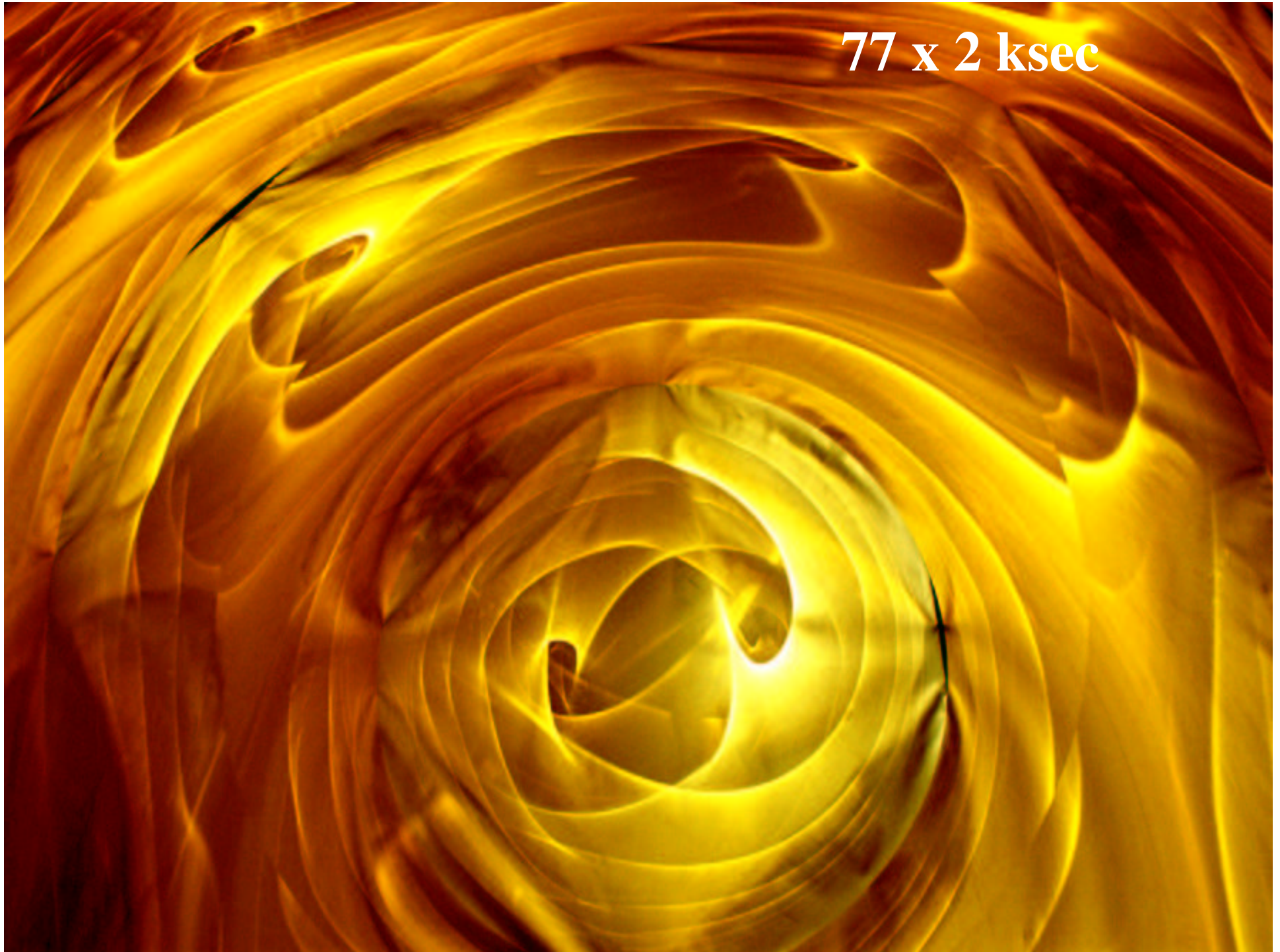
