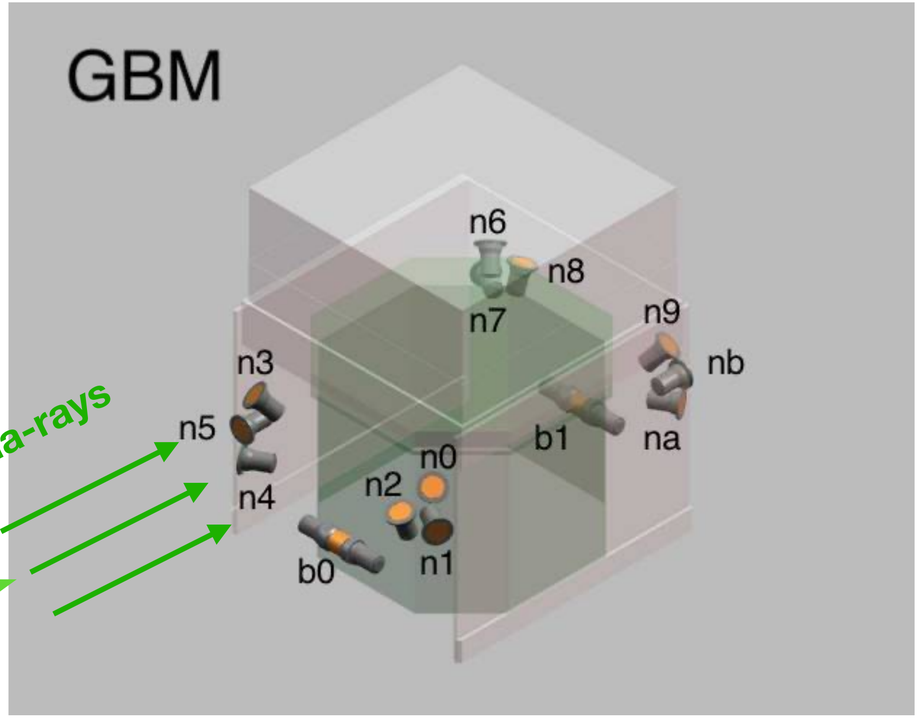
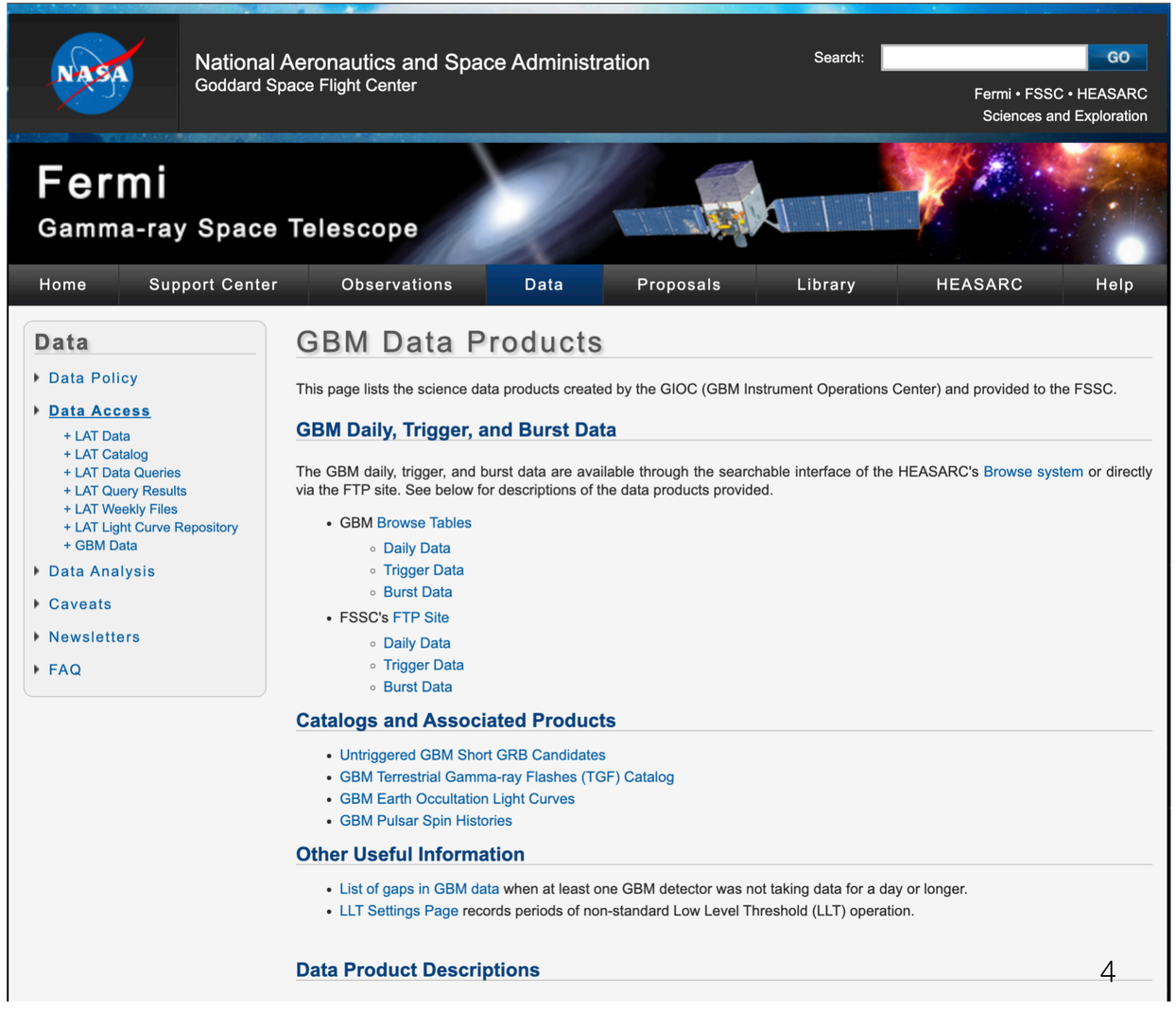


