



M1 INTERSHIP:

PREPARATION OF A BACKGROUND MODEL FOR SIMULATIONS OF SPACE- BASED X-RAY OBSERVATORIES

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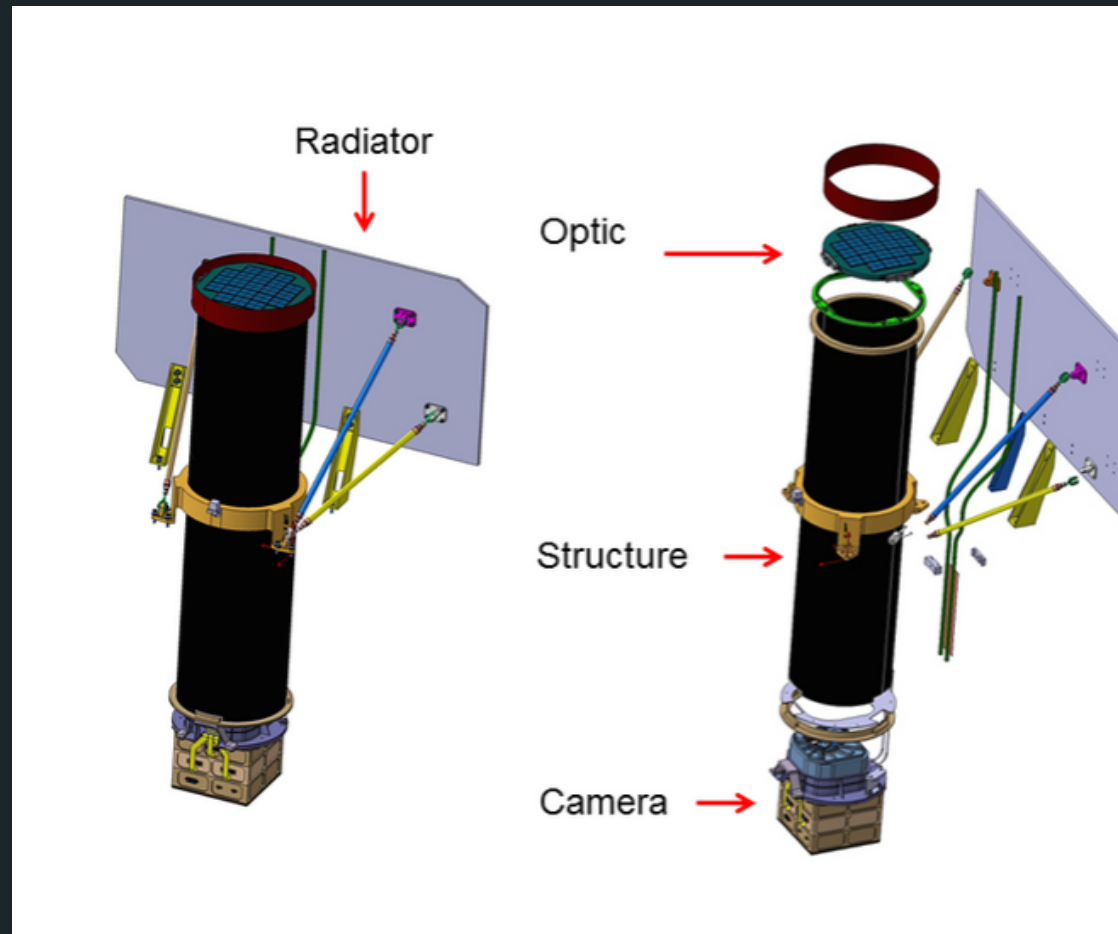
THANKS

INTRODUCTION

CONTEXT AND PROBLEMATICS OF THE INTERSHIP

SVOM MISSION

MXT (MICROCHANNEL X-RAY
TELESCOPE)



SEARCH OF GAMMA RAYS BURST

X RAY BACKGROUND

WHAT ARE THE INFLUENCES
OF THE X RAY
BACKGROUND ON
MEASUREMENTS

HOW CAN WE SIMULATE THE
BEHAVIOR OF X RAY
BACKGROUND WITH THE
TOOLS AVAILABLE

WHAT ARE THE MAJOR
COMPONENTS ?

