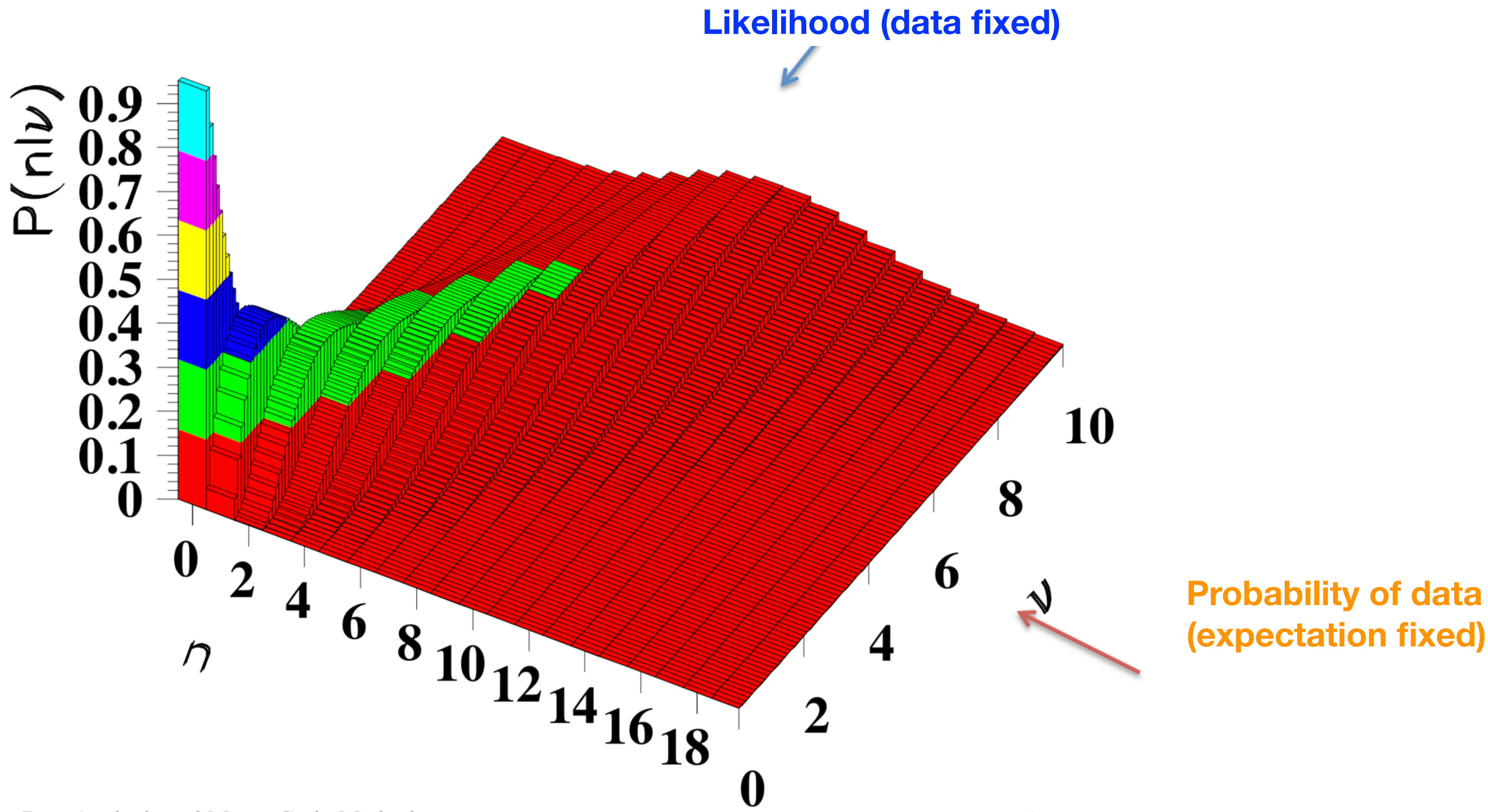
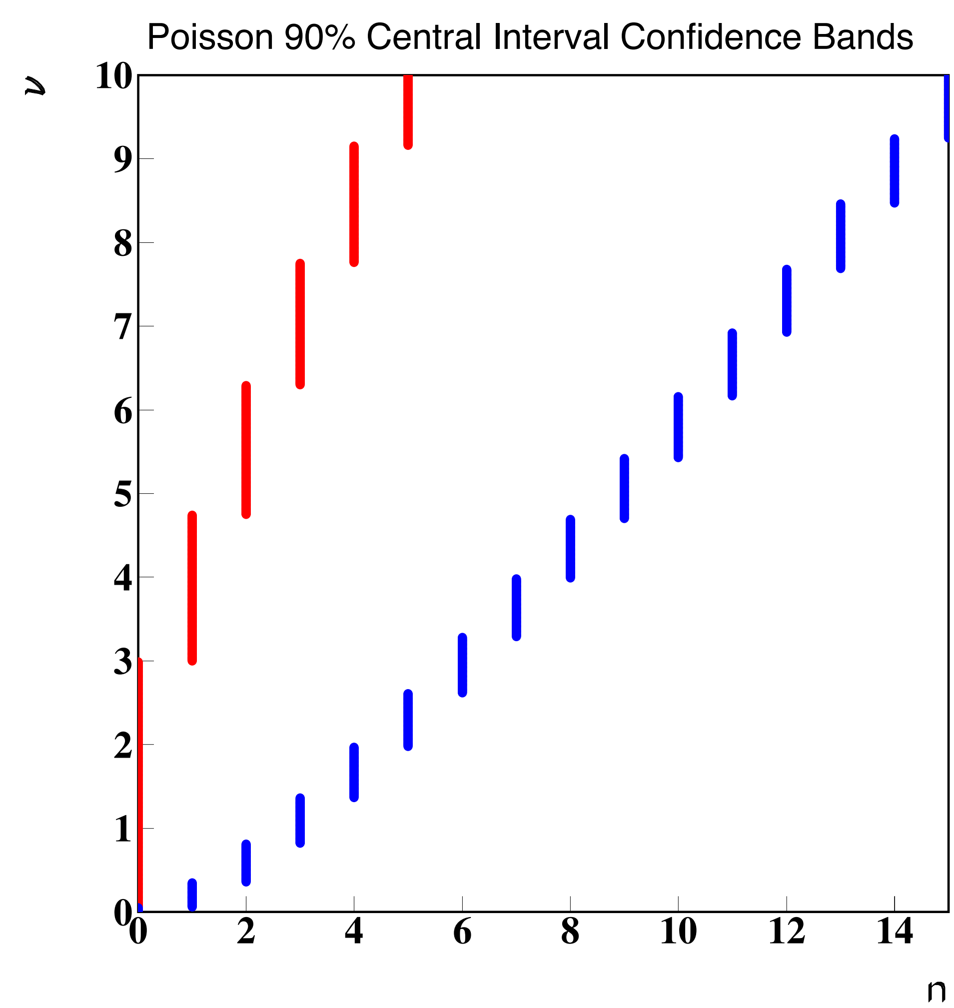
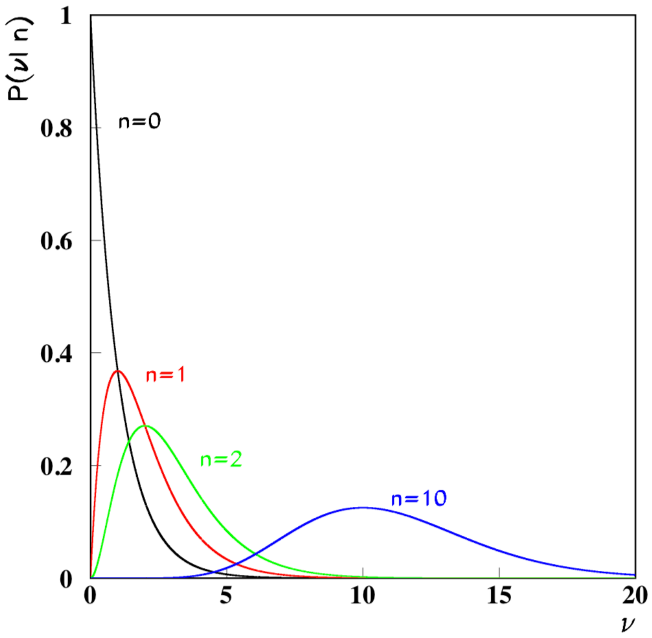
Poisson Distribution