Where to Find GBM Data?

https://fermi.gsfc.nasa.gov/ssc/data/access/gbm/



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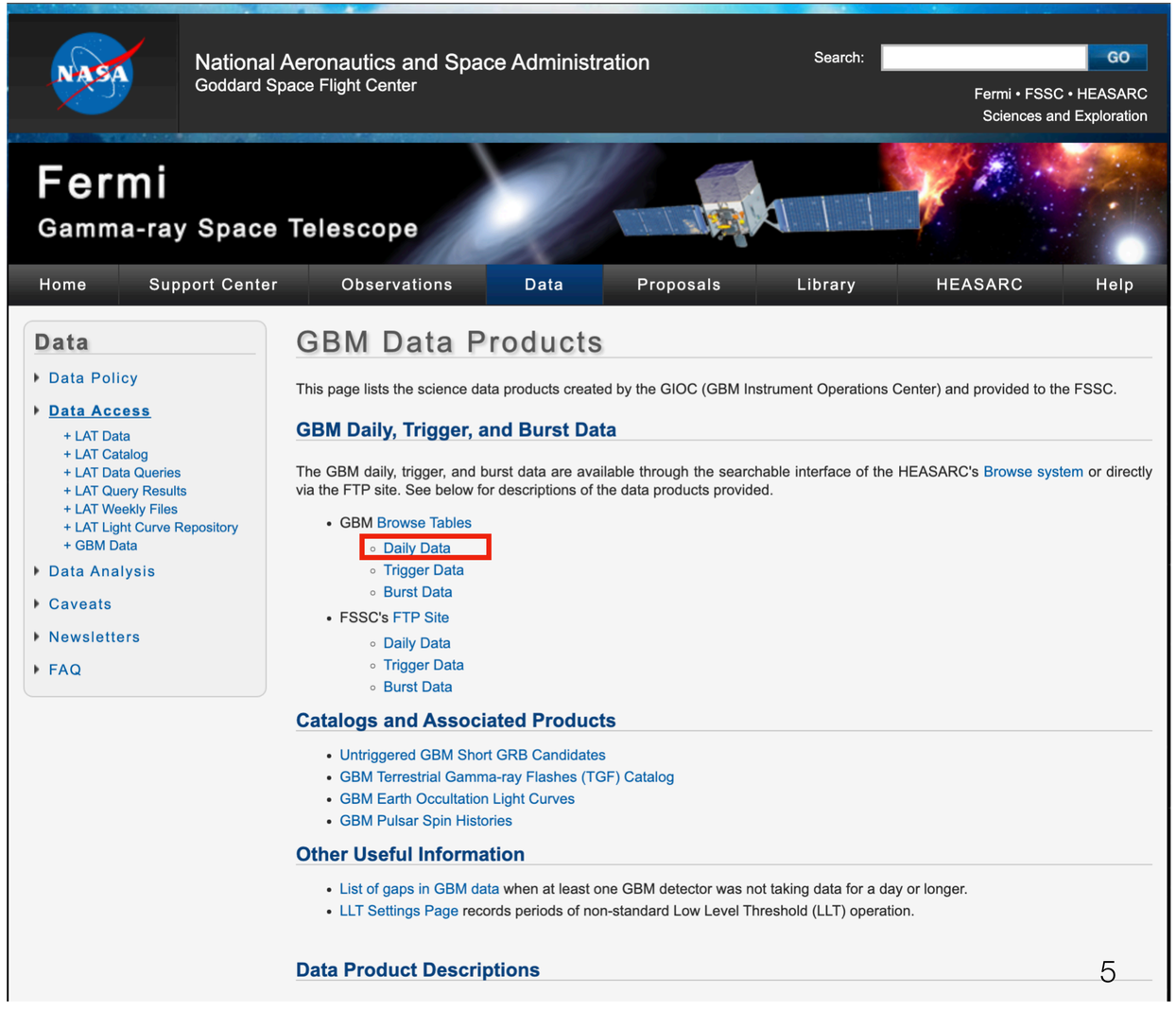

