

# COSMIC MAGNETIC FIELDS

KRZYSZTOF NALEWAJKO, CAMK PAN

[KNALEW@CAMK.EDU.PL](mailto:KNALEW@CAMK.EDU.PL)

*Introduction*



# ORGANIZATION

- Registration open until Sunday, March 6th.
- Tuesdays from March 1st to June 21st — 14 meetings.  
No lecture on April 19th, May 3rd, May 17th.
- First hour (11:15 - 12:00) on phenomenology (observational evidence),  
Second hour (12:15 - 13:00) on theory.
- Lecture materials available after each lecture [<https://events.camk.edu.pl/event/37/>]:
  - slides by end of Tuesday,
  - notes by end of Thursday.
- 2 lectures (June 7th, 14th) reserved for presentations, final lecture (June 21st) for the exam.
- Credit points: problems (max 50), presentation (max 50), exam (max 50), individual interview.
- Problems: assigned regularly, 1-page reports by next lecture, please don't clone them.
- Presentations: journal club of classic papers (suggestions welcome).
- Grades: no pass (0-59), 3 (60-79), 4 (80-99), 5 (100-150).

questions, comments, suggestions:  
[knalew@camk.edu.pl](mailto:knalew@camk.edu.pl)



# SCOPE OF THIS LECTURE

- phenomenology: Earth, planets, Sun, stars, pulsars/magnetars, galaxies, AGN (relativistic jets), extragalactic
- theory: electrodynamics, MHD, waves, instabilities, shocks, reconnection, particle acceleration, radiation, dynamo