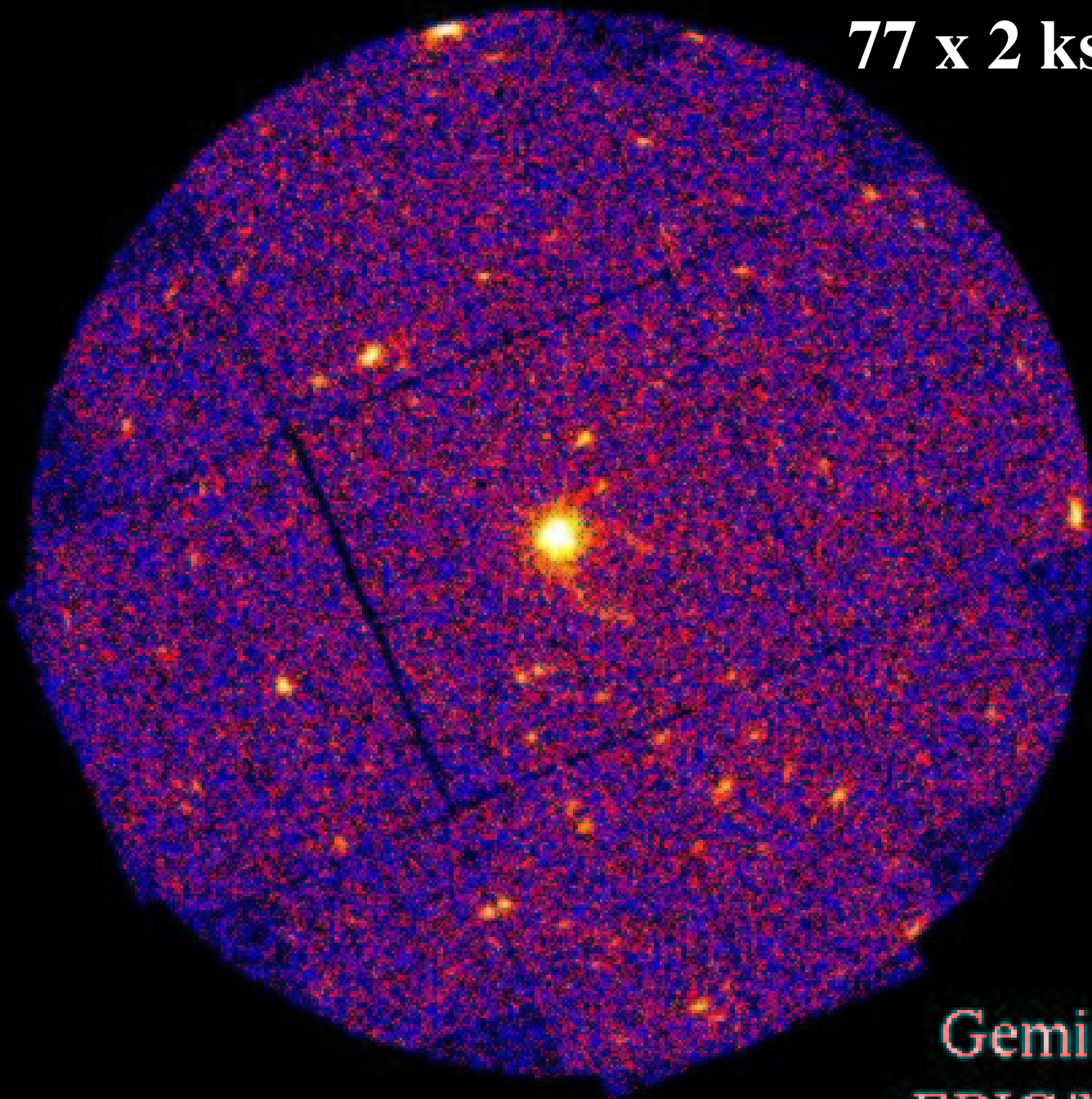


