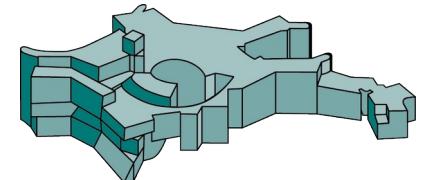


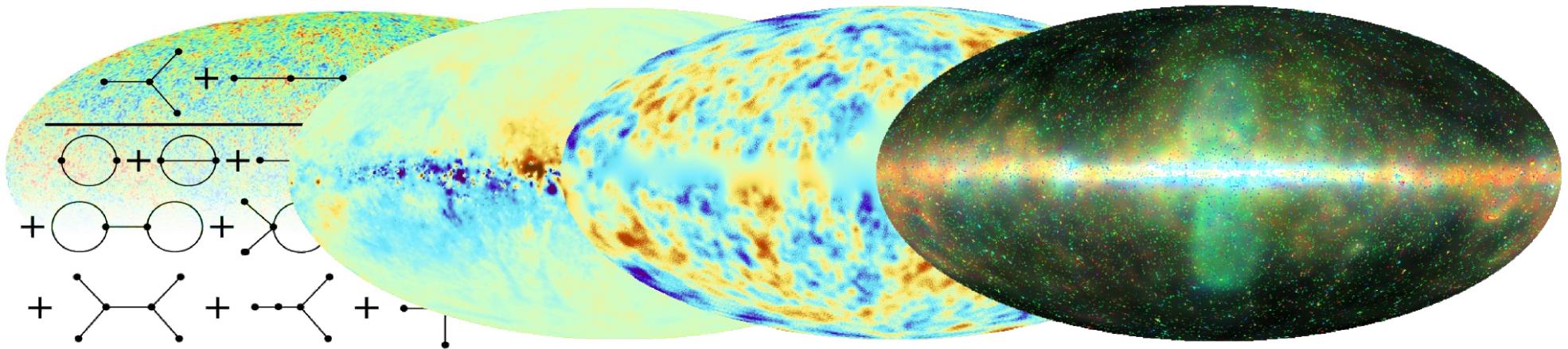
Information field theory



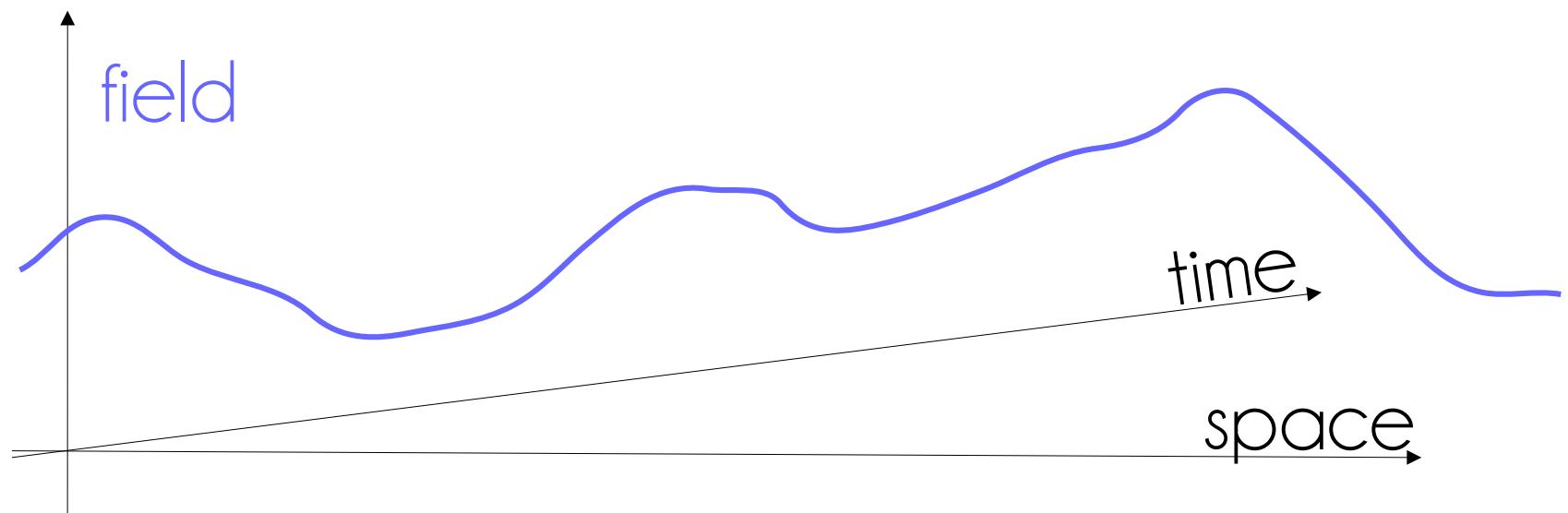
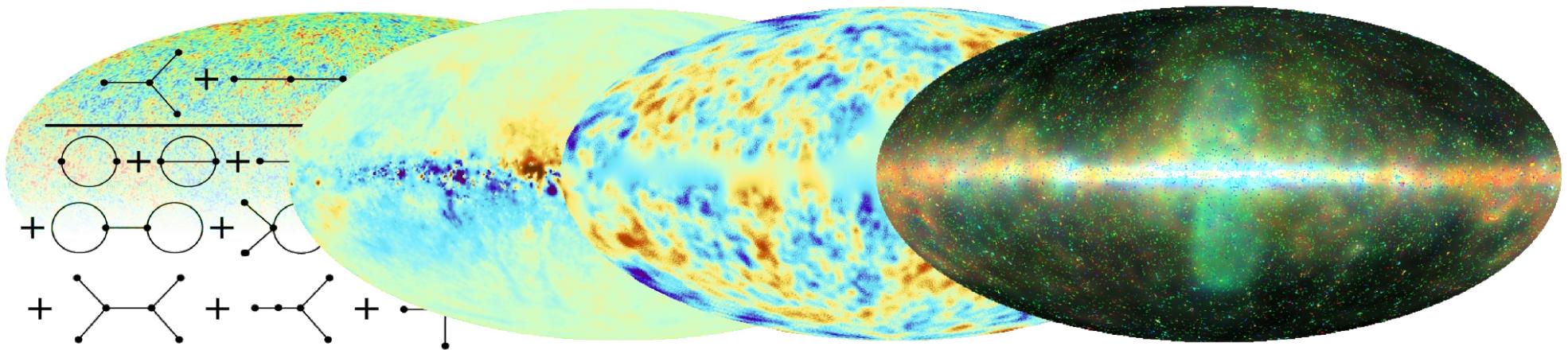
Torsten Enßlin
MPI for Astrophysics
Ludwig Maximilian University Munich