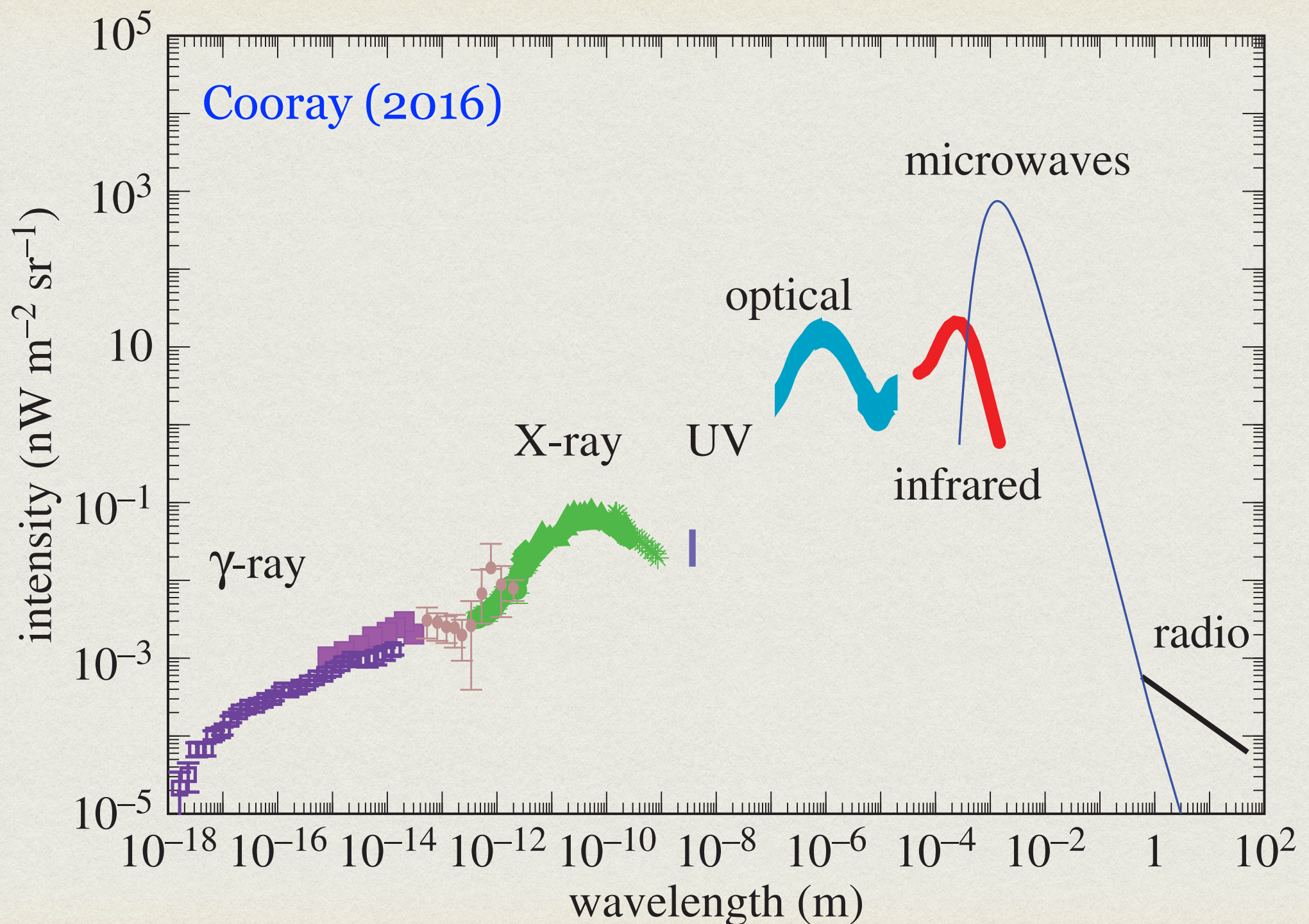


# BASIC QUESTIONS

- What are magnetic fields?
- Where in the Universe do we find magnetic fields?
- How do we know that magnetic fields are there?
- What is the role of magnetic fields in the Universe?
- How important are they?