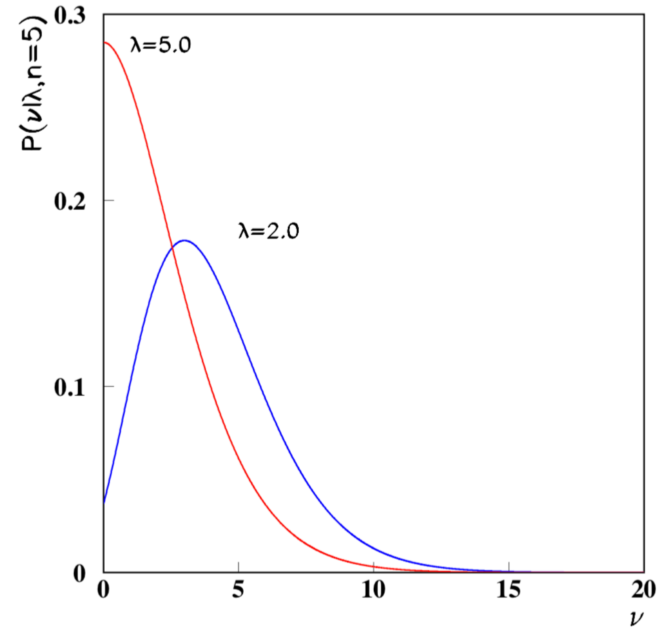


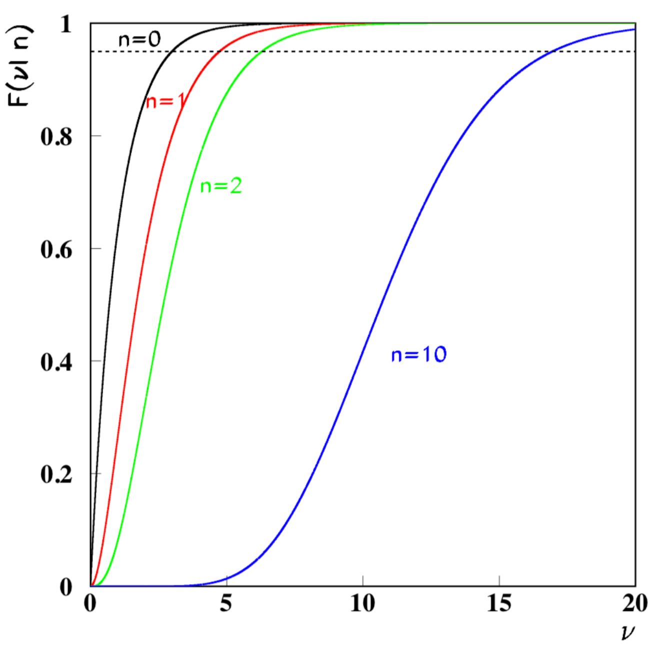
$$\nu = 10/3$$

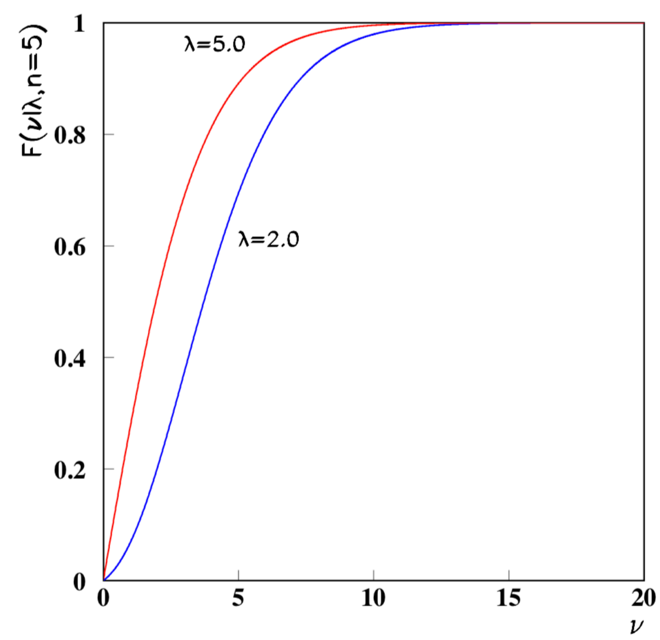
n	$P(n\|\nu)$	$F(n\|\nu)$	R	$F_R(n\|\nu)$
0	0.0357	0.0357	7	0.9468
1	0.1189	0.1546	5	0.8431
2	0.1982	0.3528	2	0.4184
3	0.2202	0.5730	1	0.2202
4	0.1835	0.7565	3	0.6019
5	0.1223	0.8788	4	0.7242
6	0.0680	0.9468	6	0.9111
7	0.0324	0.9792	8	0.9792
8	0.0135	0.9927	9	0.9927
9	0.0050	0.9976	10	0.9976
10	0.0017	0.9993	11	0.9993
11	0.0005	0.9998	12	0.9998
12	0.0001	1.0000	13	1.0000