- Full Daily Data for people who want *everything* → all photon events in every detector, every hour of the day:

Example Link

https://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/daily/2022/06/03/current/

glg_ctime_n8_220603_v00.pha	04-Jun-2022 01:09	11M
glg_ctime_n9_220603_v00.pha	04-Jun-2022 01:09	11M
glg_ctime_na_220603_v00.pha	04-Jun-2022 01:09	11M
glg_ctime_nb_220603_v00.pha	04-Jun-2022 01:09	11M
glg_poshist_all_220603_v00.fit	03-Jun-2022 21:47	8.8M
glg_spechist_b0_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_b1_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_n0_220603_v00.fit	04-Jun-2022 01:10	17K
glg_spechist_n1_220603_v00.fit	04-Jun-2022 01:10	17K
glg_spechist_n2_220603_v00.fit	04-Jun-2022 01:10	17K
glg_spechist_n3_220603_v00.fit	04-Jun-2022 01:10	17K
glg_spechist_n4_220603_v00.fit	04-Jun-2022 01:10	17K
glg_spechist_n5_220603_v00.fit	04-Jun-2022 01:10	17K
glg_spechist_n6_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_n7_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_n8_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_n9_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_na_220603_v00.fit	04-Jun-2022 01:10	14K
glg_spechist_nb_220603_v00.fit	04-Jun-2022 01:10	17K
glg_tte_b0_220603_00z_v00.fit.gz	02-Jun-2022 22:25	39M
glg_tte_b0_220603_01z_v00.fit.gz	03-Jun-2022 00:18	57M
glg_tte_b0_220603_02z_v00.fit.gz	03-Jun-2022 00:18	38M
glg_tte_b0_220603_03z_v00.fit.gz	03-Jun-2022 02:30	47M
glg_tte_b0_220603_04z_v00.fit.gz	03-Jun-2022 02:30	32M

Useful if you want to look for something we haven't found with an on-board trigger