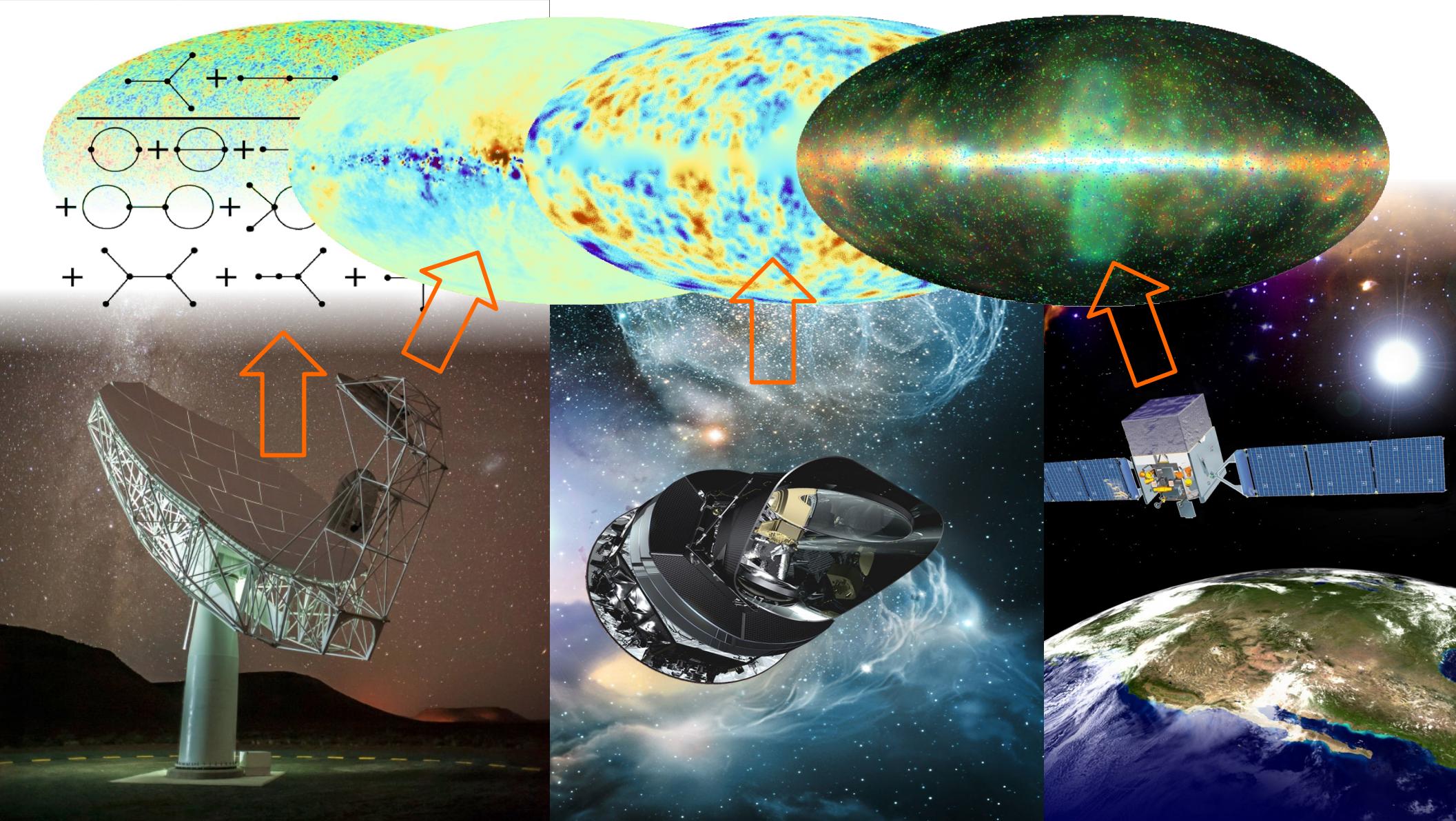


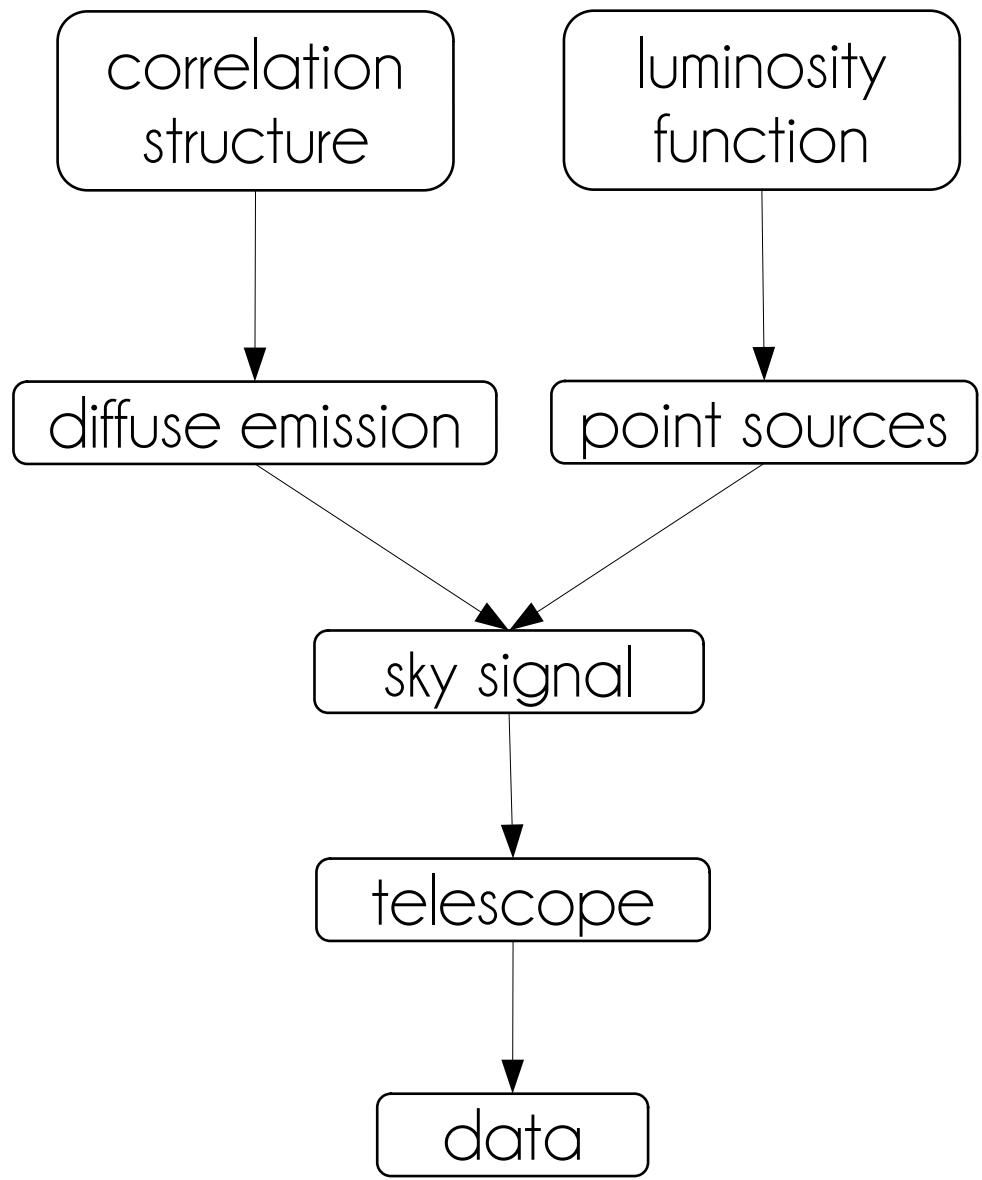
IFT Team: Philipp Arras, Michael Bell, Vanessa Böhm, Sebastian Dorn, Martin Dupont, Mona Frommert, Philipp Frank, Mahsa Chaempanah, Maksim Greiner, Philipp Haim, Sebastian Hutschenreuter, Henrik Junklewitz, Francisco-Shu Kitaura, Jakob Knollmüller, Christoph Lienhard, Reimar Leike, Anca Müller, Johannes Oberpriller, Niels Oppermann, Natalia Porquerese, Daniel Pumpe, Tiago Ramalho, Martin Reinecke, Julia Stadler, Marco Selig, Theo Steininger, Valentina Vacca, Cornelius Weig, Margret Westerkamp, & many more