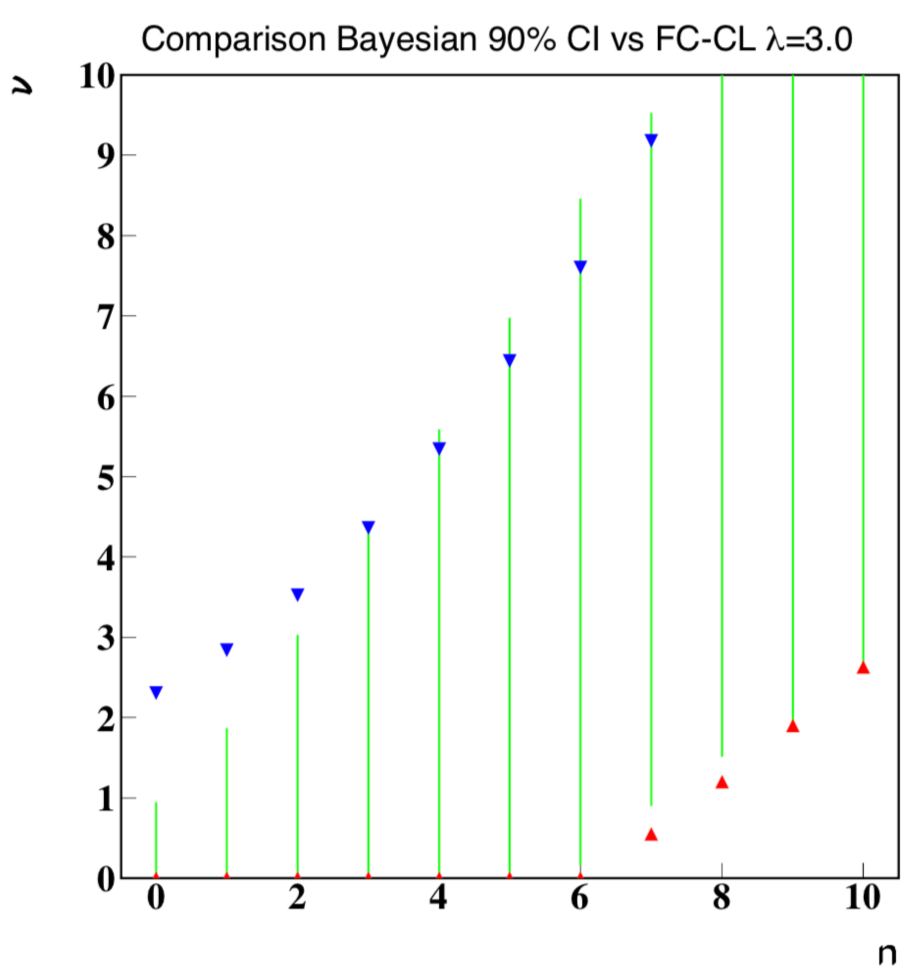




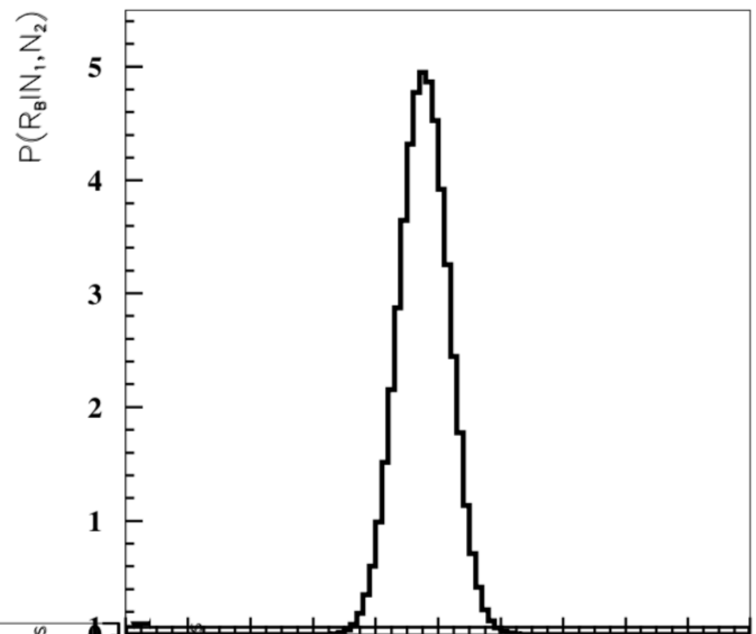




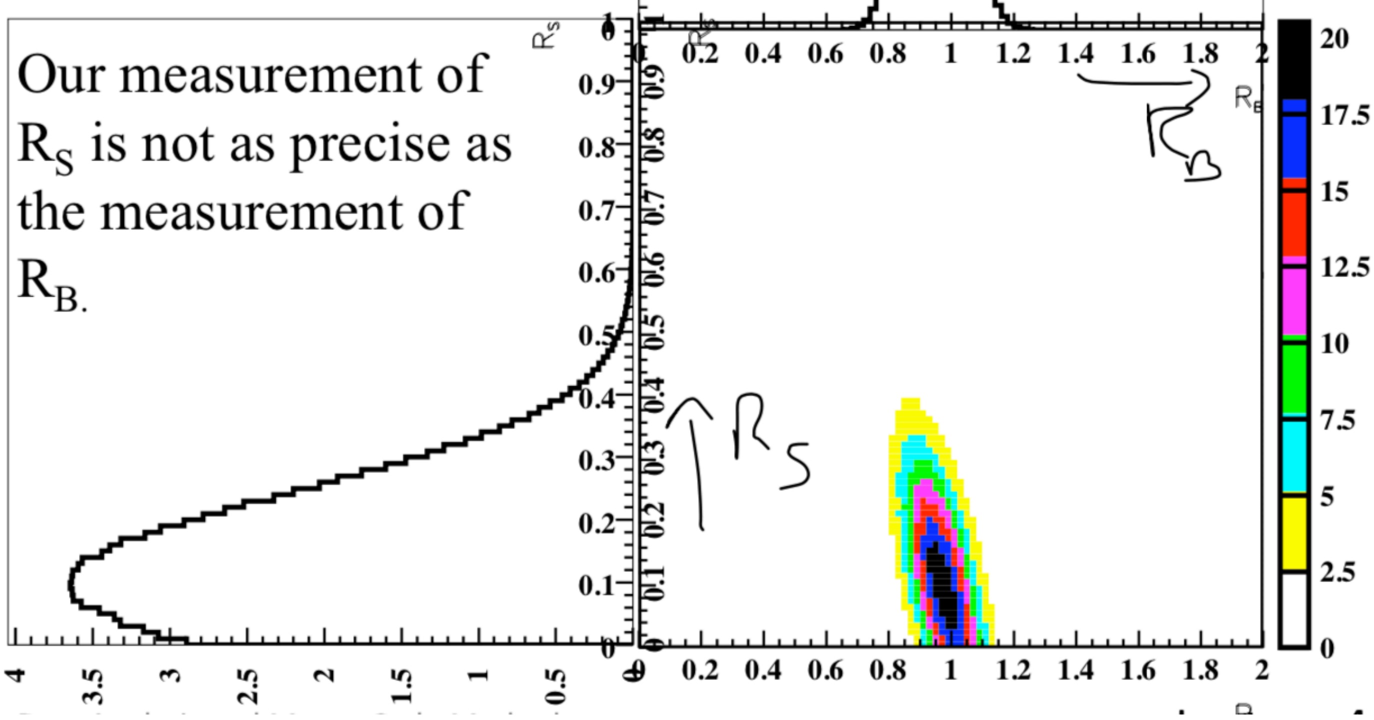
n	$P(n\|\mu)$	$\hat{\mu}$	$P(n\|\hat{\mu})$	r	Rank	$F_R(n\|\mu)$
0	0.0357	3.0	0.050	0.717	5	0.7565
1	0.1189	3.0	0.149	0.796	4	0.7208
2	0.1982	3.0	0.224	0.885	3	0.6091
3	0.2202	3.0	0.224	0.983	1	0.2202
4	0.1835	4.0	0.195	0.941	2	0.4037
5	0.1223	5.0	0.175	0.699	6	0.8788
6	0.0680	6.0	0.161	0.422	7	0.9468