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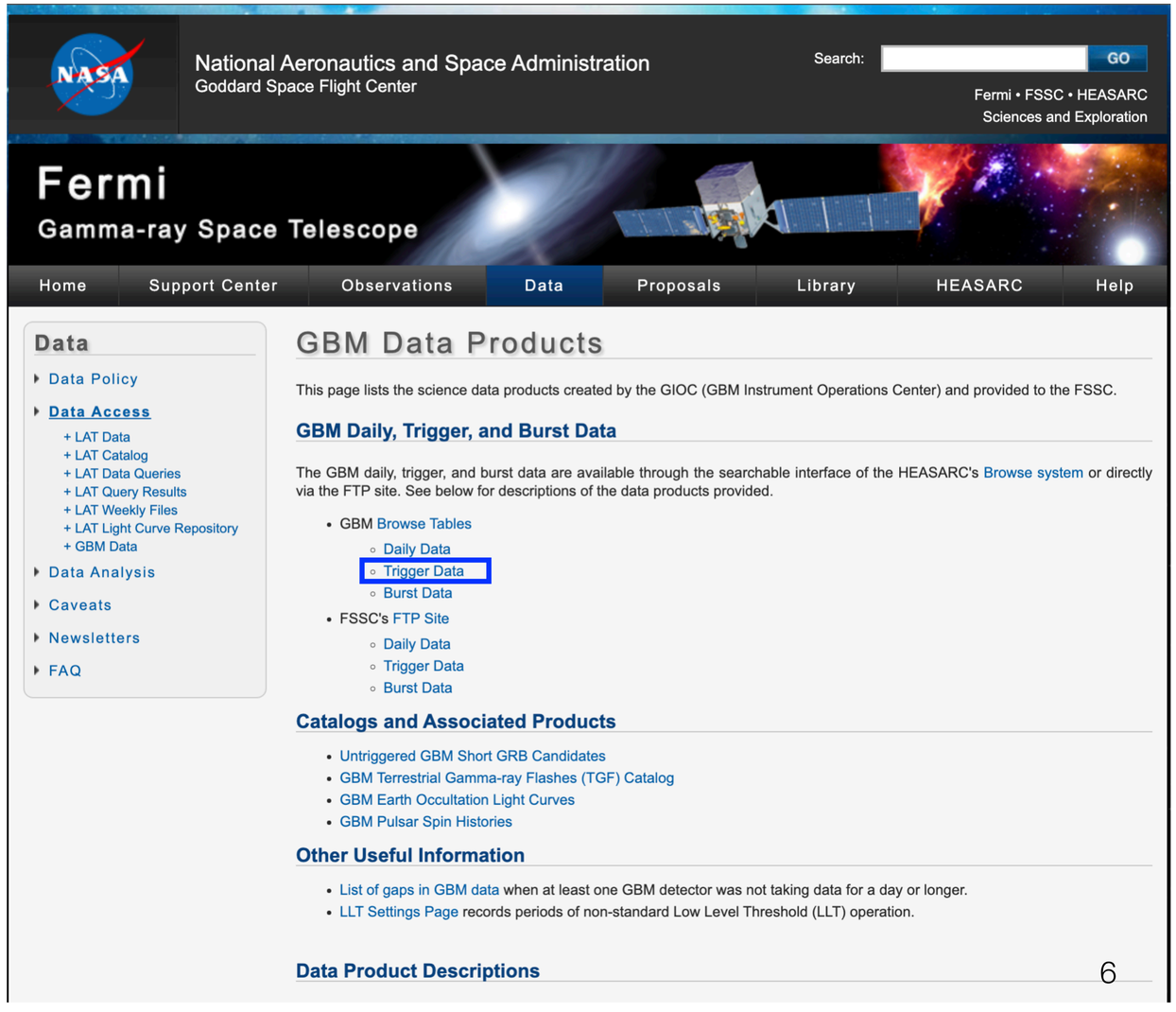

- Trigger Data for people who want data for any *trigger* issued by GBM

Example Link

https://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/triggers/2017/bn170817529/current/

glg_lc_all_bn170817529_v00.gif	17-Aug-2017 08:49	19K
glg_lc_chan12_bn170817529_v00.pdf	17-Aug-2017 08:49	305K
glg_lc_chan34_bn170817529_v00.pdf	17-Aug-2017 08:49	297K
glg_lc_chan567_bn170817529_v00.pdf	17-Aug-2017 08:50	302K
glg_lc_chantot_bn170817529_v00.pdf	17-Aug-2017 08:50	421K
glg_lc_hires12_bn170817529_v00.gif	17-Aug-2017 08:50	7.9K
glg_lc_hires34_bn170817529_v00.gif	17-Aug-2017 08:50	6.9K
glg_lc_hires567_bn170817529_v00.gif	17-Aug-2017 08:51	7.1K
glg_lc_lores12_bn170817529_v00.gif	17-Aug-2017 08:51	9.3K
glg_lc_lores34_bn170817529_v00.gif	17-Aug-2017 08:51	8.4K
glg_lc_lores567_bn170817529_v00.gif	17-Aug-2017 08:52	7.5K
glg_lc_medres12_bn170817529_v00.gif	17-Aug-2017 08:52	9.8K
glg_lc_medres34_bn170817529_v00.gif	17-Aug-2017 08:52	8.7K
glg_lc_medres567_bn170817529_v00.gif	17-Aug-2017 08:52	8.2K
glg_lc_tot_bn170817529_v00.pdf	17-Aug-2017 08:53	316K
glg_lc_zxradec_bn170817529_v00.gif	17-Aug-2017 08:53	7.7K
glg_loclist_all_bn170817529_v02.txt	17-Aug-2017 12:11	6.6K
glg_locplot_all_bn170817529_v02.png	17-Aug-2017 12:11	204K
glg_locprob_all_bn170817529_v02.fit	17-Aug-2017 12:12	2.0M
glg_scat_all_bn170817529_flnc_band_v00.fit	16-Oct-2017 07:35	28K
glg_scat_all_bn170817529_flnc_comp_v00.fit	16-Oct-2017 07:35	28K