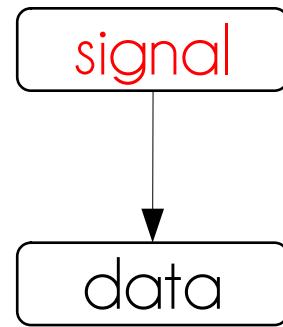


Information theory for fields











Correlations





7

[Search docs](#)[IFT - Information Field Theory](#)[Discretisation and Volume in NIFTy](#)[Gallery](#)[Installation](#)[Code Overview](#)[NIFTy-related publications](#)[Package Documentation](#)

NIFTy – Numerical Information Field Theory

NIFTy^{1 2 3}, “Numerical Information Field Theory”, is a versatile library designed to enable the development of signal inference algorithms that are independent of the underlying grids (spatial, spectral, temporal, ...) and their resolutions. Its object-oriented framework is written in Python, although it access libraries written in C++ and C for efficiency.

NIFTy offers a toolkit that abstracts discretized representations of continuous spaces, fields in these spaces, and operators acting on these fields as classes. This allows for an abstract formulation and programming of inference algorithms, including those derived within information field theory. NIFTy’s interface is designed to resemble common formulae in the sense that the user implements algorithms in NIFTy independent of the topology of the underlying spaces and the discretization scheme. Thus, the user can develop algorithms on subsets of problems and on spaces where the detailed performance of the algorithm can be properly evaluated and then easily generalized to other, more complex spaces and the full problem, respectively.

Differentiable Probabilistic Programming in Python



7

Search docs

IFT - Information Field Theory

Discretisation and Volume in NIFTy

Gallery

Installation

Code Overview

NIFTy-related publications

Package Documentation

correlation
structure

luminosity
function

diffuse emission

point sources

sky signal

telescope

data





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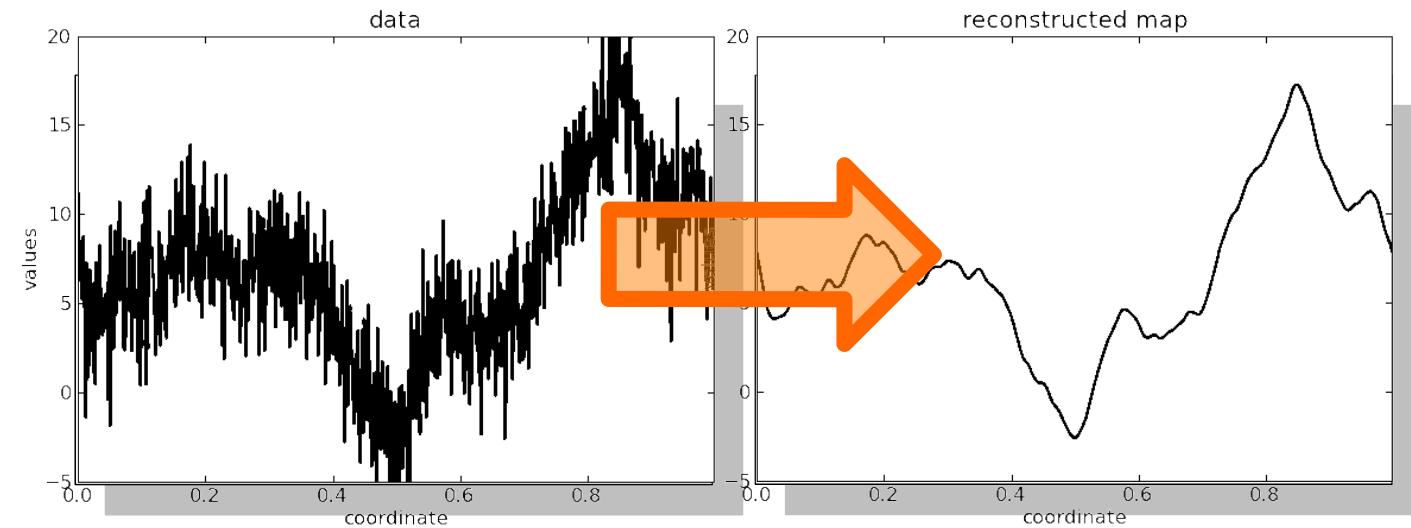
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Gallery

Installation

Code Overview

NIFTy-related publications



```
import nifty7 as ift  
s_space = ift.RGSpace([N])
```



7

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IFT – Information Field Theory