7	0.0324	7.0	0.149	0.217	8	0.9792
8	0.0135	8.0	0.140	0.096	9	0.9927
9	0.0050	9.0	0.132	0.038	10	0.9976
10	0.0017	10.0	0.125	0.014	11	0.9993
11	0.0005	11.0	0.119	0.004	12	0.9998
12	0.0001	12.0	0.114	0.001	13	1.0000



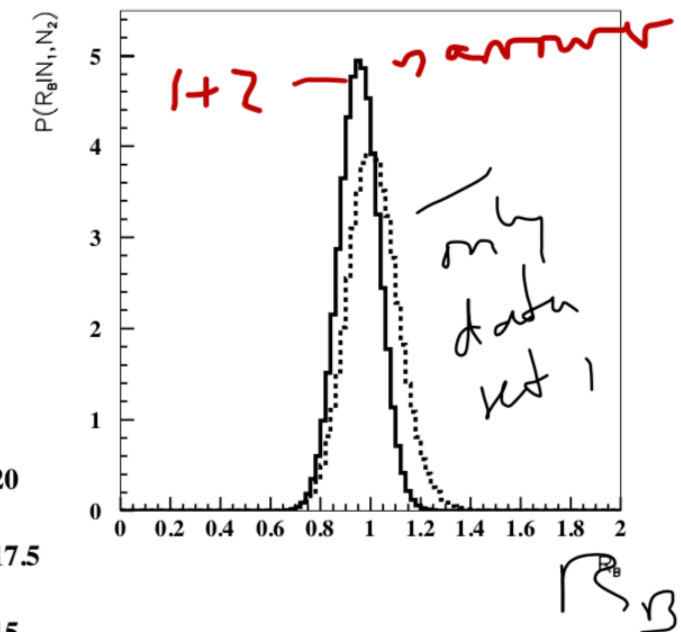
Radioactive Decay



Our measurement of R_S is not as precise as the measurement of R_B.

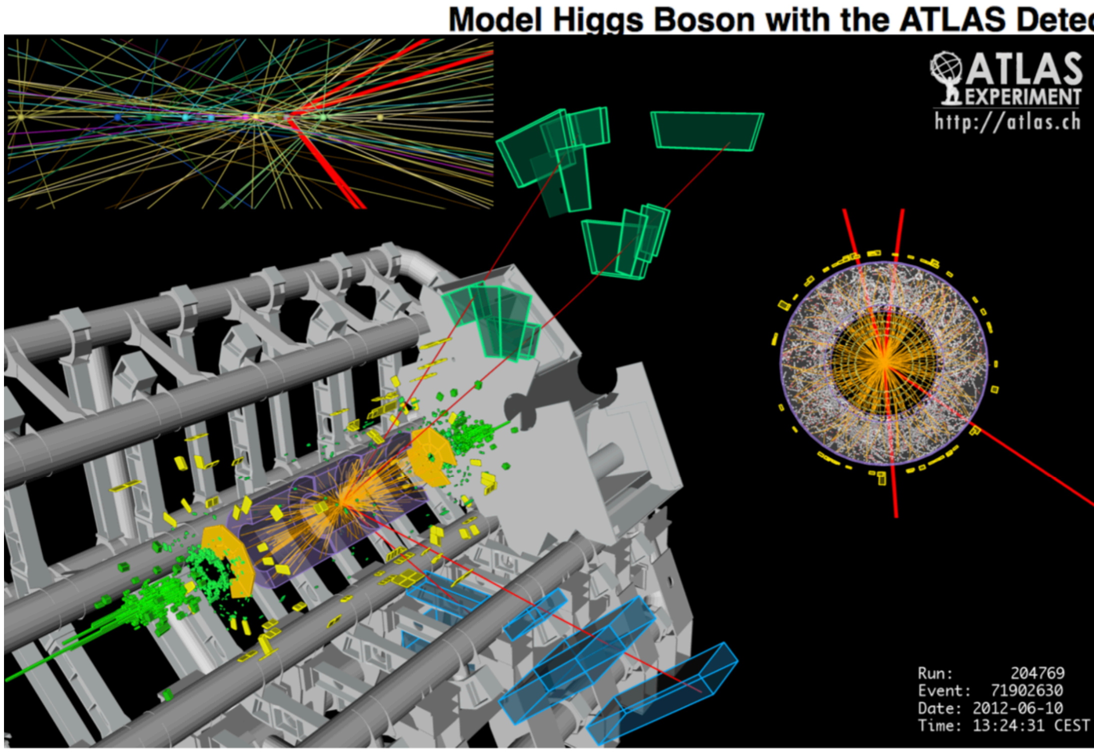


The measurement of R_B has improved.