GRB triggers tend to have more trigger data products

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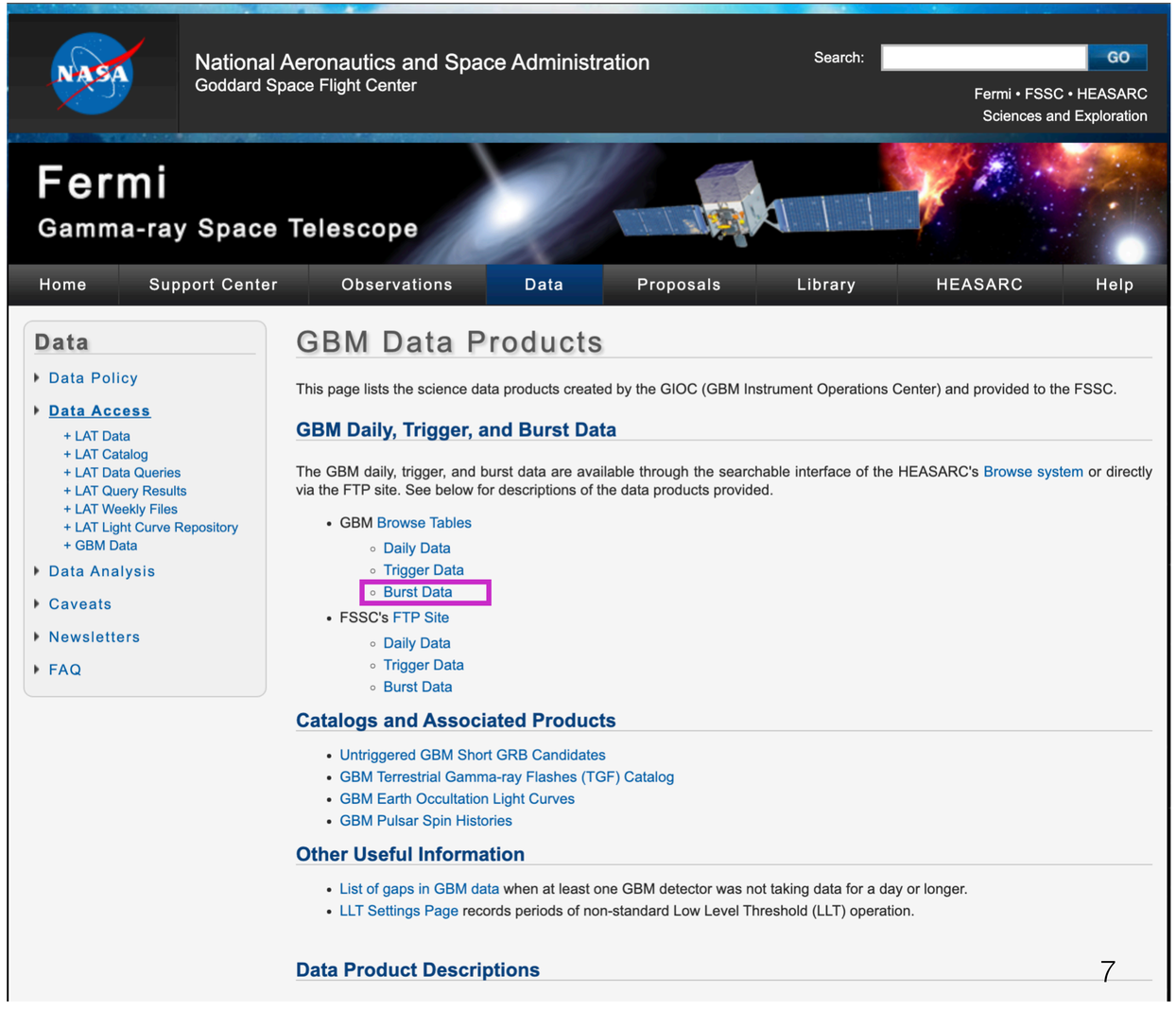