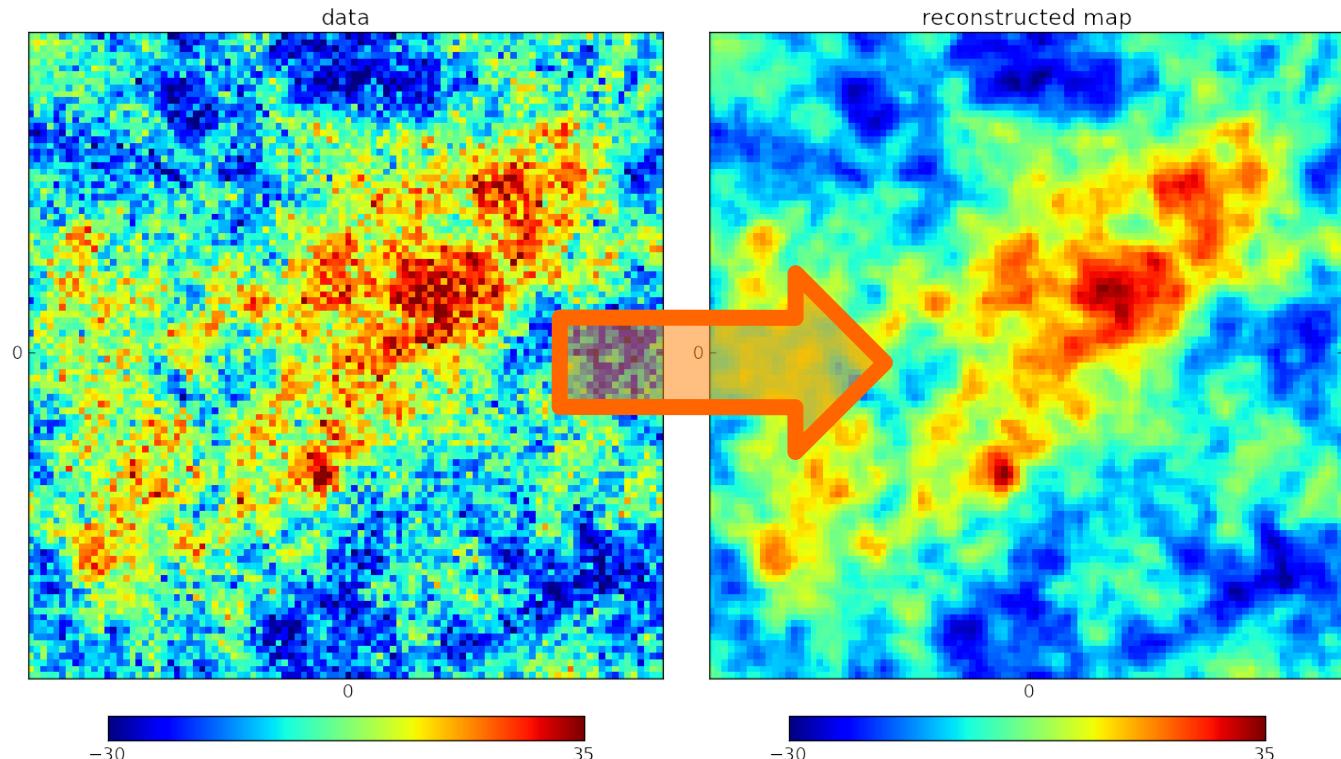
Discretisation and Volume in NIFTy

Gallery

Installation

Code Overview

NIFTy-related publications



```
import nifty7 as ift  
s_space = ift.RGSpace([N,N])
```

NIFTY



7

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IFT - Information Field Theory