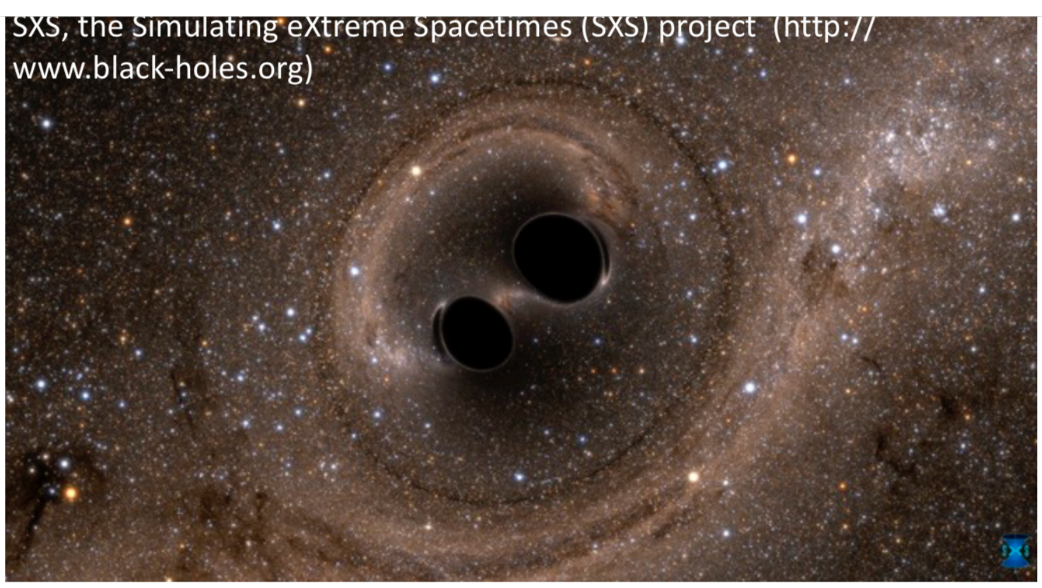


Data Set	Source in/out	Run Time	Events
1	Out	100	100
2	In	100	110

Observation of a New Particle in the Search for the Standard Model Higgs Boson with the ATLAS Detector at the LHC



A search for the Standard Model Higgs boson in proton-proton collisions with the ATLAS detector at the LHC is presented. The datasets used correspond to integrated luminosities of approximately 4.8 fb^{-1} collected at $\sqrt{s} = 7$ TeV in 2011 and 5.8 fb^{-1} at $\sqrt{s} = 8$ TeV in 2012. Individual searches in the channels $H \to ZZ^{(*)} \to 4\ell$, $H \to \gamma\gamma$ and $H \to WW^{(*)} \to e\nu\mu\nu$ in the 8 TeV data are combined with previously published results of searches for $H \to ZZ^{(*)}$, $WW^{(*)}$, bb and $\tau^+\tau^-$ in the 7 TeV data and results from improved analyses of the $H \to ZZ^{(*)} \to 4\ell$ and $H \to \gamma\gamma$ channels in the 7 TeV data. Clear evidence for the production of a neutral boson with a measured mass of $126.0 \pm 0.4\ (\mathrm{stat}) \pm 0.4\ (\mathrm{sys})$ GeV is presented. This observation, which has a significance of 5.9 standard deviations, corresponding to a background fluctuation probability of 1.7×10^{-9}, is compatible with the production and decay of the Standard Model Higgs boson.



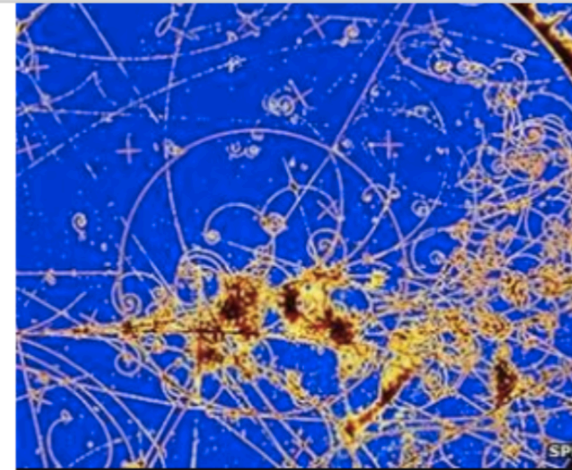
Observation of Gravitational Waves from a Binary Black Hole Merger

B. P. Abbott *et al.**
(LIGO Scientific Collaboration and Virgo Collaboration)
(Received 21 January 2016; published 11 February 2016)

On September 14, 2015 at 09:50:45 UTC the two detectors of the Laser Interferometer Gravitational-Wave Observatory simultaneously observed a transient gravitational-wave signal. The signal sweeps upwards in frequency from 35 to 250 Hz with a peak gravitational-wave strain of 1.0×10^{-21}. It matches the waveform predicted by general relativity for the inspiral and merger of a pair of black holes and the ringdown of the resulting single black hole. The signal was observed with a matched-filter signal-to-noise ratio of 24 and a false alarm rate estimated to be less than 1 event per 203 000 years, equivalent to a significance greater than 5.1σ. The source lies at a luminosity distance of 410^{+160}_{-180} Mpc corresponding to a redshift $z = 0.09^{+0.03}_{-0.04}$. In the source frame, the initial black hole masses are $36^{+5}_{-4} M_\odot$ and $29^{+4}_{-4} M_\odot$, and the final black hole mass is $62^{+4}_{-4} M_\odot$, with $3.0^{+0.5}_{-0.5} M_\odot c^2$ radiated in gravitational waves. All uncertainties define 90% credible intervals. These observations demonstrate the existence of binary stellar-mass black hole systems. This is the first direct

Faster-than-light neutrino anomaly

From Wikipedia, the free encyclopedia



The results of the neutrino experiment shook the world of physics

In a March 2011 analysis of their data, scientists of the OPERA collaboration reported evidence that neutrinos they produced at CERN in Geneva and recorded at the OPERA detector at Gran Sasso, Italy, had traveled faster than light. The neutrinos were calculated to have arrived approximately 60.7 nanoseconds (60.7 billionths of a second) sooner than light would have if traversing the same distance in a vacuum. After six months of cross checking, on September 23, 2011, the researchers announced that neutrinos had been observed traveling at faster-than-light speed.[11] Similar results were obtained using higher-energy (28 GeV) neutrinos, which were observed to check if neutrinos' velocity depended on their energy. The particles were measured arriving at the detector faster than light by approximately one part per 40,000, with a 0.2-in-a-million chance of the result being a false positive, *assuming* the error were entirely due to random effects (significance of six sigma).