Gemininga

77 x 2 ksec

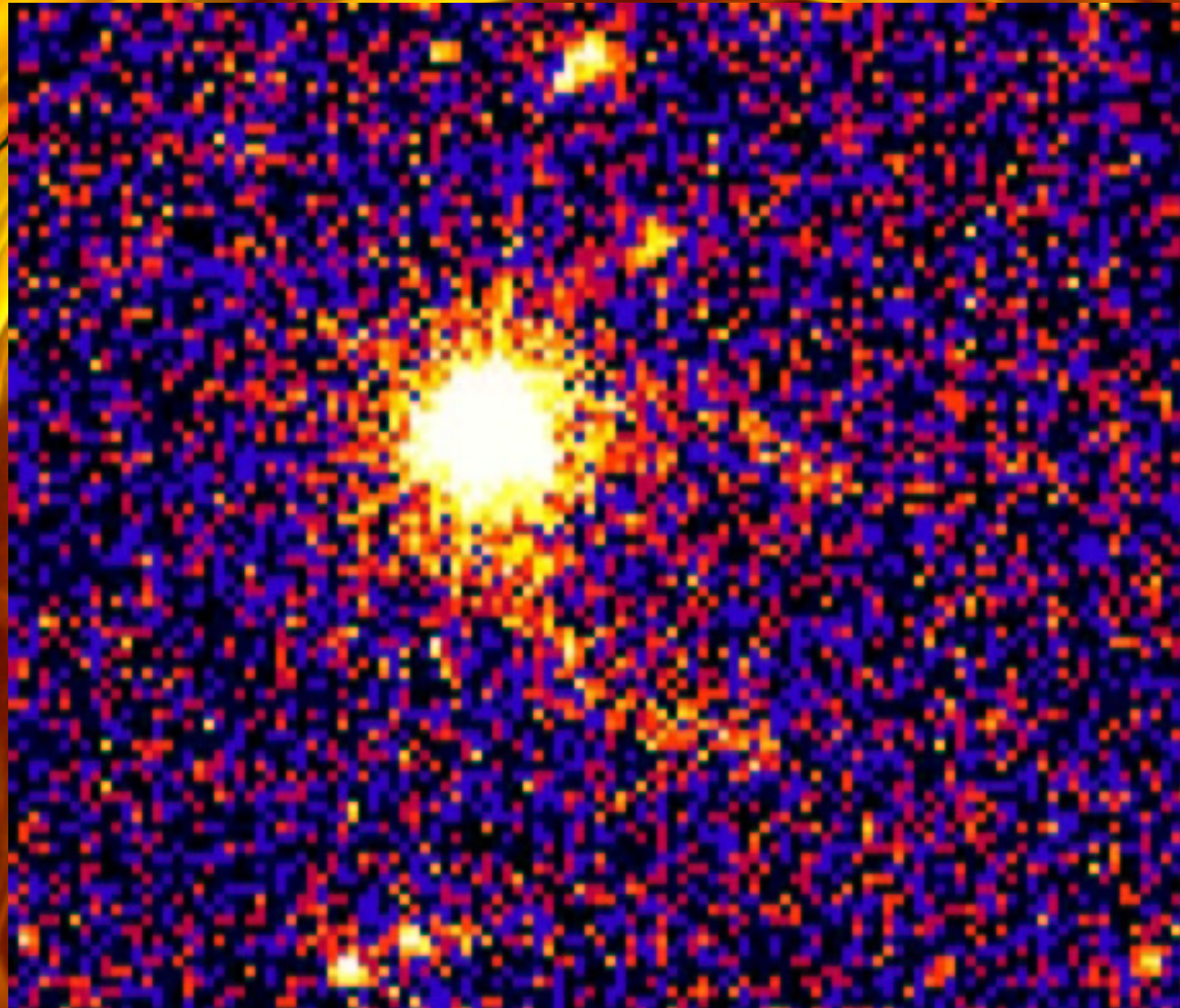


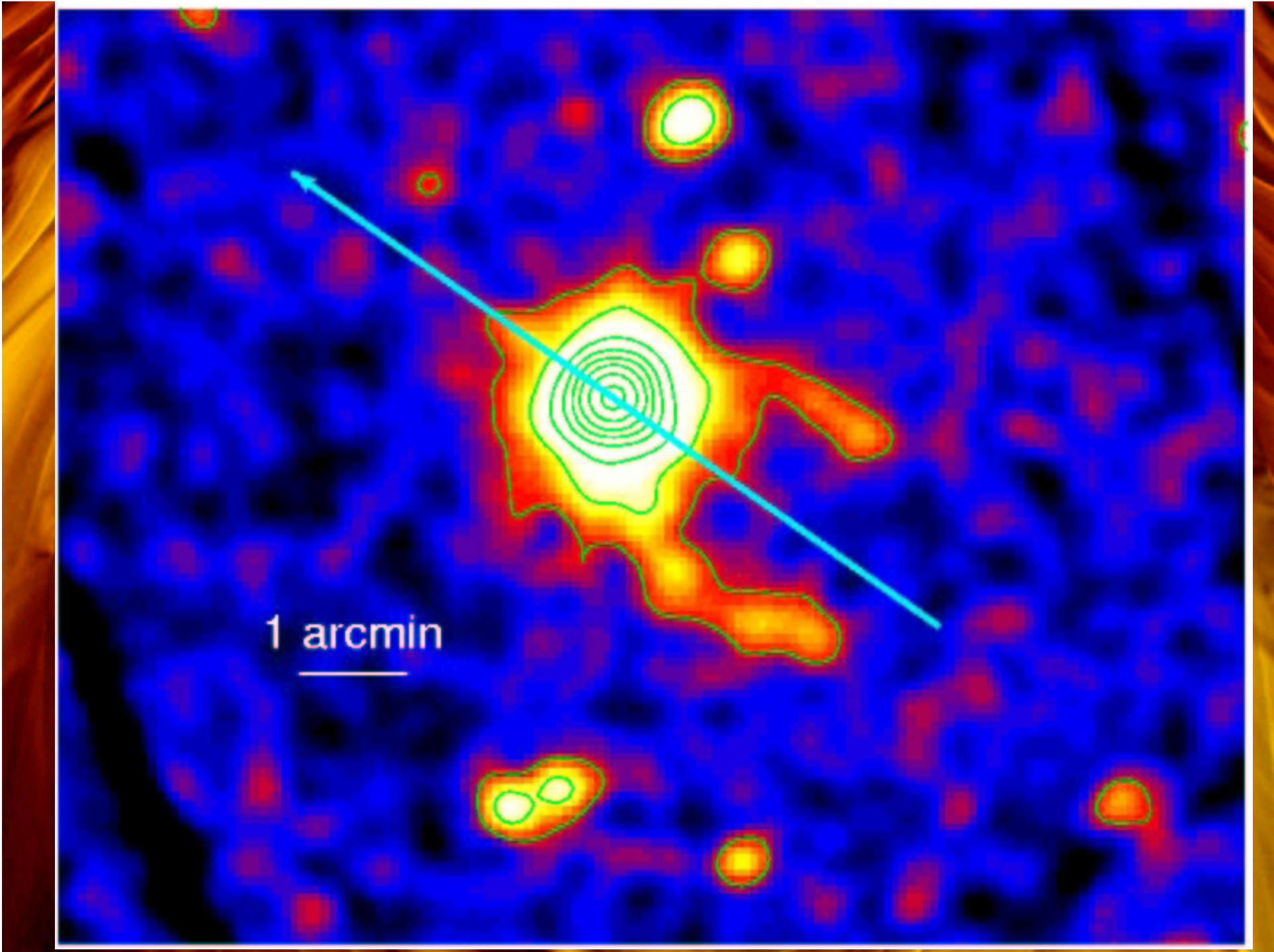
77 x 2 ksec



Geminga
EPIC/MOS

77 x 2 ksec





Science

5 September 2003

Vol. 301 No. 5638
Pages 1273-1424 \$10

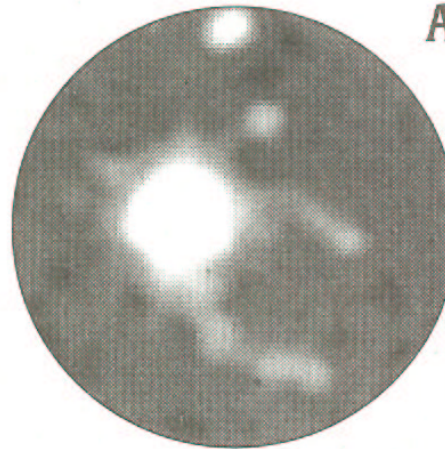
PhysicsWorld

SEPTEMBER 2003 physicsweb.org

VOLUME 16 NO 9

6D · MONDAY, SEPTEMBER 8, 2003 · USA TODAY

A better
Life
Health, education
& science



ESA/XMM-Newton/Caraveo et al.

Astronomers snap shots of a rip-roaring pulsar

European Space Agency astronomers have captured the first images of a pulsar that is roaring through space at 20 times the speed of sound and creating a massive shock wave in its wake. A pulsar is a collapsed star, as heavy as the sun but compacted to about 10 miles in diameter, that emits radio waves. An image of the shock wave from the pulsar Geminga, traveling about 500 light-years from Earth, appears on the cover of the current edition of the journal *Science*.



COVER Sinuous patterns formed by the reflection of indirect light off the gold-plated spare mirror of the European Space Agency's XMM/Newton orbiting x-ray telescope. In flight, this telescope was used to observe the Geminga pulsar and revealed the tails of its shock wave as it moves through space, allowing the determination of its supersonic motion and local matter density. See page 1345. [Photo credit: Patrick Dumas/CESR Toulouse]