Discretisation and Volume in NIFTy

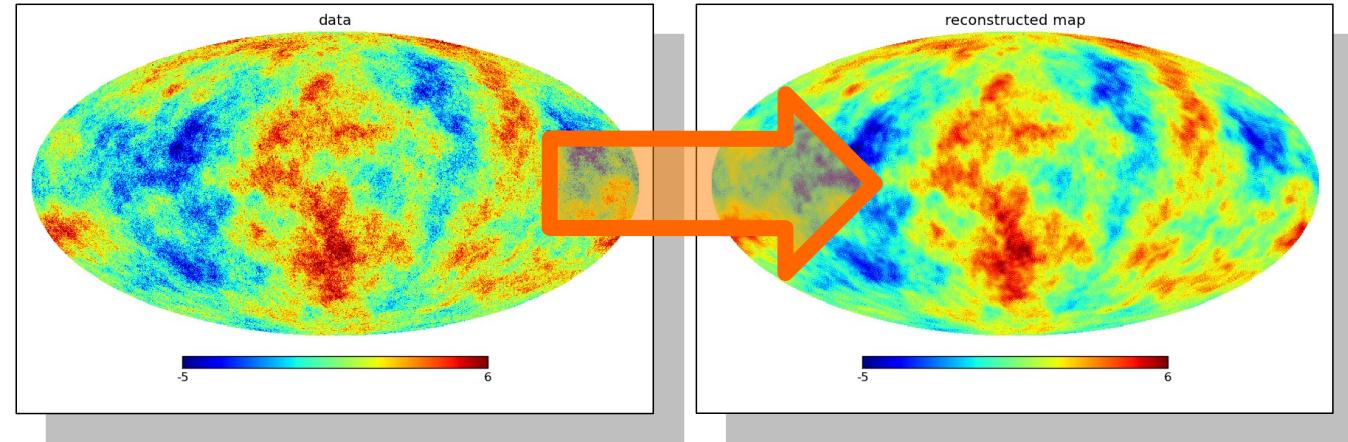
Gallery

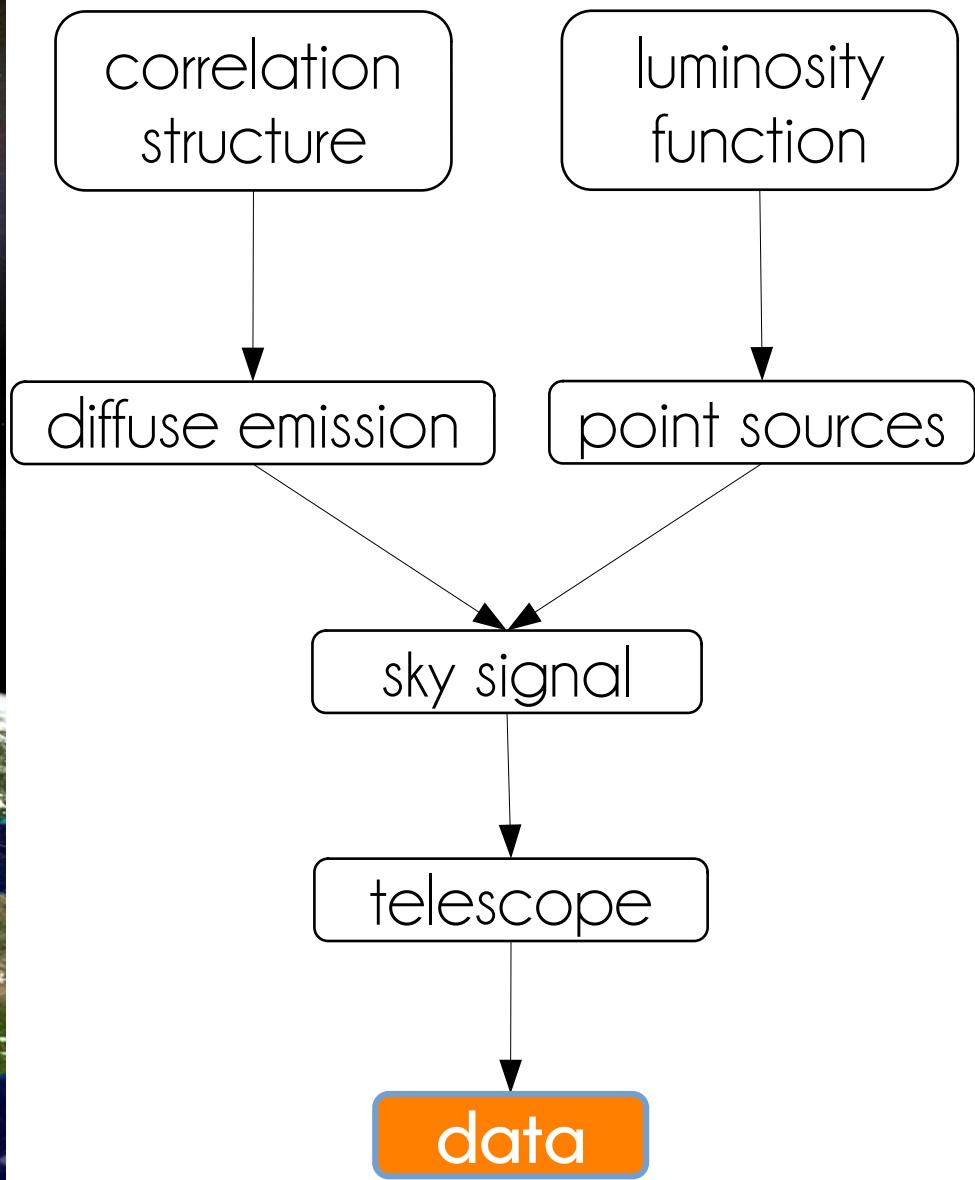
Installation

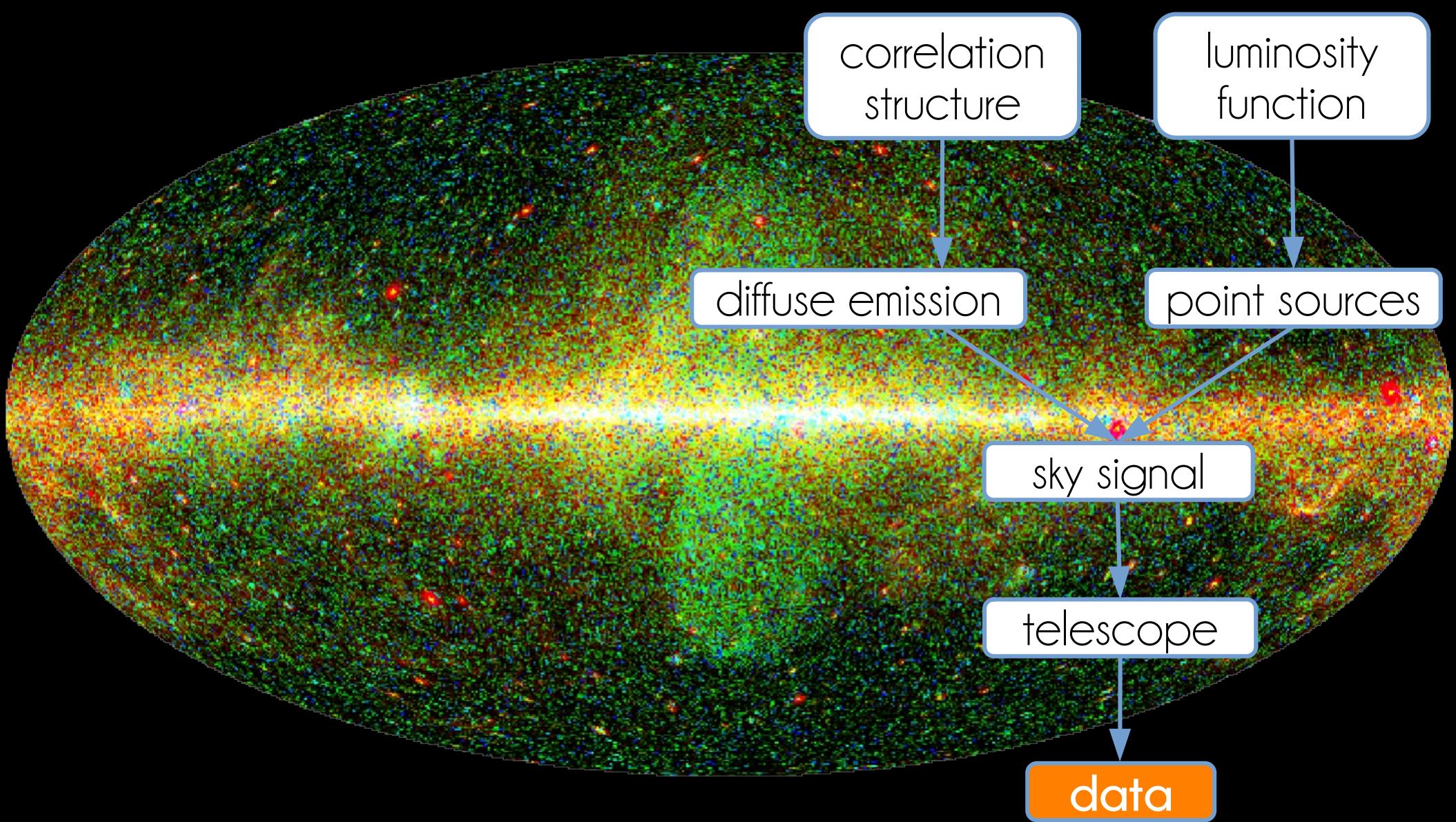