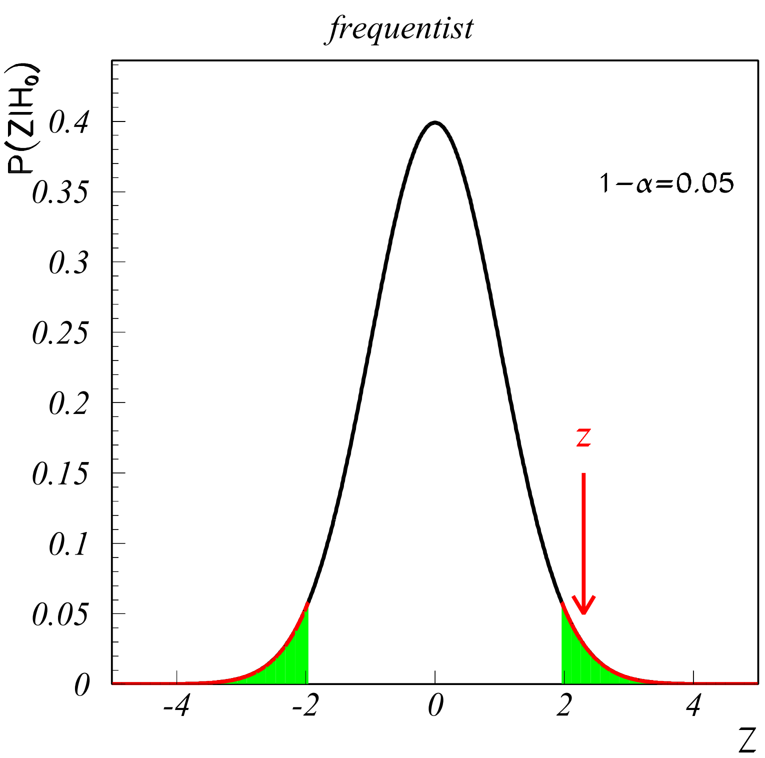
PARTICLES AND INTERACTIONS | RESEARCH UPDATE

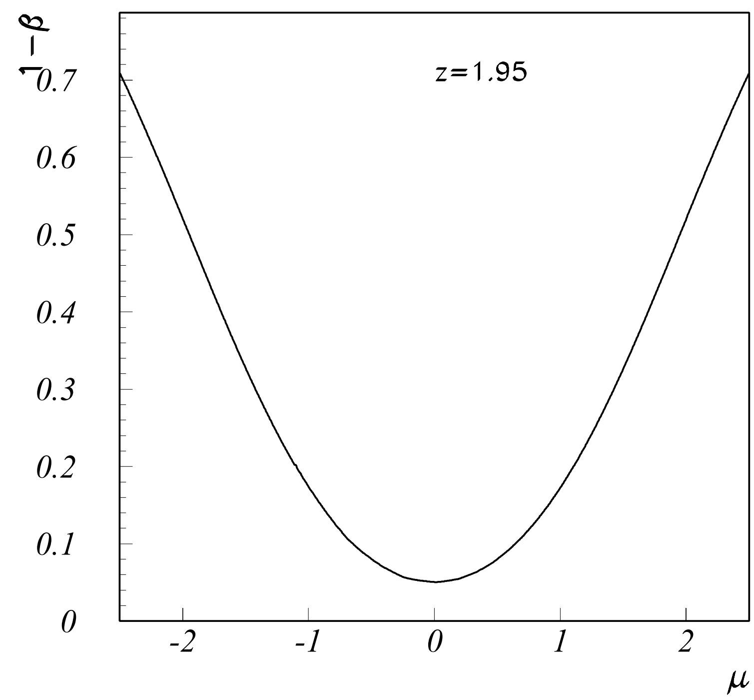
Evidence for sterile neutrinos claimed by Fermilab experiment