OBJECTIFS AND GOALS OF THE INTERSHIP

Objectifs :

1

CARACTERISATION OF THE X RAY BACKGROUND

SCIENTIFICS ARTICLES AND BIBLIOGRAPHIC RESSOURCES

2

IMPLEMENTATION OF THE X RAY BACKGROUND

BASH SCRIPT AND USE OF X RAY TOOLS

3

TEST AND VERIFICATION OF THE MODEL

TEST AND VERIFICATION OF THE ENTER FILE

Goals:

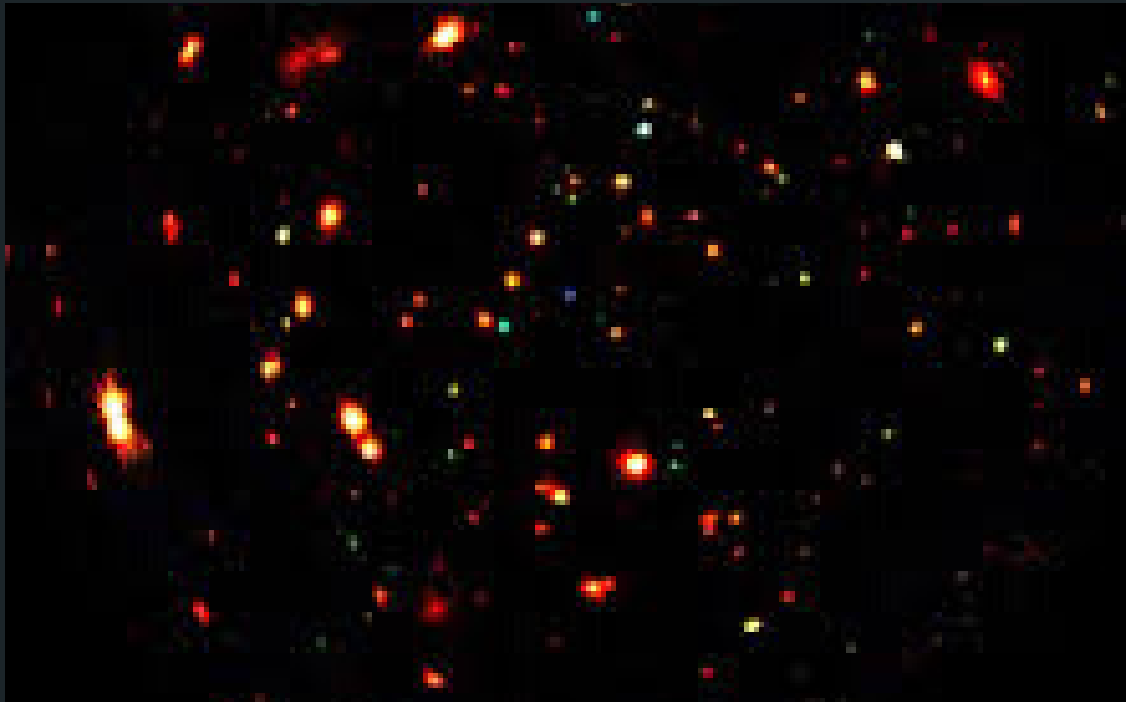
1

Build X ray background file as an environment for measurements made by a given virtual telescope

2

Allow to compare multiple telescope

X ray background Components



POINTS SOURCES

Taken from the "Second
ROSAT all-sky survey (2RXS)
source catalog"



DIFFUSE SOURCES

Galaxies clusters &
supernova remnants



GXB AND CXB

Galactic & Cosmic X rays
background

THEORETICAL DESCRIPTION AND IMPLEMENTATION OF X RAY BACKGROUND

WHAT IS A SOURCE IN ASTRONOMY ?

SOURCE FLUX

SOURCE SPECTRUM

LOCATION IN THE SKY

SPECTRUMS

Thermal Spectrum

THERMAL BREMSSTRAHLUNG

acceleration of electrons in collisions
with other electrons
-hot gas

BLACK BODY

Plancks law

EMISSION AND ABSORPTION LINES

-Atoms, atoms nuclei.

Non Thermal Spectrum

SYNCHROTRON

radiation associated with
acceleration of electron in a
magnetic field
-powerlaw shape