Science

Volume 301
5 September 2003
Number 5638

Energetics

$\dot{E} = 3 \times 10^{34}$ erg/sec

$D = 160$ pc

$\mu = 170$ mas/y

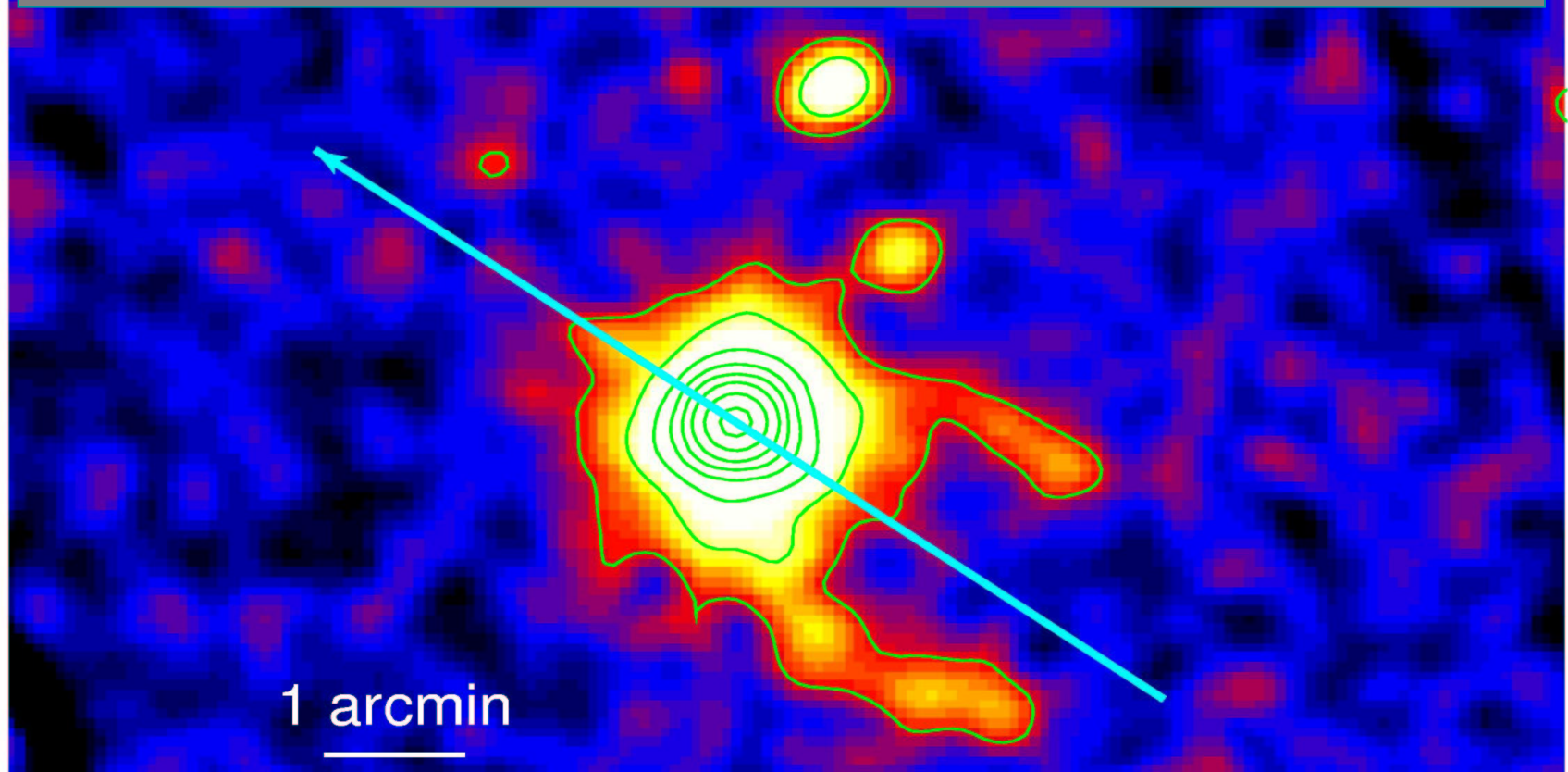
$v_{\text{tr}} = 120$ km/sec

Geminga luminosity 3×10^{31} erg/sec (0.1-5 keV)

Tails luminosity 6.8×10^{28} erg/sec

The tails account for $2 \times 10^{-6} \dot{E}$

10^{14} eV electrons will have a Larmor radius
of $3.4 \cdot 10^{16}$ cm \rightarrow thickness $6.8 \cdot 10^{16}$ cm $\rightarrow 27''$



10^{14} eV electrons will lose half of their
energy in 800 y .
 $180'' / 170 \text{ mas/y} = 1,000 \text{ y}$