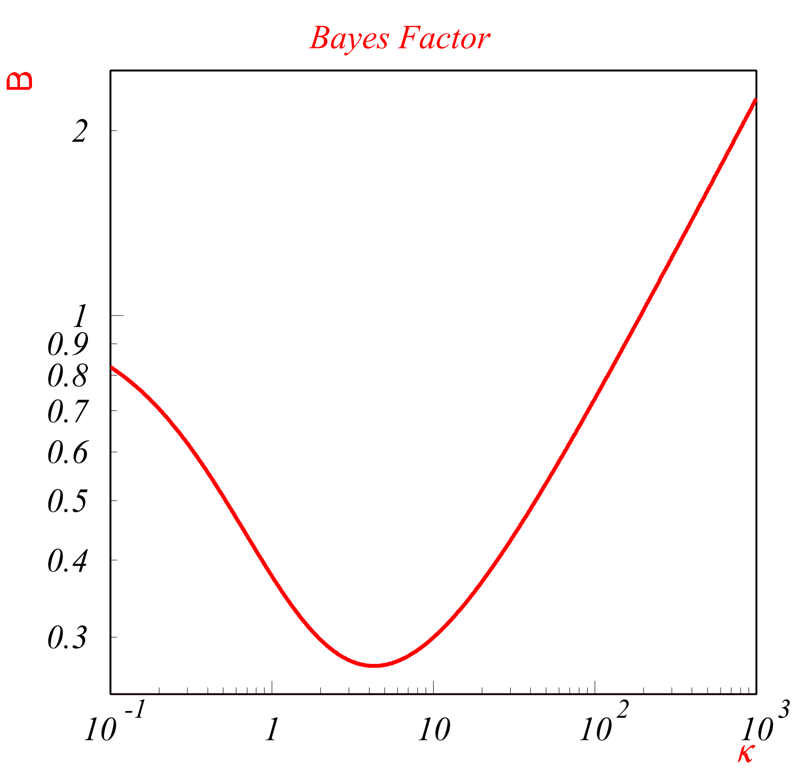
04 Jun 2018

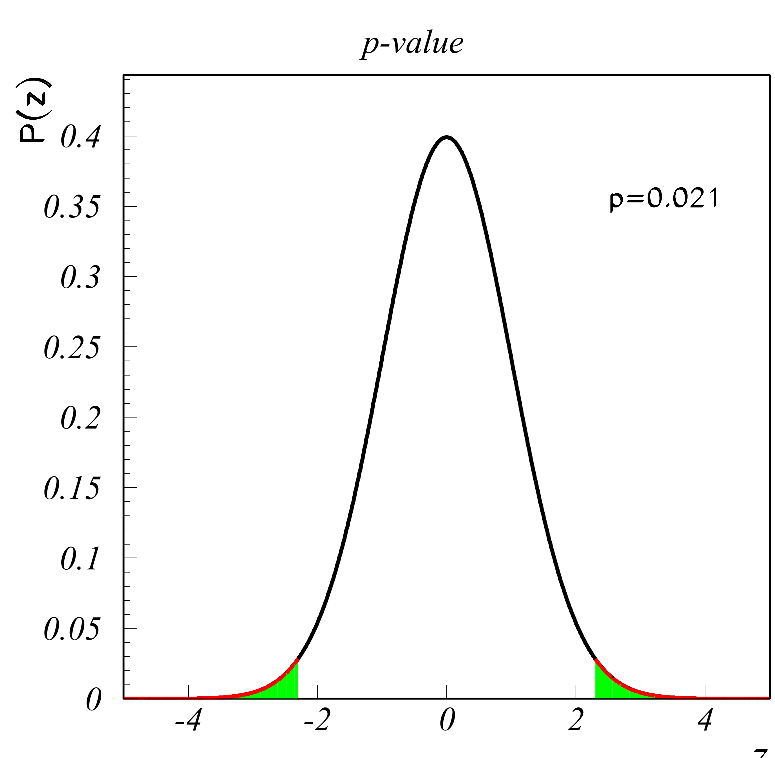
Statistically speaking

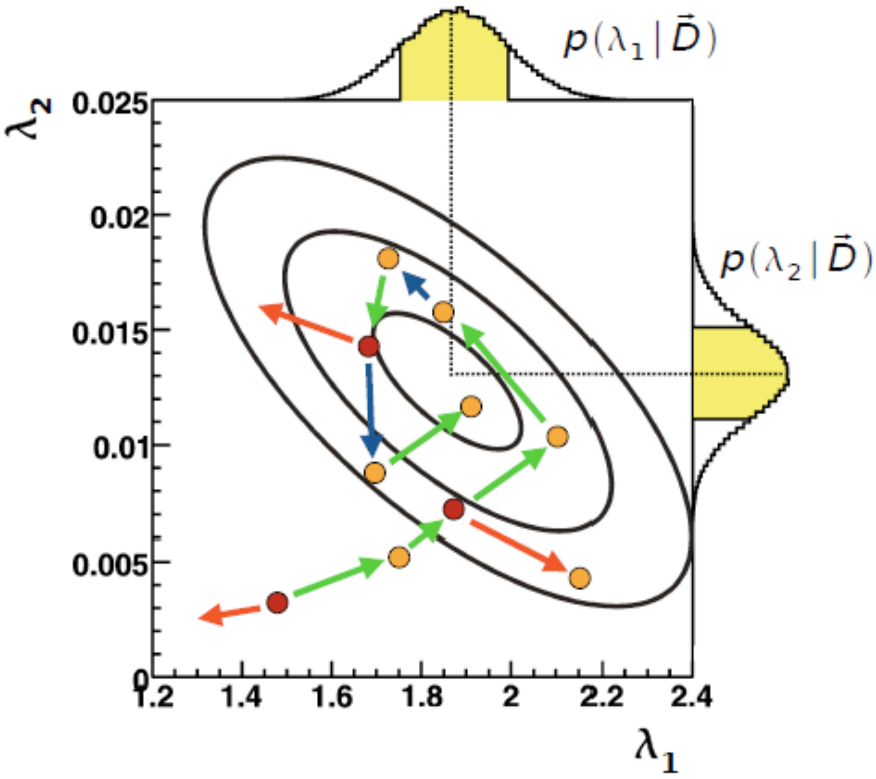
In a preprint uploaded recently to the *arXiv* server, the MiniBooNE collaboration reports having detected far more electron neutrinos than would be expected from purely Standard Model oscillations after collecting data for 15 years. According to collaboration member William Louis of Los Alamos, the measurement suggests that some of the muon neutrinos oscillate into sterile neutrinos that in turn transform into electron neutrinos. That interpretation, he says, is bolstered by the fact that the variation of electron-neutrino excess with neutrino energy – a parameter of neutrino oscillations – seen in MiniBooNE matches that recorded at LSND. He and his colleagues conclude that the combined excess from the two experiments has a statistical significance of 6.1σ, which is well above the 5σ that is normally considered a discovery in particle physics.