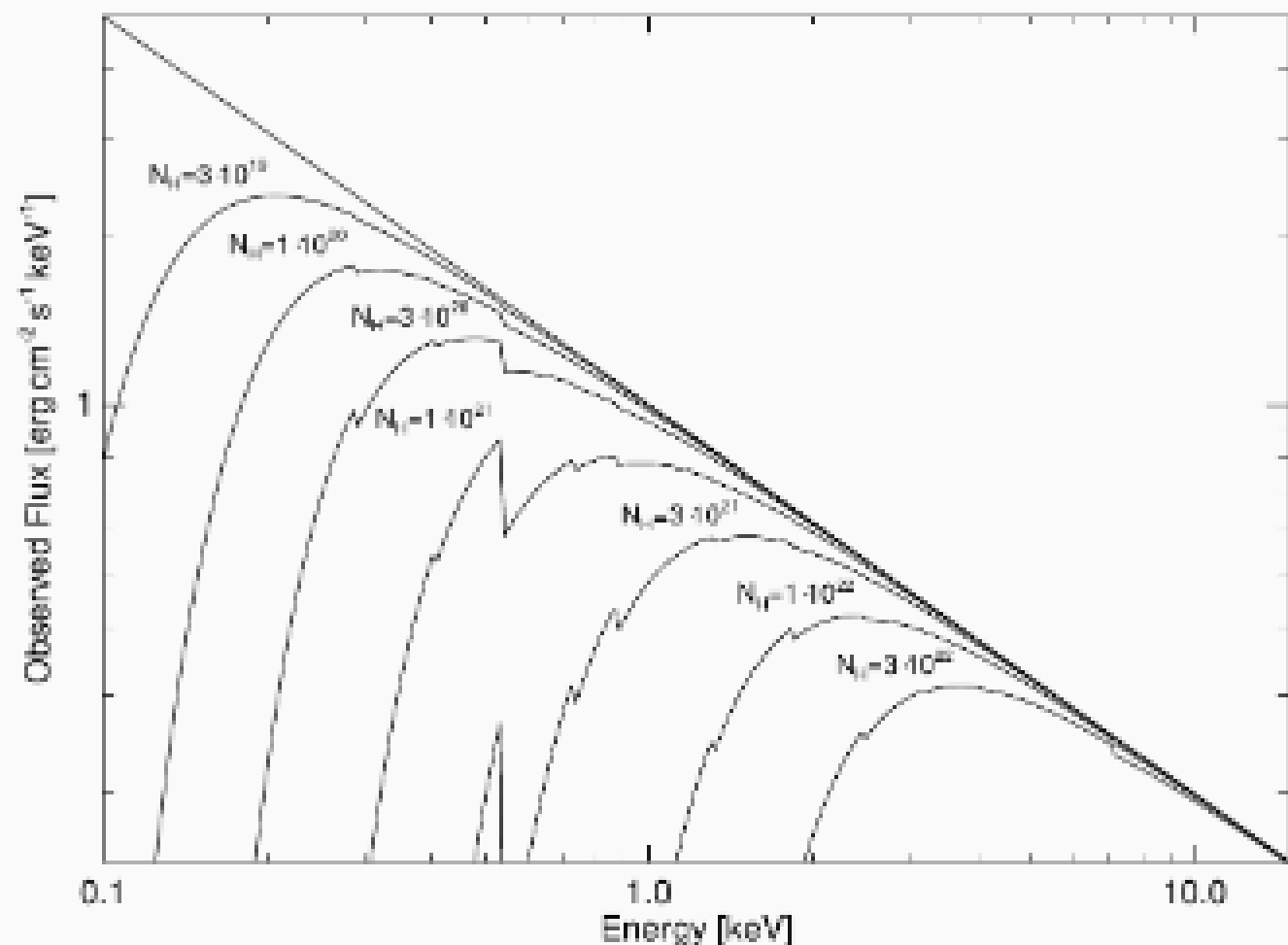
INVERSE COMPTON

scatters photons from
lower to higher energies in
interactions with electrons
-power law shape
-galaxy