Code Overview

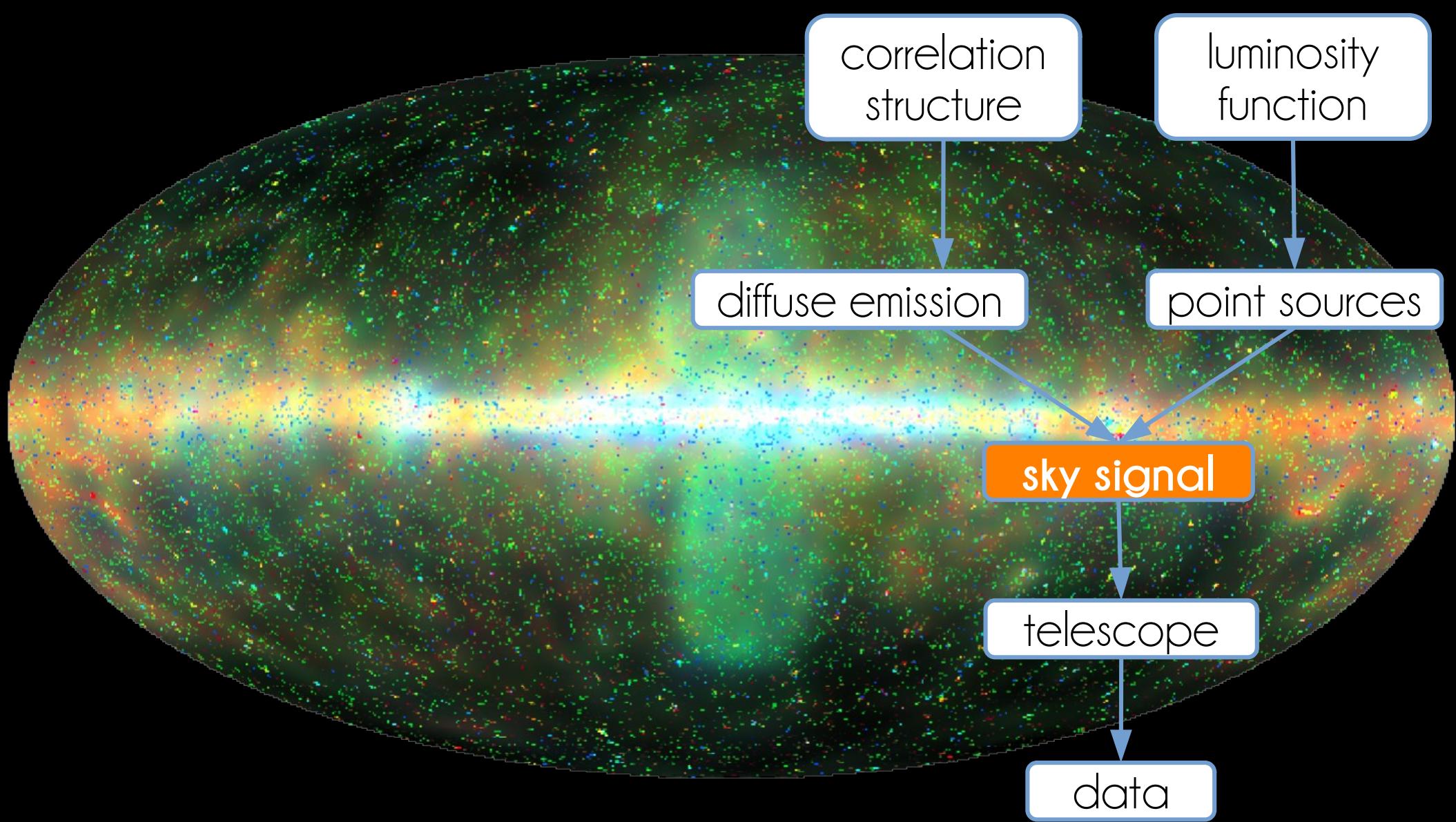
NIFTy-related publications

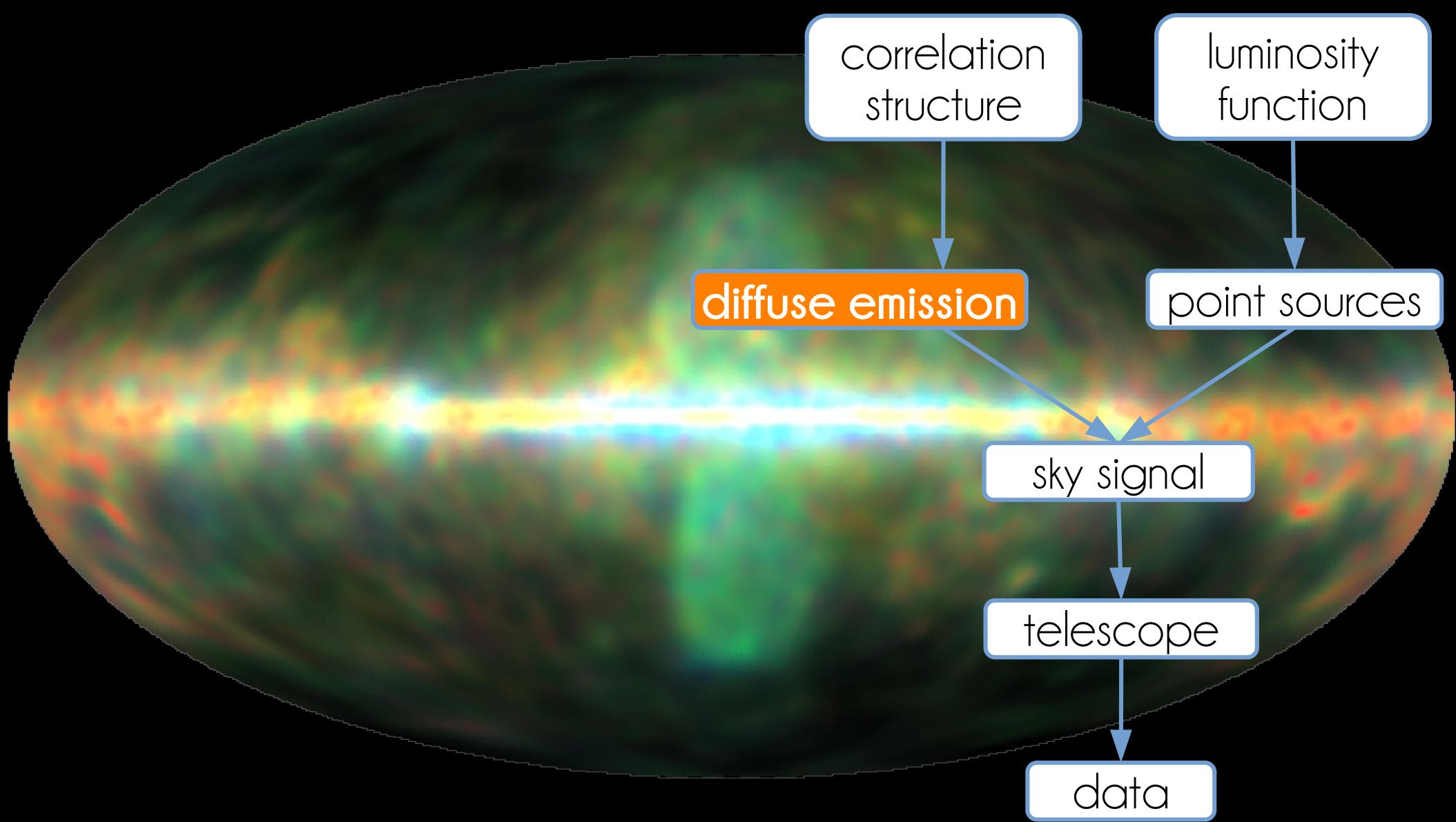
```
import nifty7 as ift  
s_space = ift.HPSpace(NSide)
```