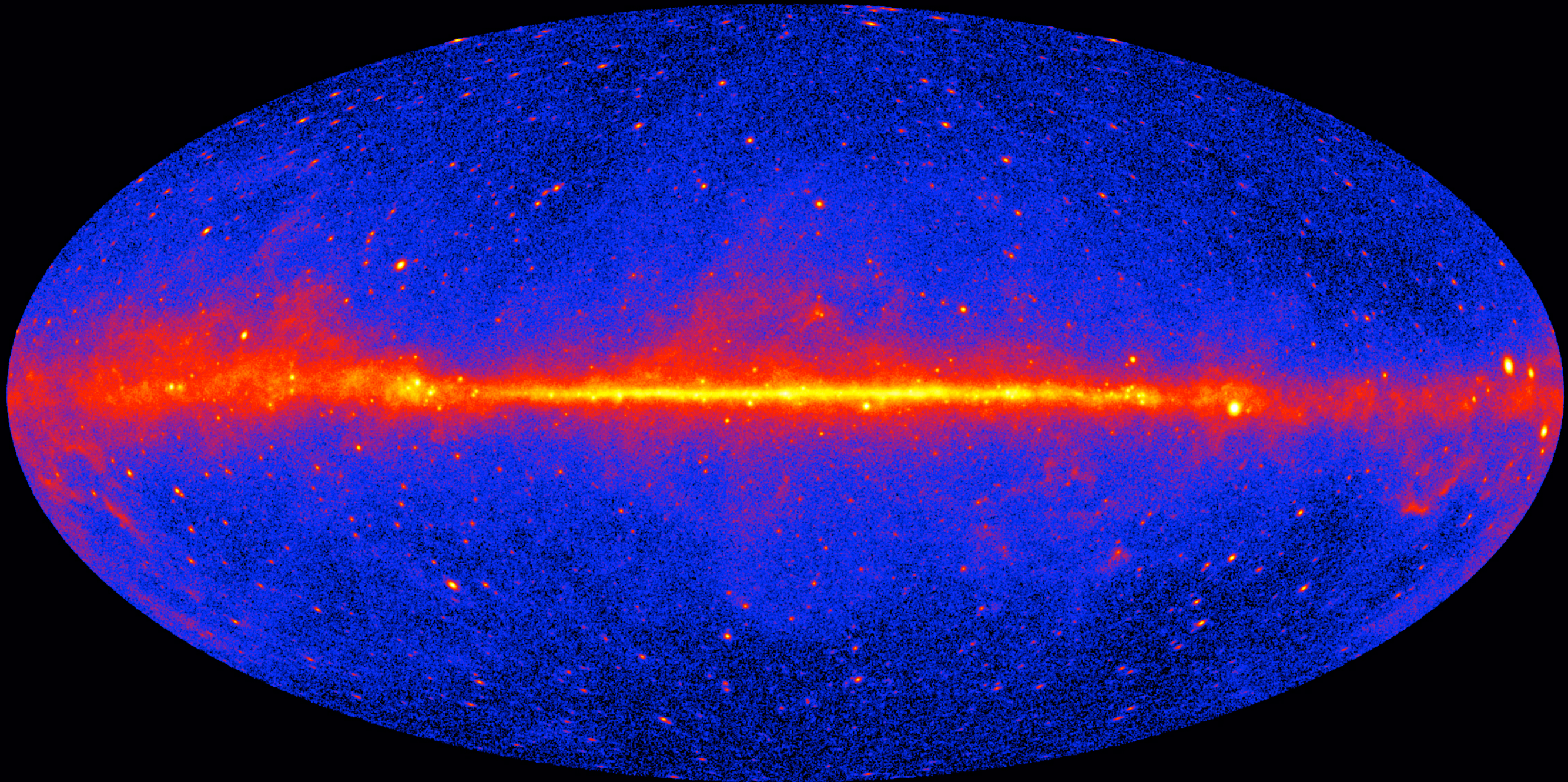
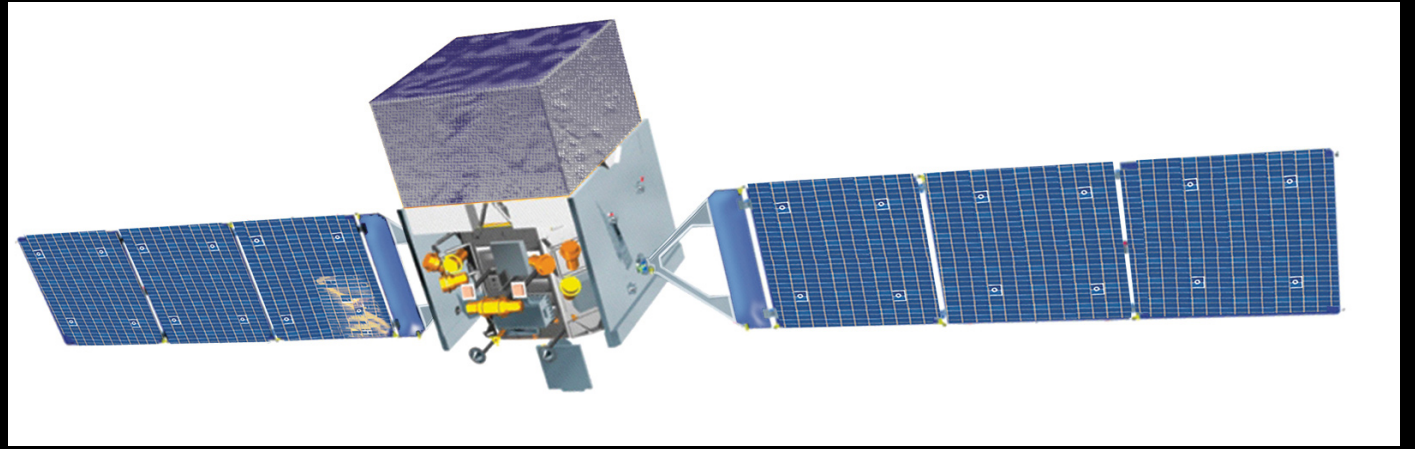