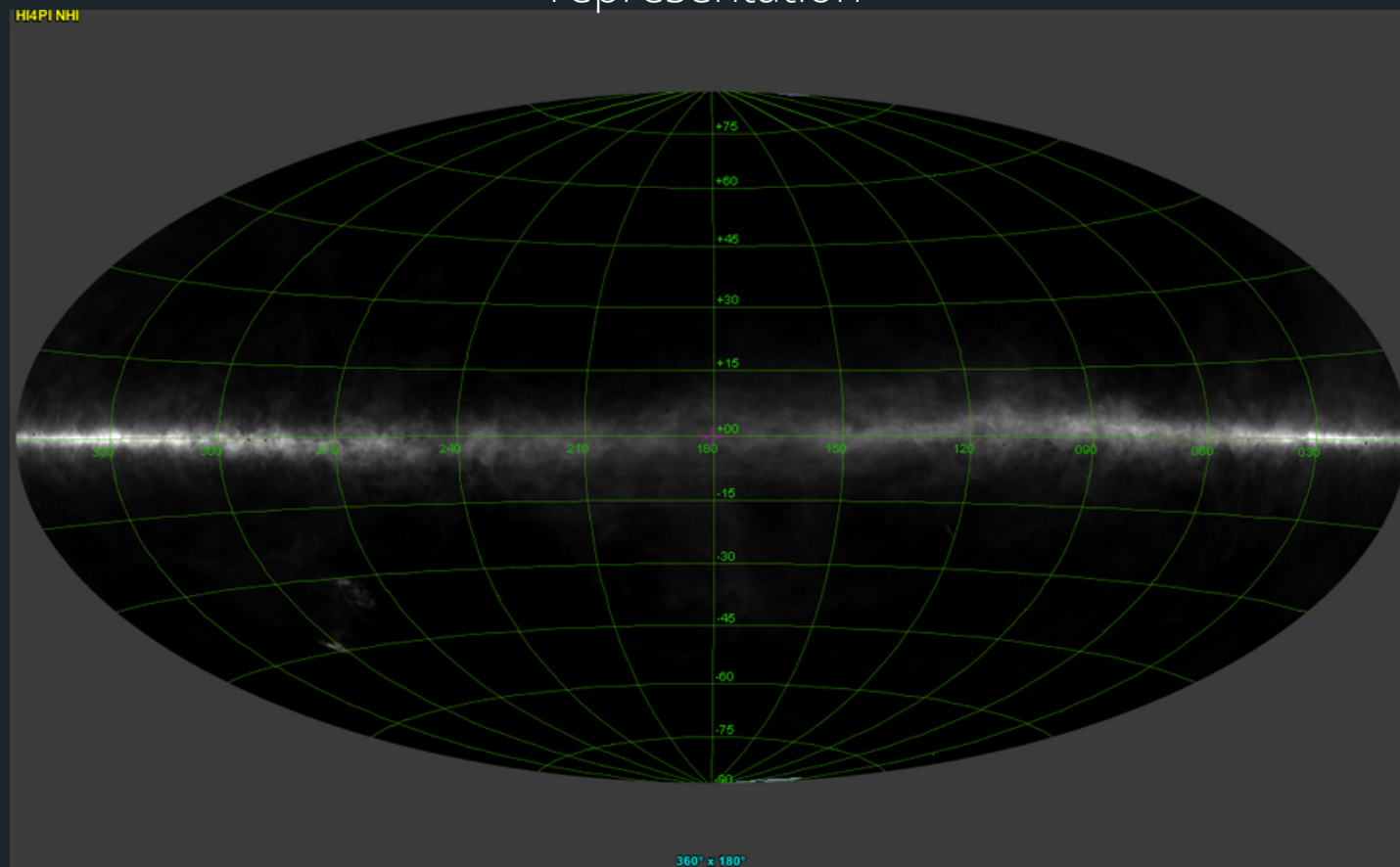
NH: hydrogen column density

TRANSLATES THE AMOUNT
OF HYDROGEN SPRAYED
ALONG THE LINE OF SIGHT

Expressed as a surface density of
hydrogen in cm^{-2}



Effect of Hydrogen column density in flux energy representation



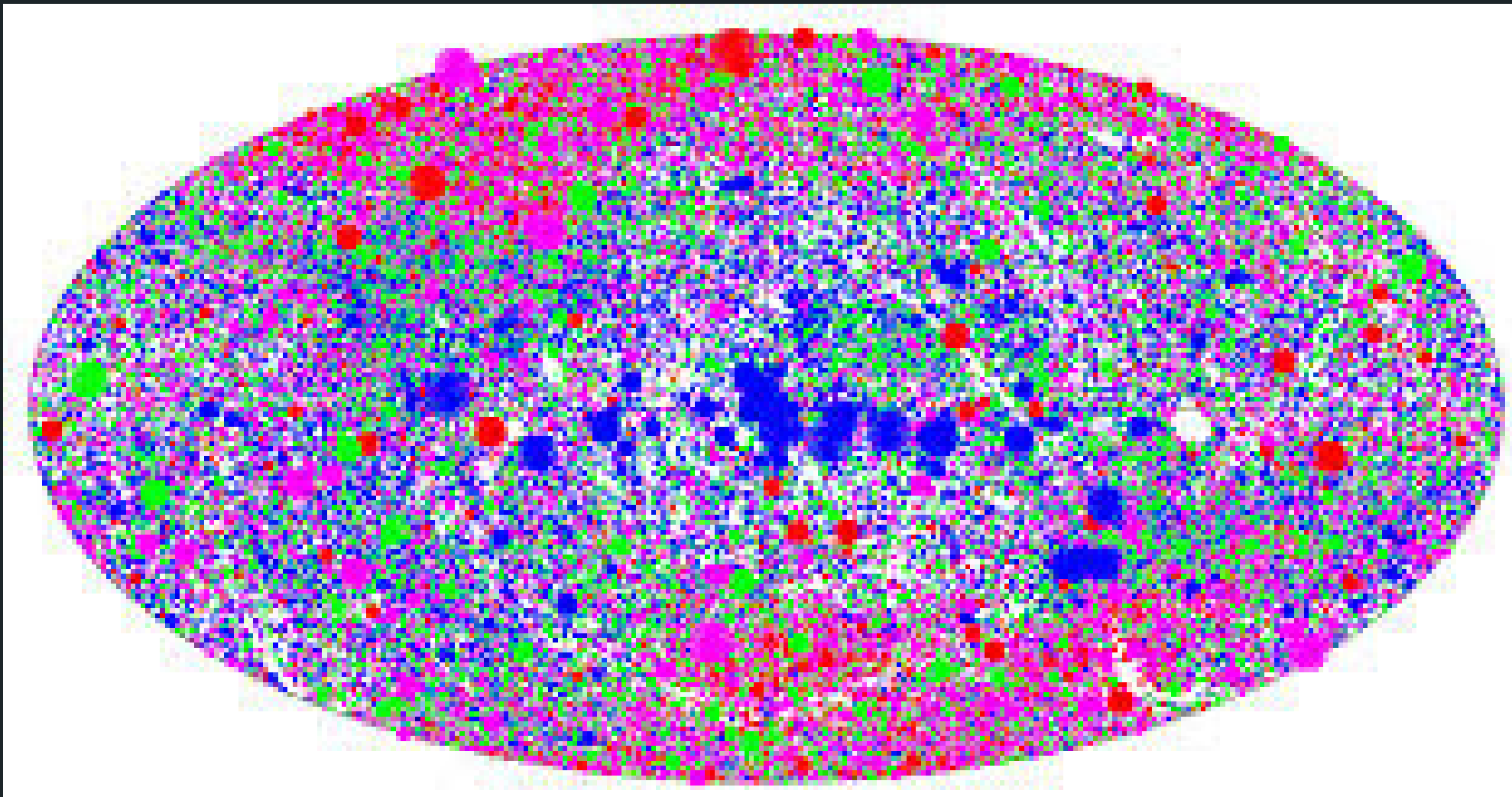
Aitoff projection of the HI4PI map

INFLUENCES THE ENERGY
OF PHOTONS

reducing the number of photons
observed at low energy

Point sources implementation

Rosat catalog



Aitoff projection in Galactic coordinates of the sky distribution of 2RXS sources. The size of the symbols scales with source count rate and the colours represent different spectral characteristics (increasing hardness ratio from red to blue).

Tables components :

RA, DEC, Nh, Number of photons, T, Photon index

Point source sampling

- 1) 135 000 point sources
- 2) 73,969 most convincing sources

Point source splitting according to their spectrum

2472 Power law spectrum

397 Mekal spectrum

1479 Black-body spectrum

69,621 non-fitted with powerlaw spectrum.