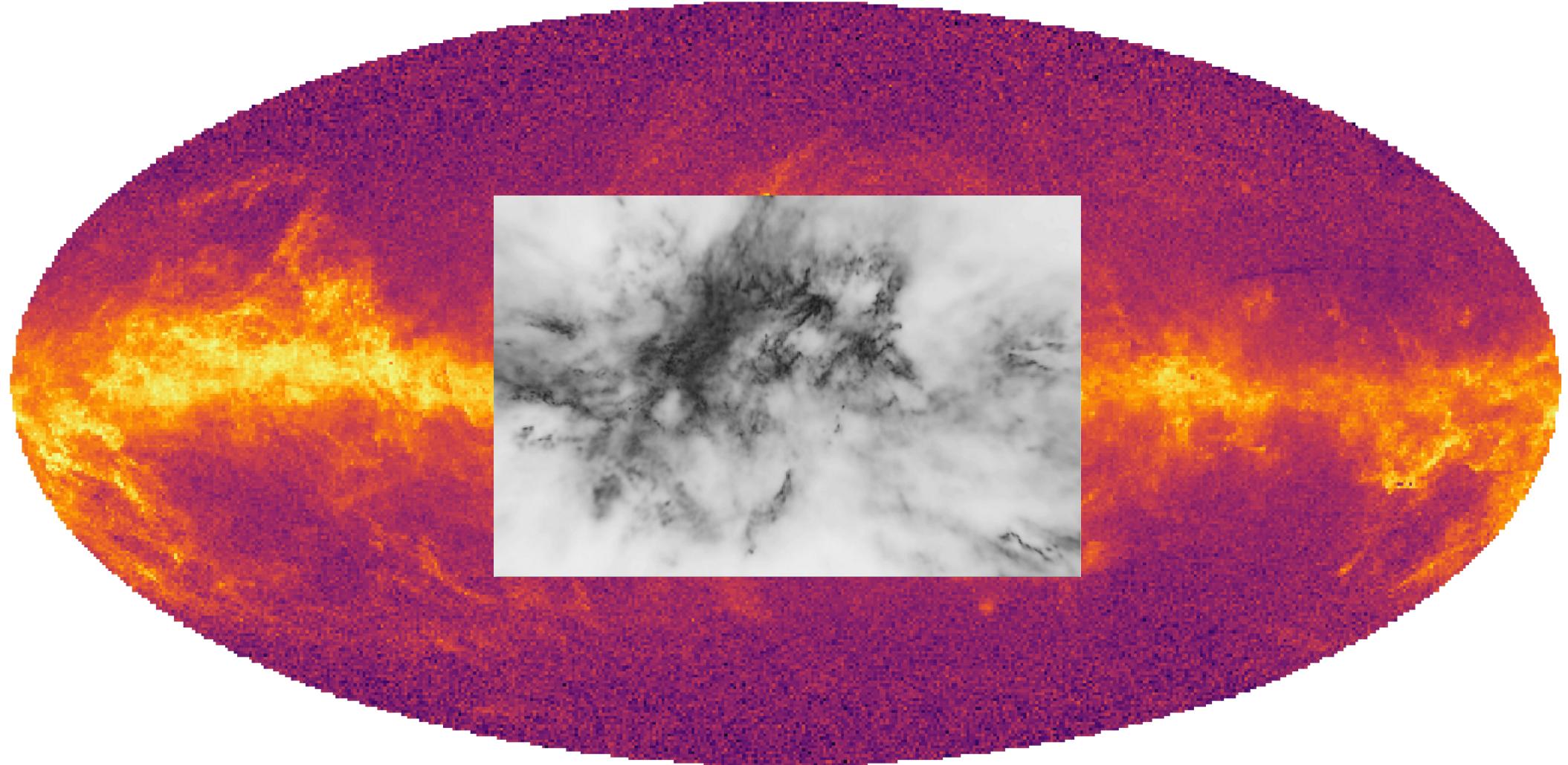








Starlight absorption by dust

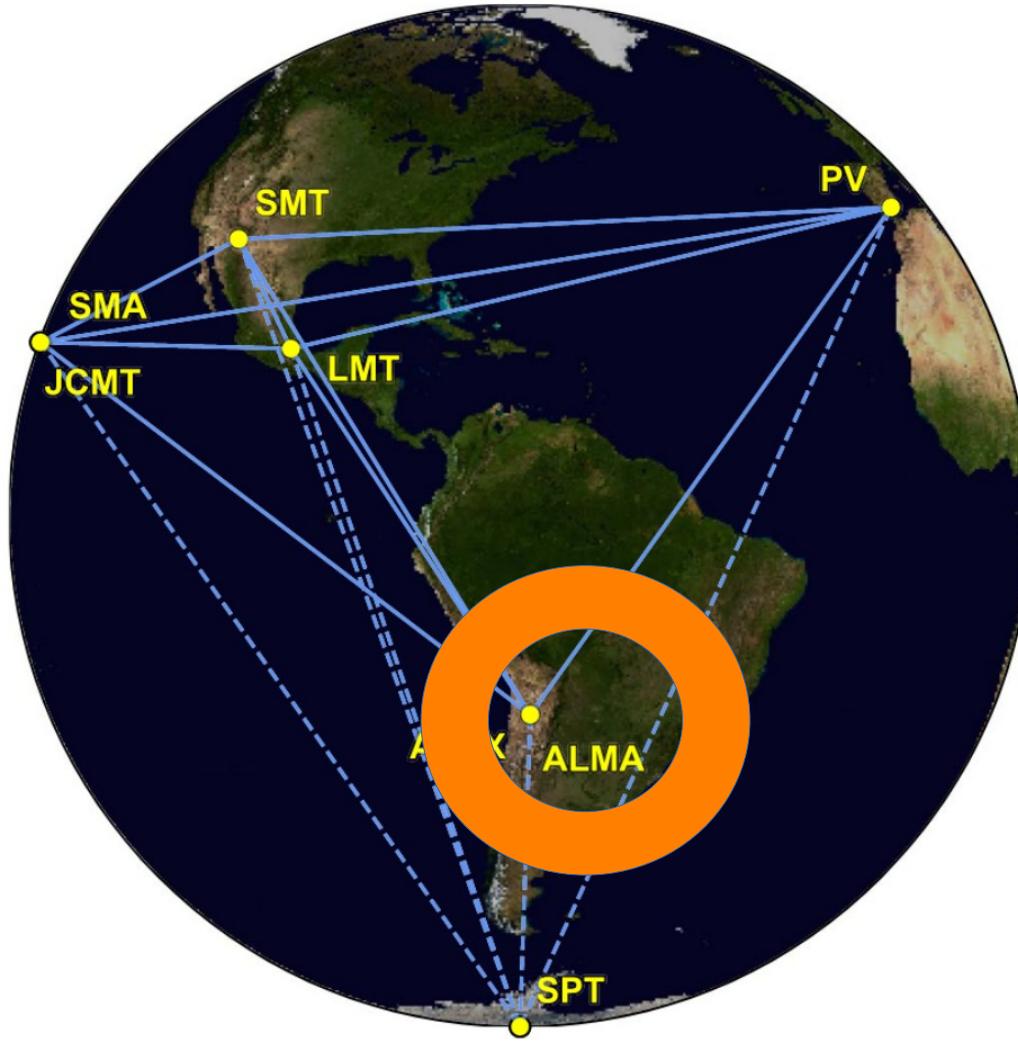


Leike & Enßlin (2019.)



10^8 voxel

Event Horizon Telescope

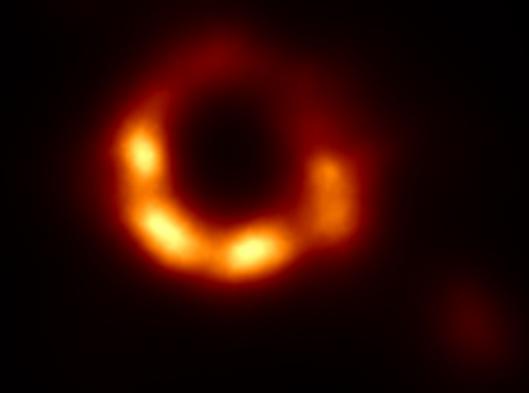


M87*

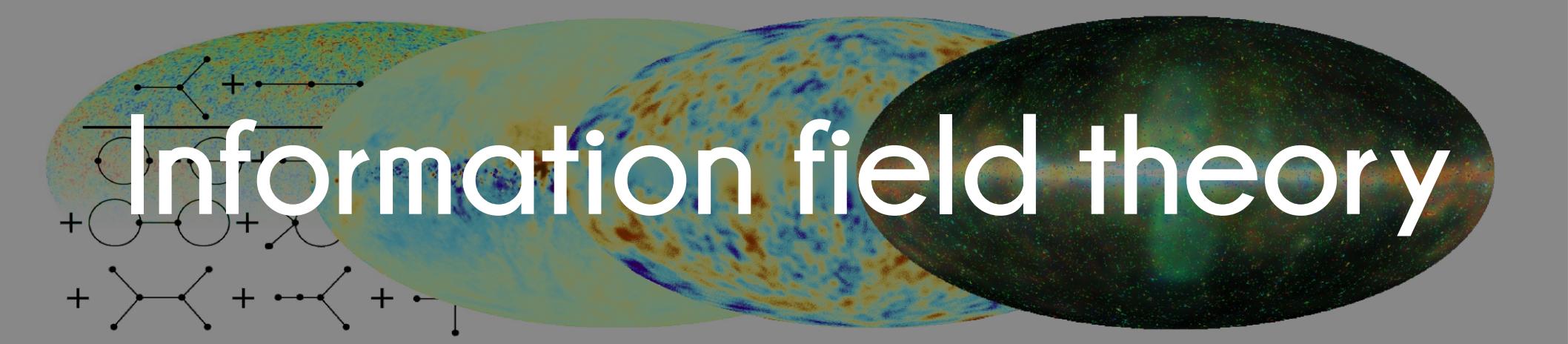


Event Horizon
Telescope
Collaboration
(2019)

M87*



Arras, Frank, Haim,
Knollmüller, Leike,
Reinecke, Enßlin
(2020)

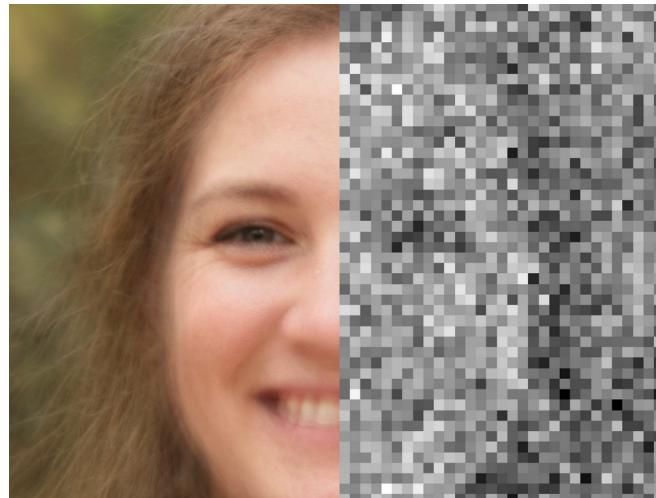