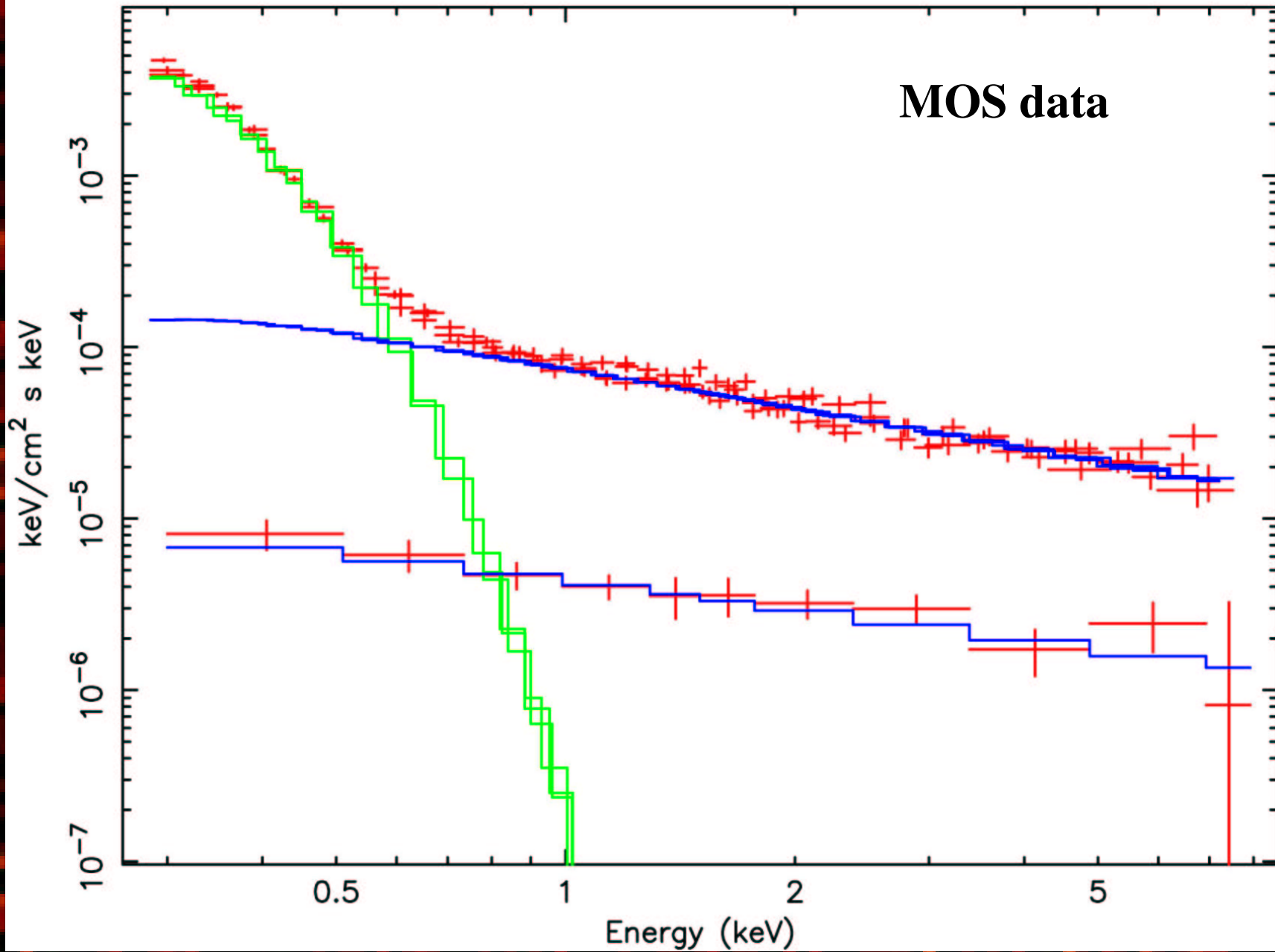
What produces the X-rays



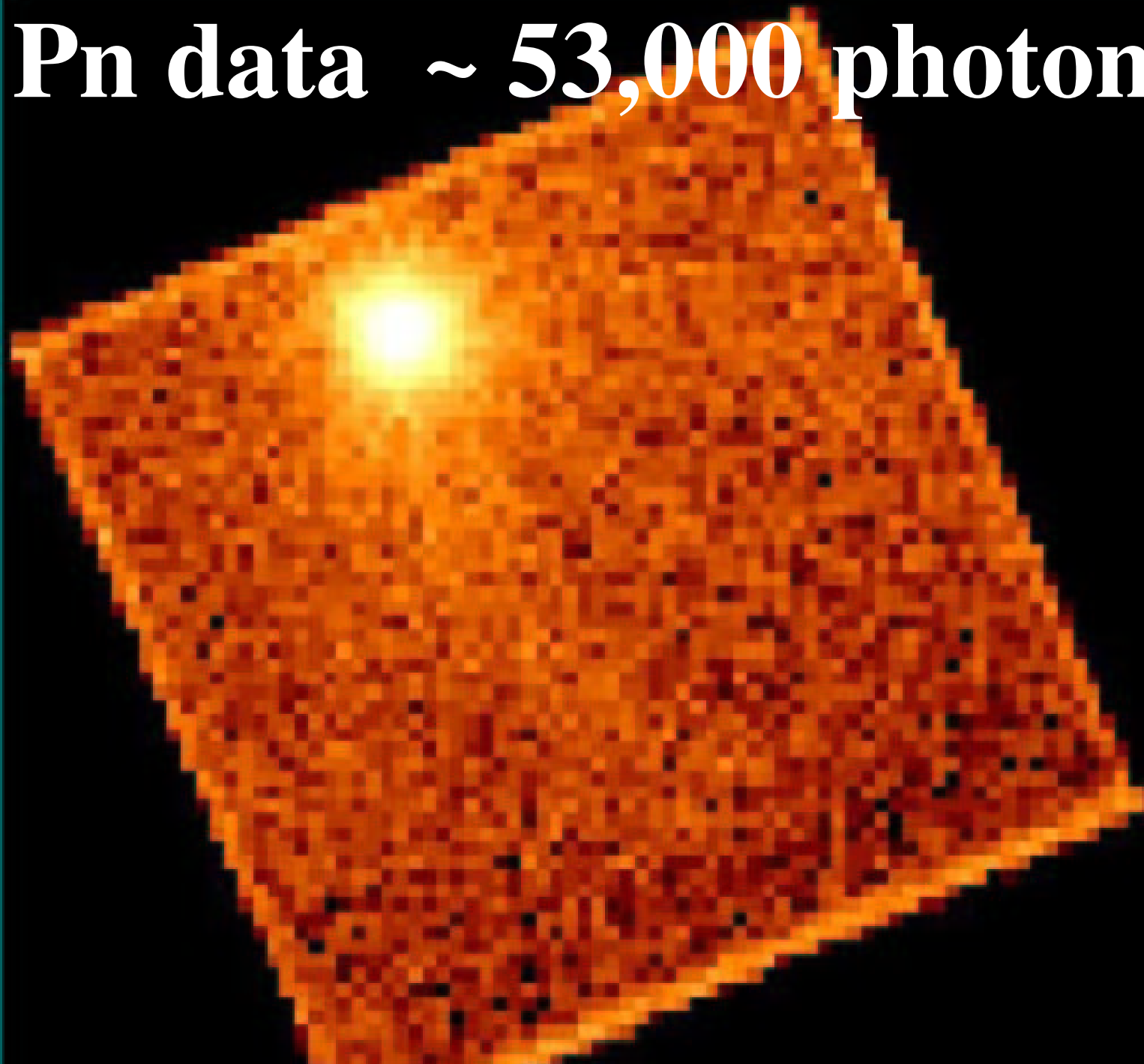
Geminga

ys