Diffuse sources implementation

Galaxies clusters & Supernova remnants

Extended sources
spatial flux dependance



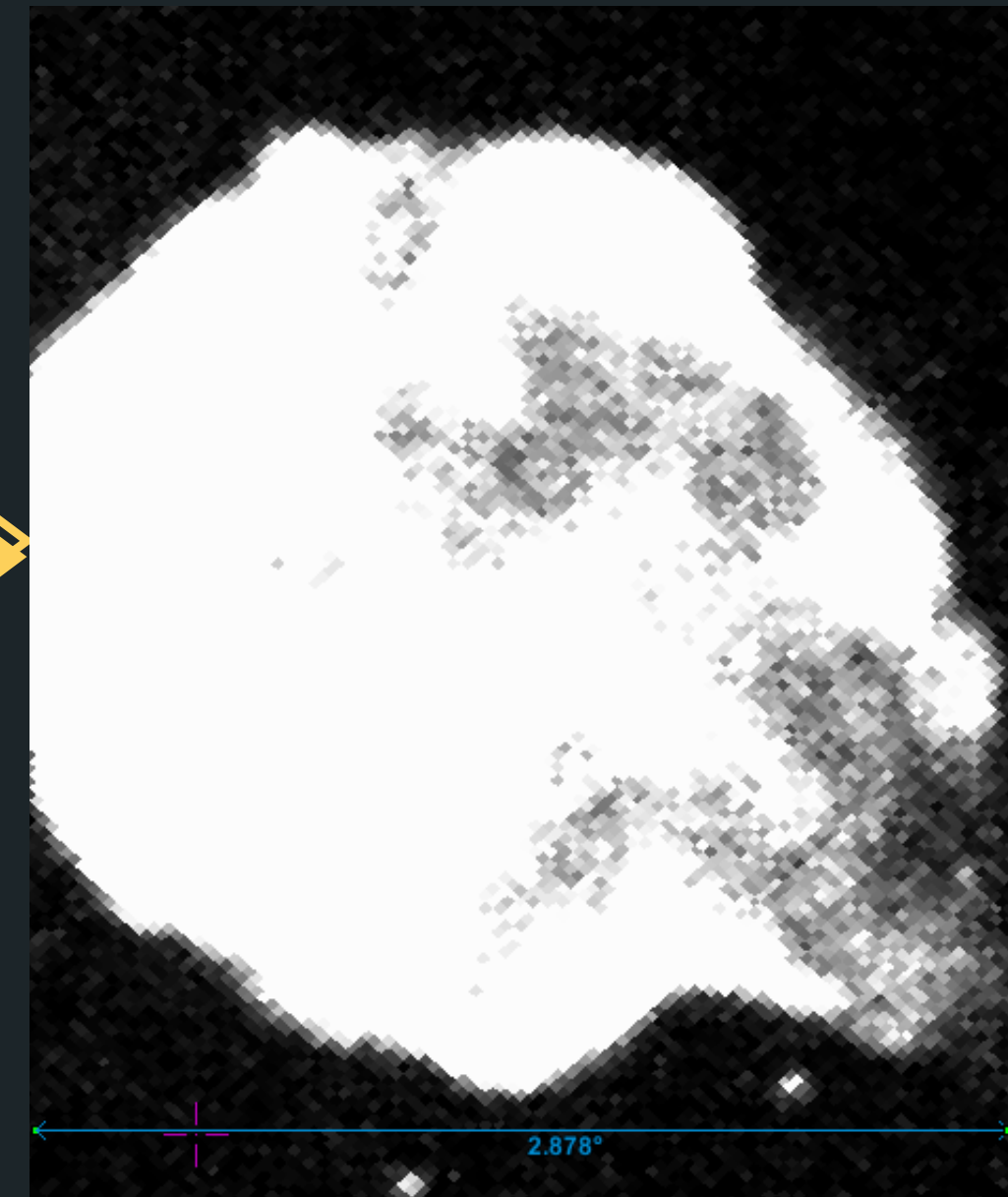
Spatial flux
representation needed



Located object



fixed value of N_H column density



CYGNUS LOOP

Hips2fits image of an SNR

located at RA=73.9816

DEC=-8.5645

Size = 2.878°

Cosmic X rays background

1

BIBLIOGRAPHIC RESEARCH

"The 2-8 keV cosmic X-ray background spectrum as observed with XMM-Newton"
by Andrea De Luca and Silvano Molendi