Information field theory

in ErUM-Data:

- (i) digital twins of instruments
- (ii) algorithmic advances
- (iii) interfacing other ML frameworks

Information field theory



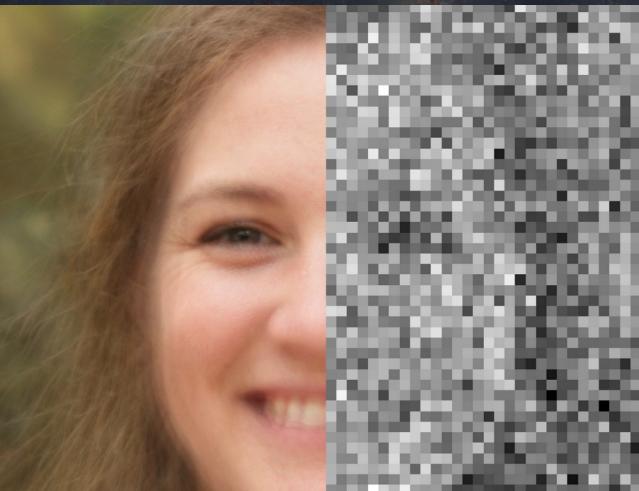
Knollmüller & Enßlin (2021)

Information field theory

IFT is big data



IFT is AI



IFT is for you

NIFTy software package:
ift.pages.mpcdf.de/nifty

IFT resource page:
wwwmpa.mpa-garching.mpg.de/ift