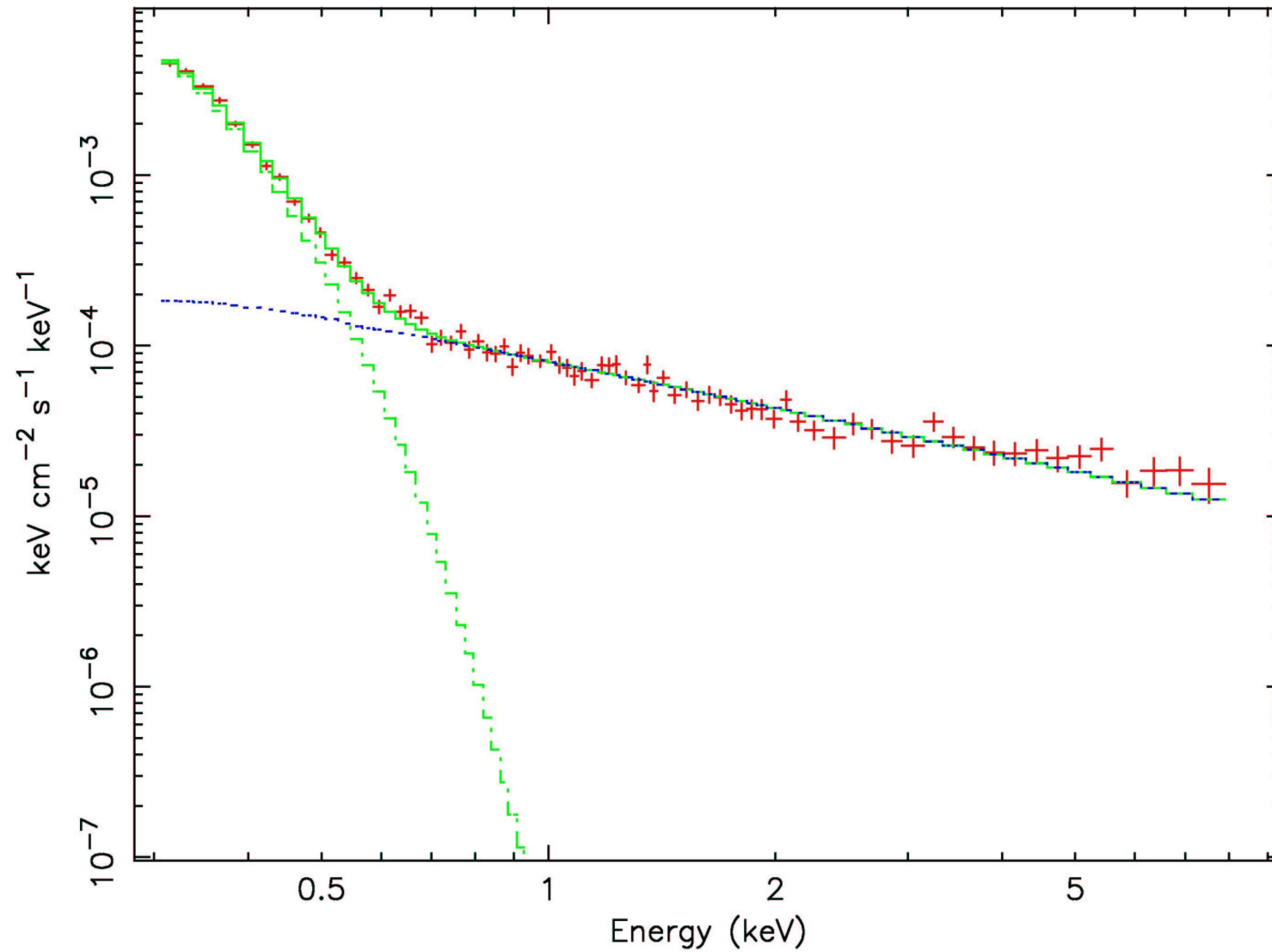
MOS data



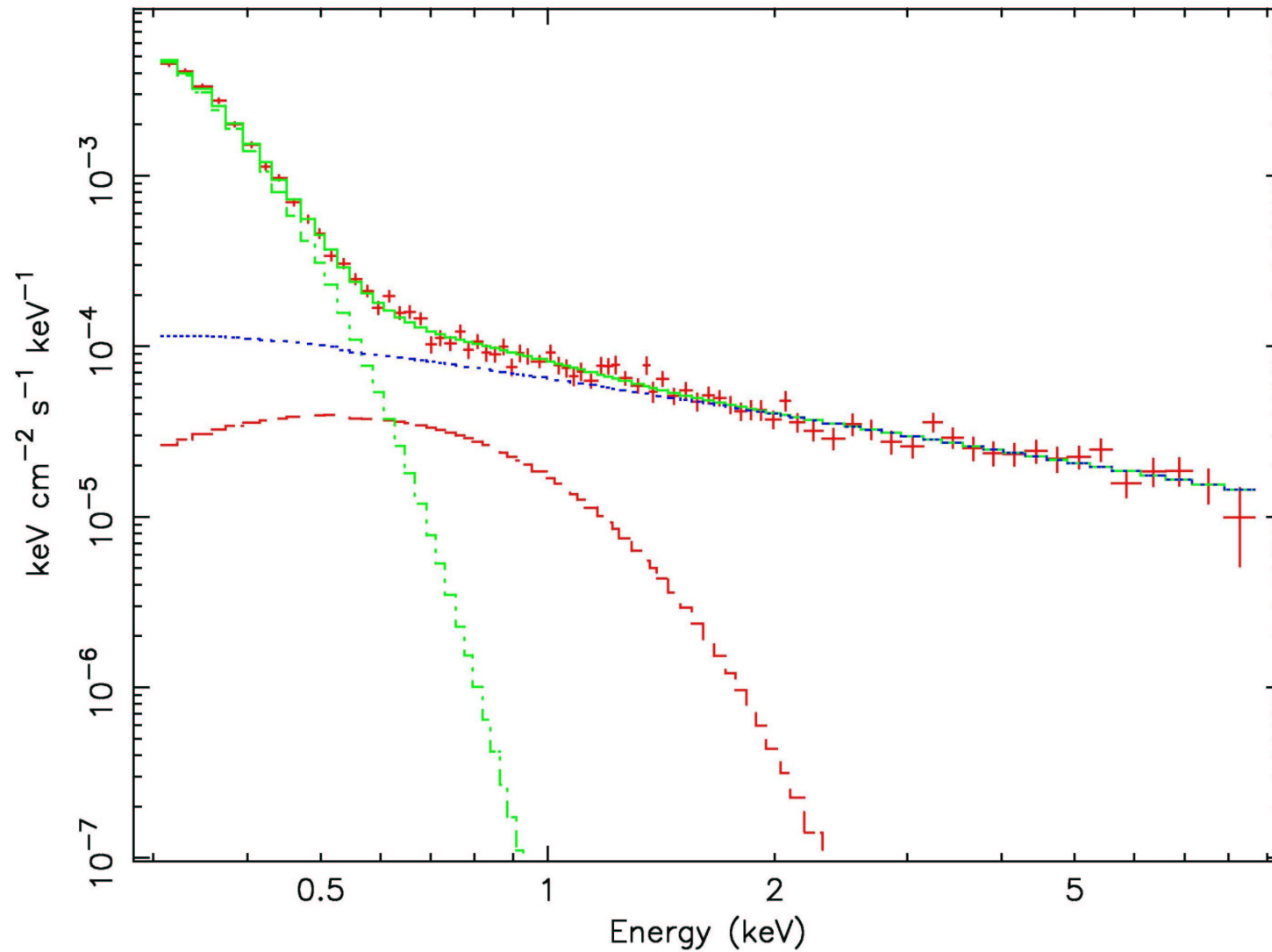
Pn data ~ 53,000 photons



Pn data ~ 53,000 photons



Pn data $\sim 53,000$ photons



and the fraternity?

PSR 0656+14 and PSR 1055-57

are similar

but very different

PSR B0656+14, PSR B1055-52 and Geminga