2

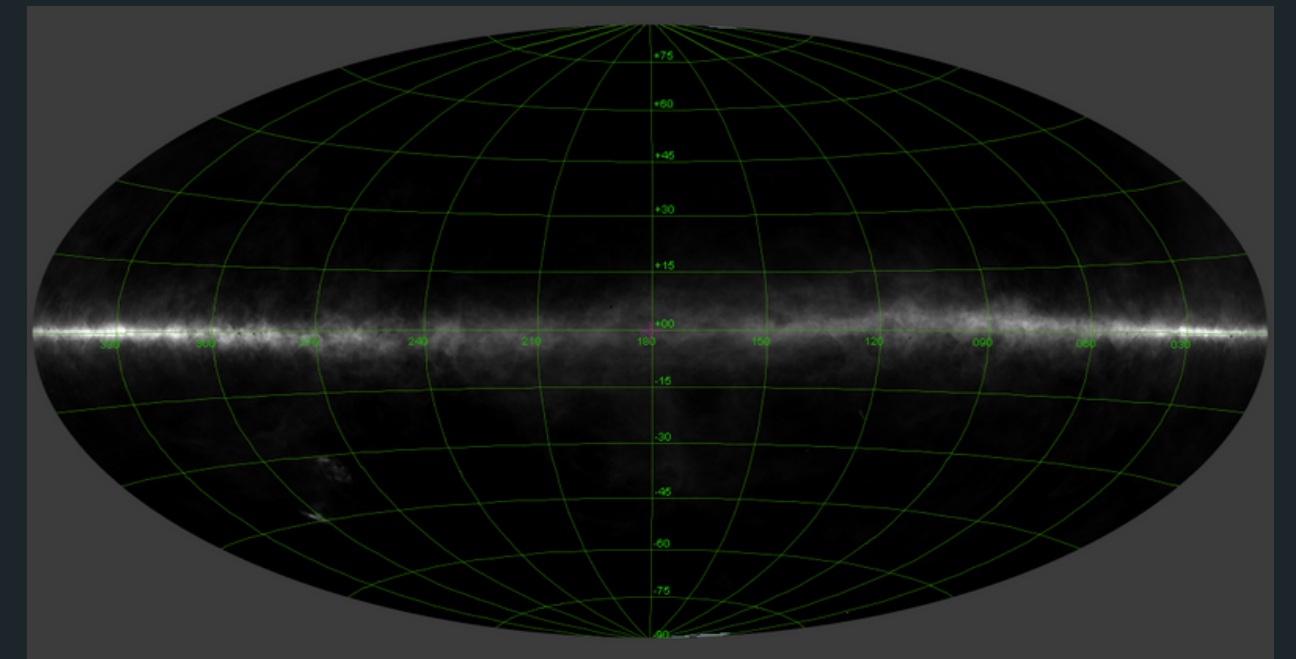
PROPERTIES

isotropic background
Power law spectrum
(Gamma=1.41)
fixed Flux = $(2.24 \pm 0.16) \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ deg}^{-2}$ in 2-10keV energy band

3

IMPLEMENTATION

Full sky cut in 32 (45*45)deg² images with a flux per image of $2.24 \times 10^{-11} \times (45 \times 45) = 4.536 \times 10^{-8} \text{ erg cm}^{-2} \text{ s}^{-1}$
Nh collumn density images with "HI4PI" map



The HI4PI map

GXB(Galactic X rays background)

LHB(Local hot bubble)

1

BIBLIOGRAPHIC RESEARCH

"The Structure of the Local Hot Bubble"
by Wenhao Liu ...

3

PROPERTIES

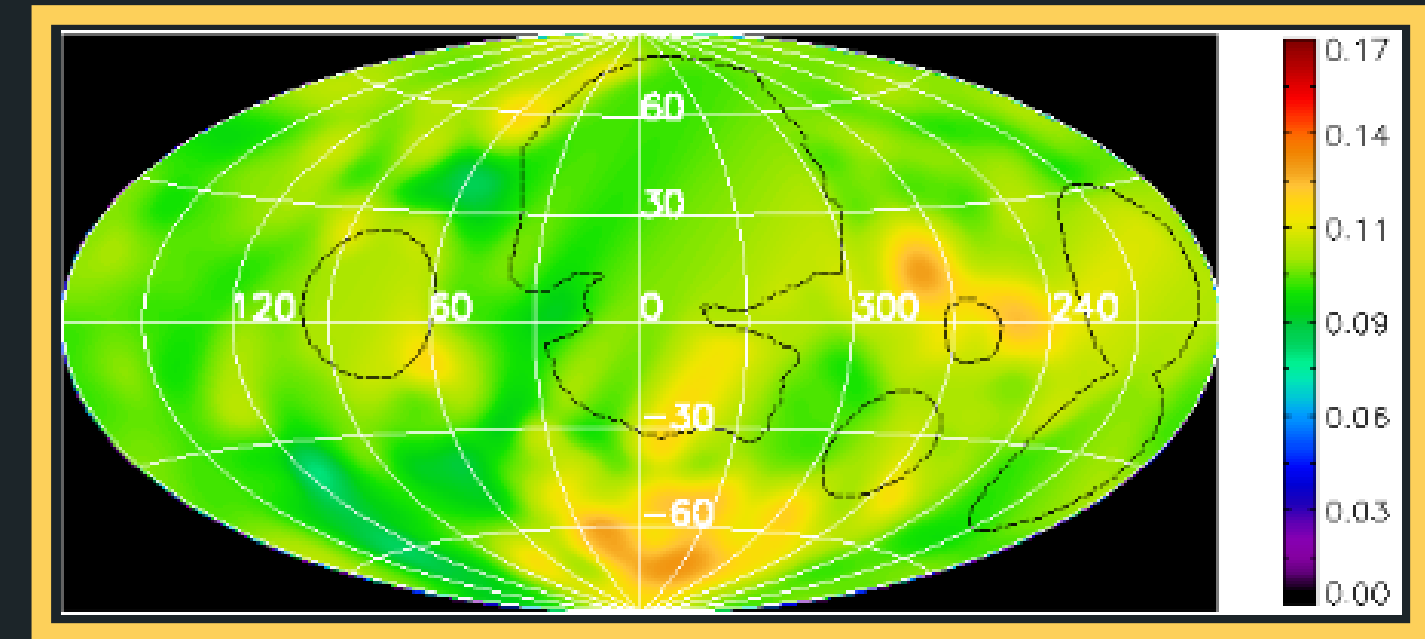
Fixed temperature = 0.097 keV
Anisotropic emission and flux
no Nh cause of his locality
Hot gas → mekal spectrum