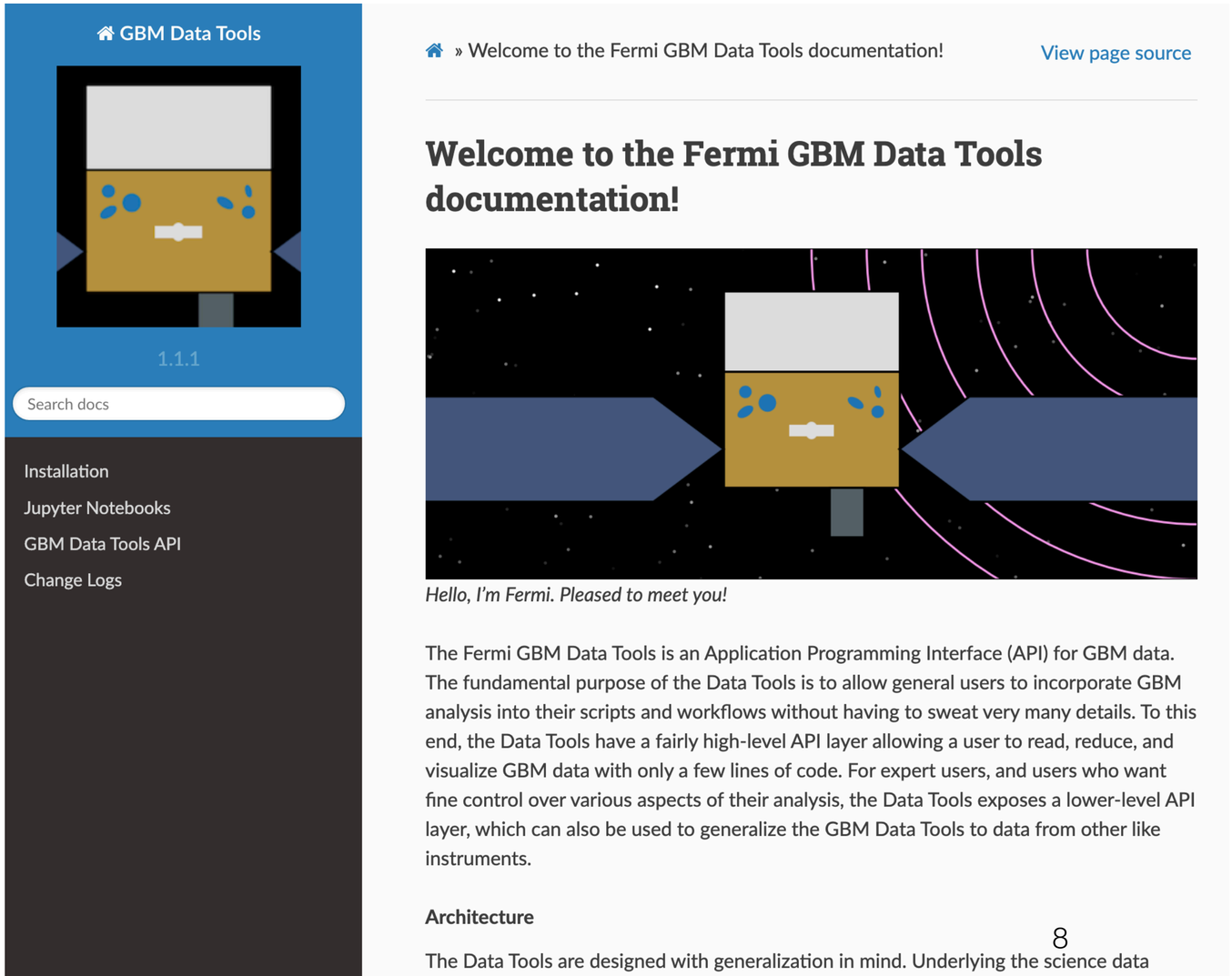
- Burst Data for people who only want data for *GRB triggers* issued by GBM and their associated data products (T90, spectral fits, etc)

glg_locplot_all_bn170817529_v02.png	17-Aug-2017 12:11	204K
glg_locprob_all_bn170817529_v02.fit	17-Aug-2017 12:12	2.0M
glg_scat_all_bn170817529_flnc_band_v00.fit	16-Oct-2017 07:35	28K
glg_scat_all_bn170817529_flnc_comp_v00.fit	16-Oct-2017 07:35	28K
glg_scat_all_bn170817529_flnc_plaw_v00.fit	16-Oct-2017 07:35	28K
glg_scat_all_bn170817529_flnc_sbpl_v00.fit	16-Oct-2017 07:36	28K
glg_scat_all_bn170817529_pflx_band_v00.fit	16-Oct-2017 07:36	28K
glg_scat_all_bn170817529_pflx_comp_v00.fit	16-Oct-2017 07:36	28K
glg_scat_all_bn170817529_pflx_plaw_v00.fit	16-Oct-2017 07:37	28K
glg_scat_all_bn170817529_pflx_sbpl_v00.fit	16-Oct-2017 07:37	28K
glg_tcat_all_bn170817529_v03.fit	16-Oct-2017 07:37	5.6K
glg_trigdat_all_bn170817529_v01.fit	17-Aug-2017 11:07	107K
glg_tte_b0_bn170817529_v00.fit	17-Aug-2017 11:45	3.8M

fits specific to GRB triggers

How to Use GBM Data?