# COSMIC RADIATION BACKGROUND





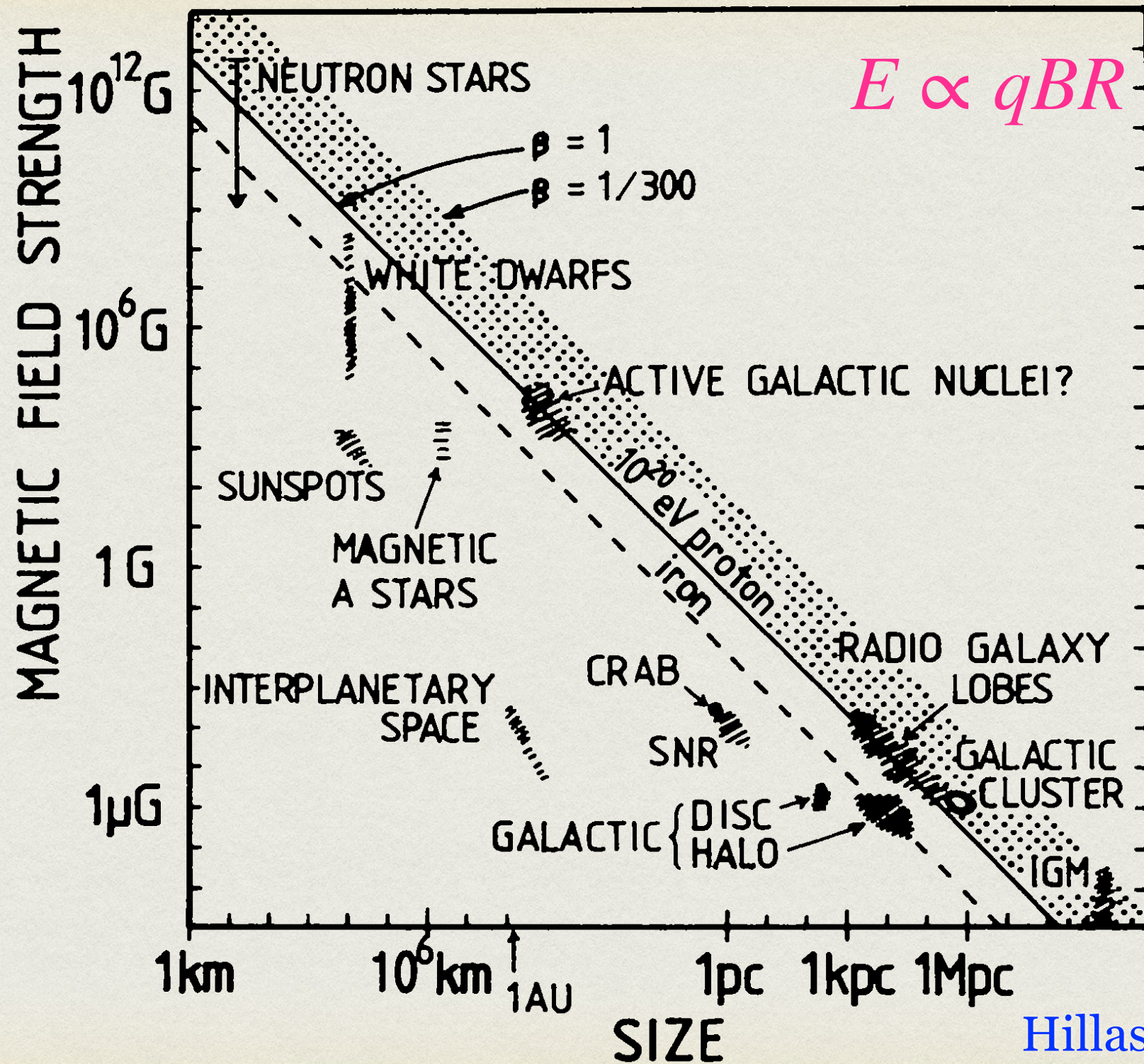
# GAMMA-RAY SKY FROM FERMI/LAT (5 YEARS, $> \text{GeV}$ )





# HILLAS PLOT

cgs units  
 $1 \text{ G} = 10^{-4} \text{ T}$



Hillas (1984, ARA&A)