IMPLEMENTATION

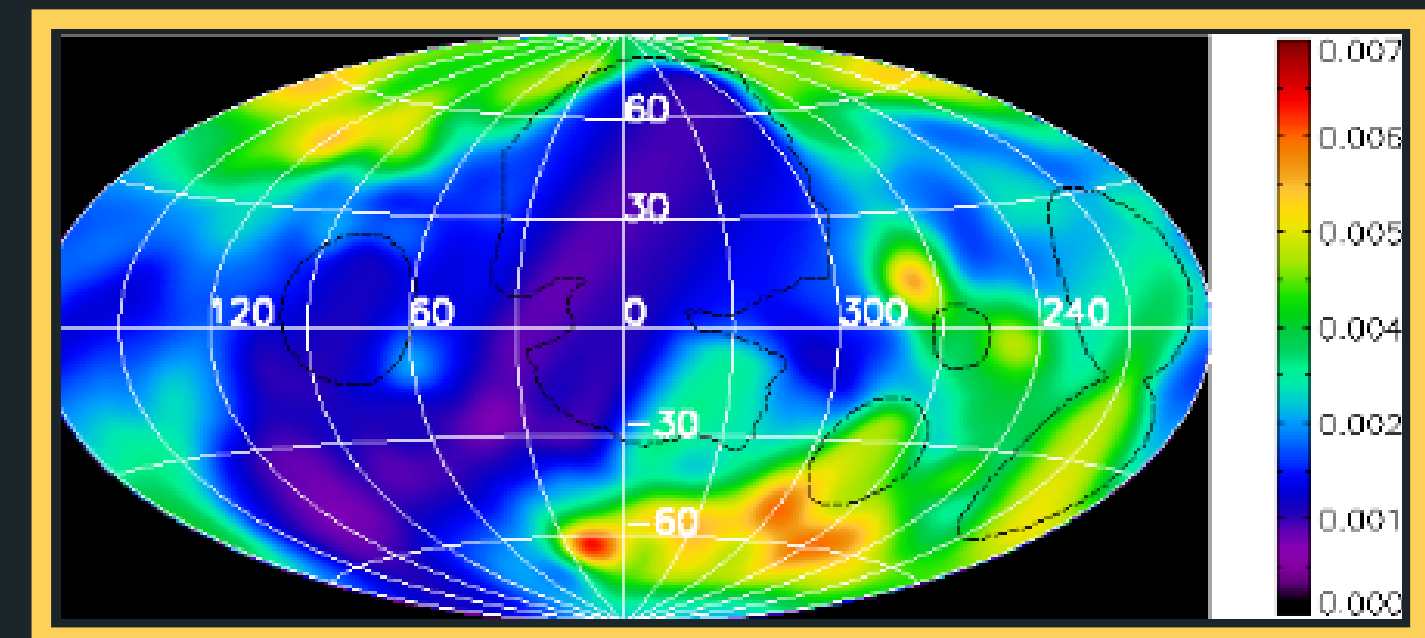
Full sky cut in 32 (45*45)deg² images with
a flux per image oof $9.598 \cdot 10^{-8}$ erg s⁻¹ cm⁻².

-No Nh values cause of his locality

2



The Aitoff-Hammer projection of the LHB temperature in keV



The Aitoff-Hammer projection of the LHB tLHB emission
measure in cm⁻⁶pc

Conclusion

Going futher

internship review

- 1** All the codes and the files created are modular you can add or improve the final input file
- 2** Create a virtual telescope
Use SIXTE and specifiy the input file, telescope and the position of the object you want to study

THANKS

I would first like to thank the entire teaching staff of the Faculty of Physics and Engineering and the professional contributors responsible for basic physical training, for having provided the administrative part of it.

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