https://fermi.gsfc.nasa.gov/ssc/data/analysis/gbm/gbm_data_tools/gdt-docs/



- Python based data analysis software written by the GBM team

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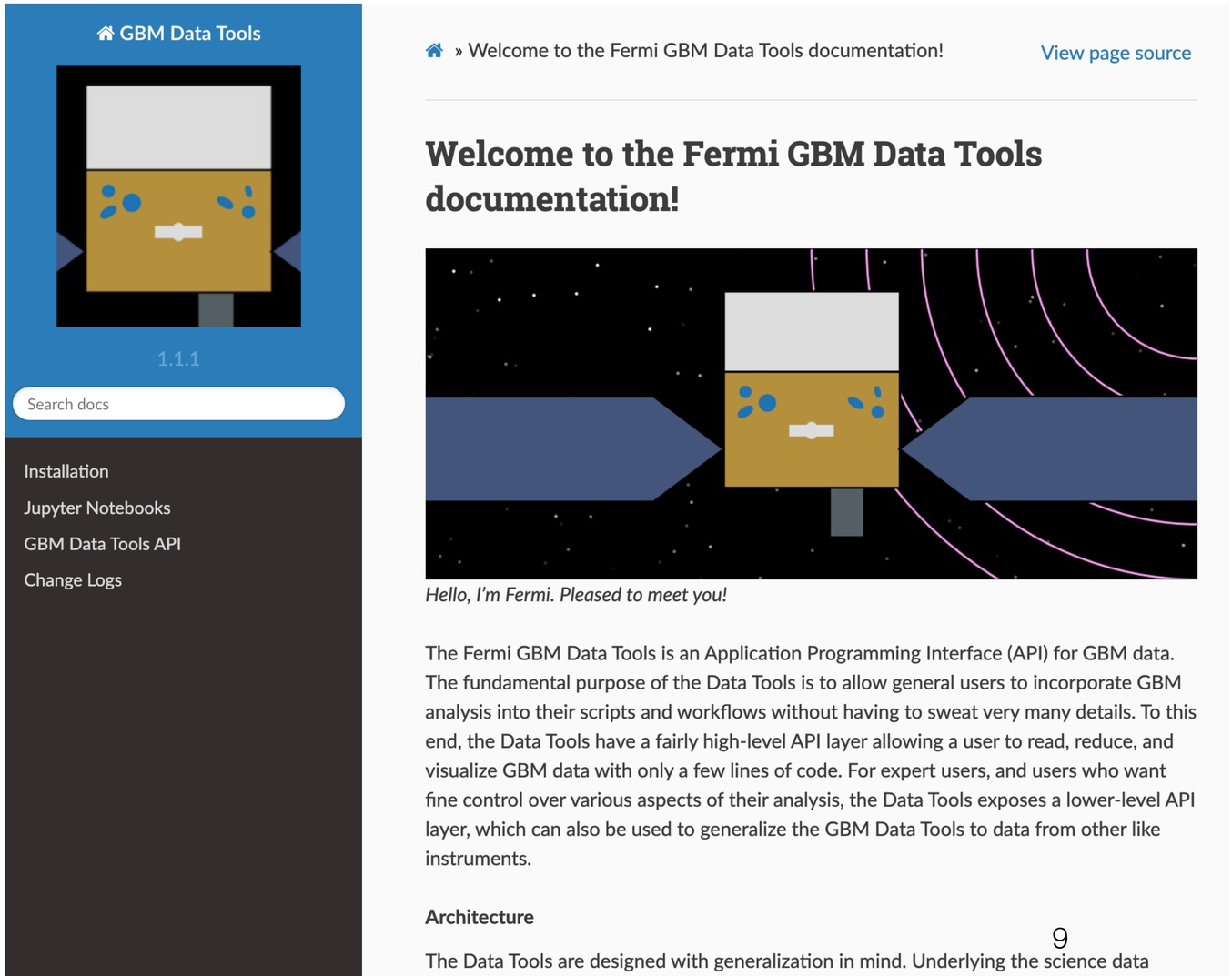

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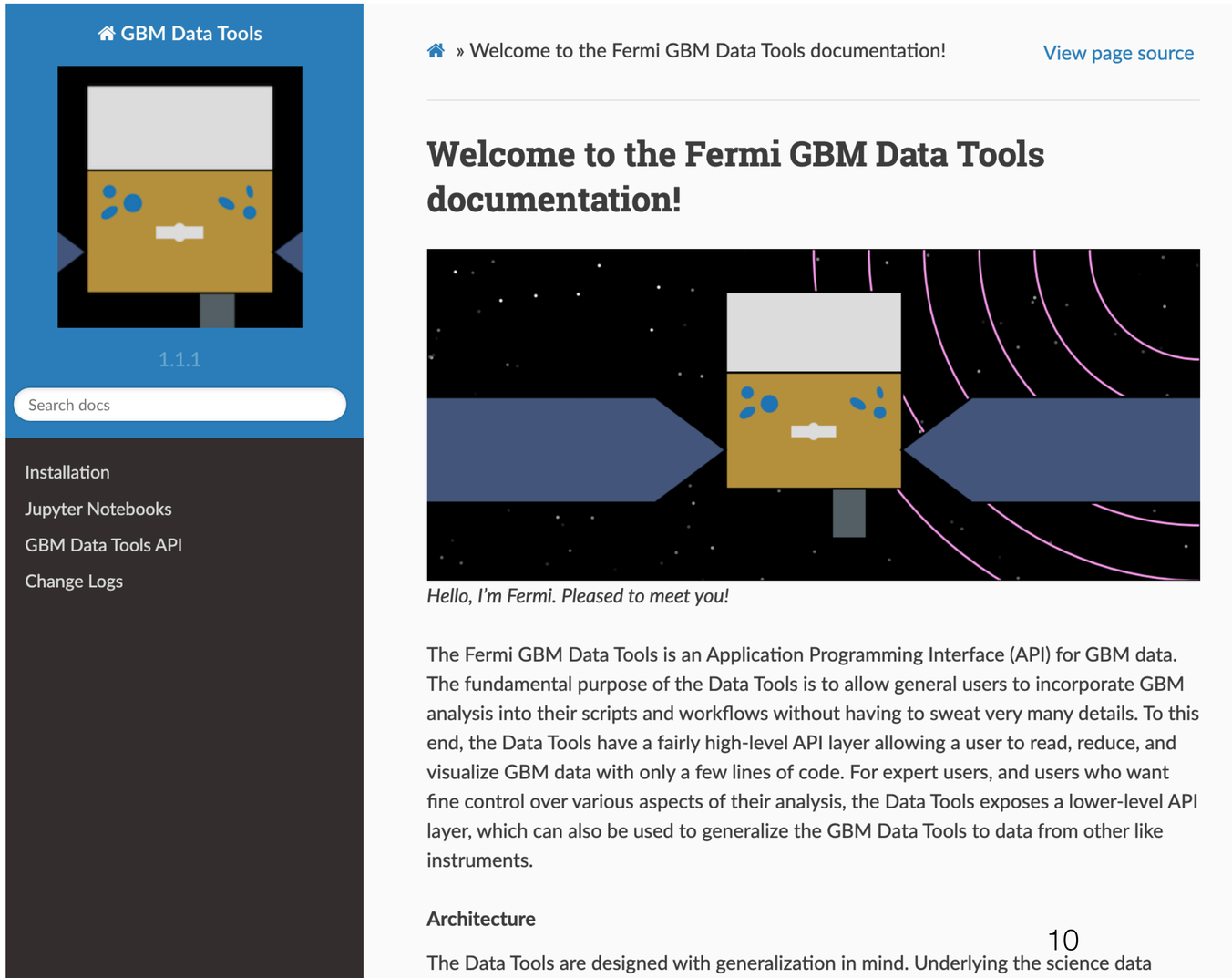

- Available to download on the web

  note: sometimes Chrome unzips the .tar.gz
  if you have issues installing, try renaming as .tar

- Available in the Fermi Bottle with

  conda activate fermigbm
  pip3 install matplotlib==3.2.1

- Will work for the tutorials we're going to run today, with some warning messages from basemap, a very outdated dependency that we're still working to replace. Only matters for certain sky plots, data is analysis unaffected

sudo chmod -R g+w /opt/anaconda/envs/fermigbm
conda install -n fermigbm -c conda-forge basemap

if you want to add basemap for later ^

Tutorial: a famous trigger GRB 170817A

https://drive.google.com/file/d/1NFyfb8gzWwRJiXMJ2h4QuMe32tRcErPp/view?usp=sharing