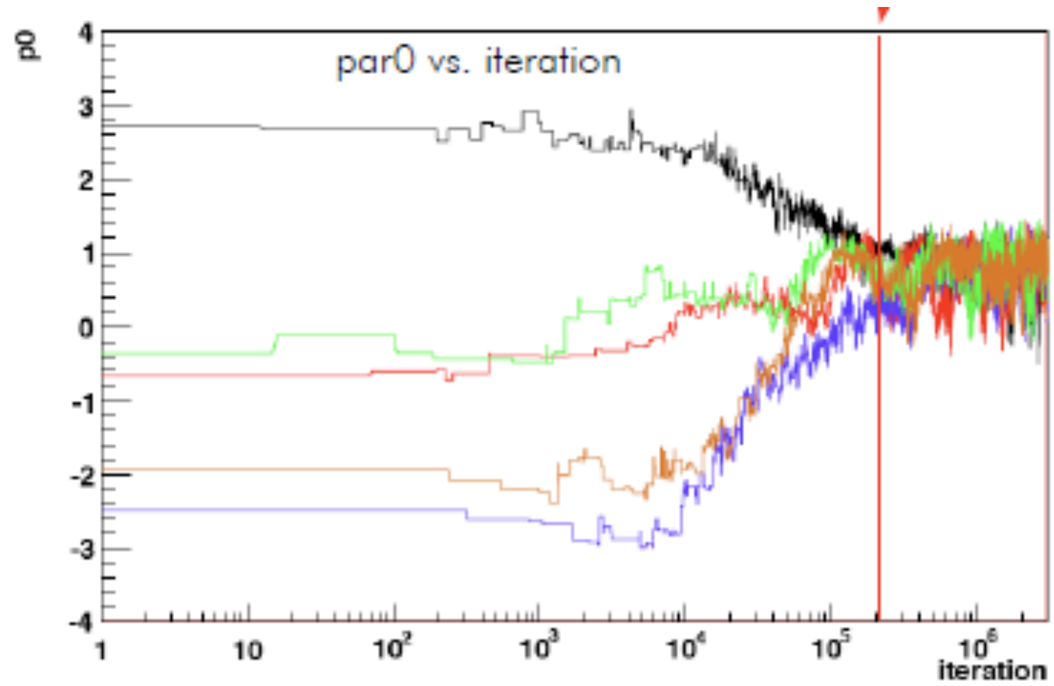

frequentist
P(Z|H$_0$)
1−α=0.05
z
Z

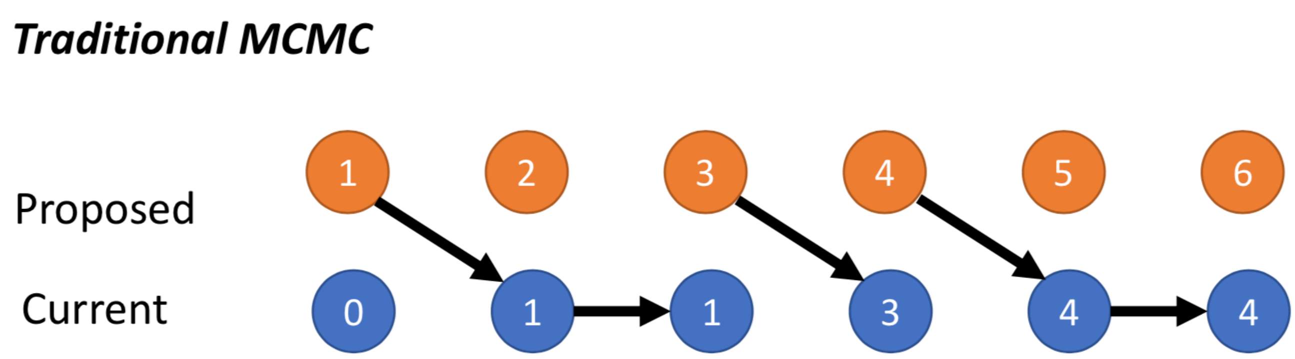

1−β
z=1.95
μ

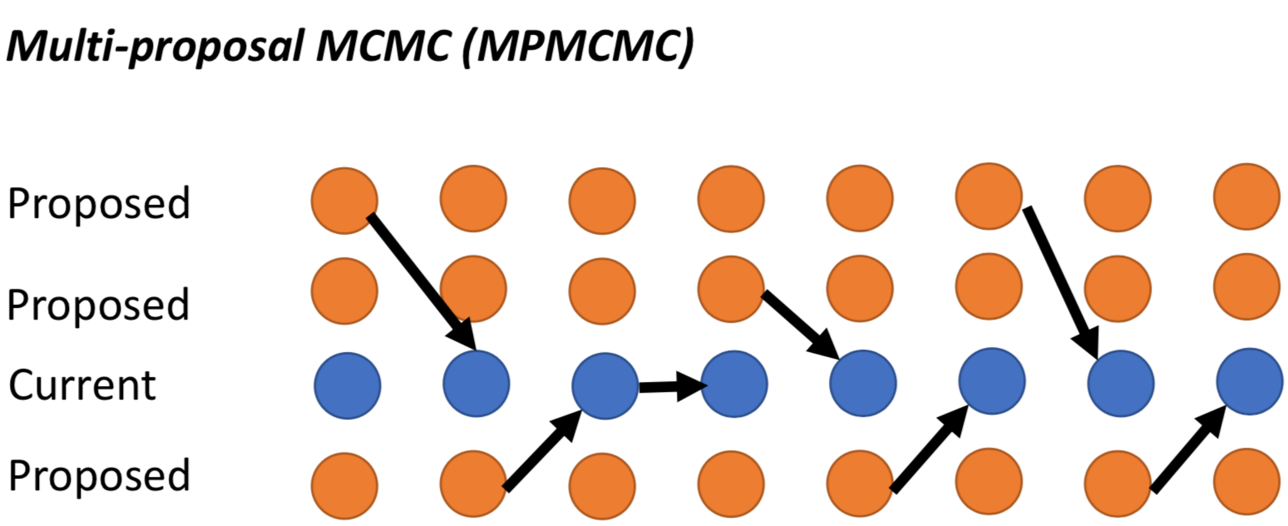

Bayes Factor
B
κ

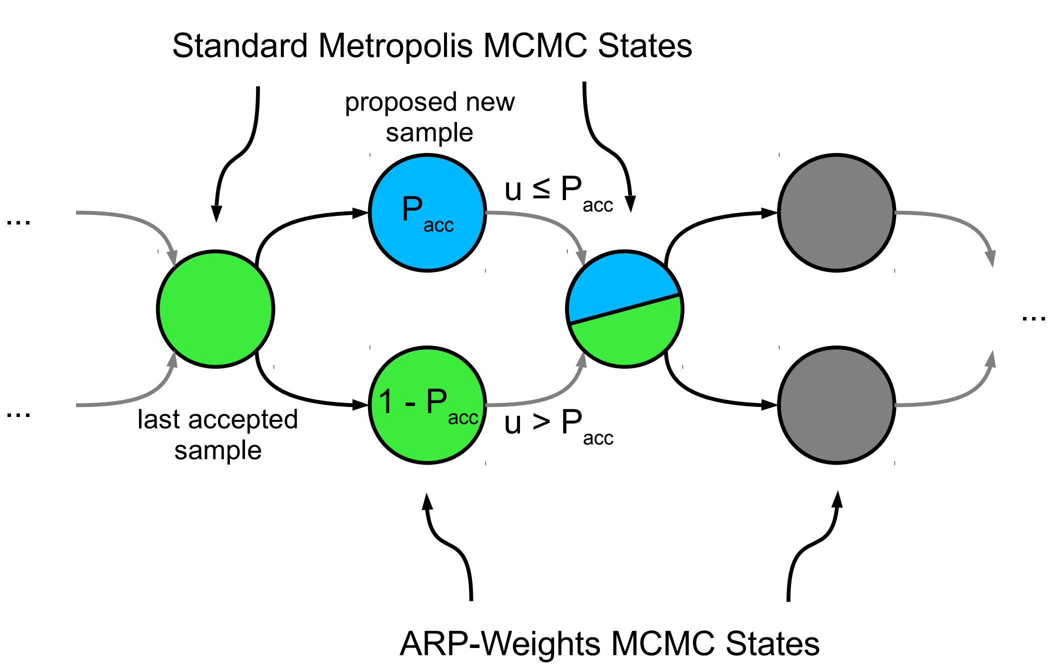

p-value
P(z)
p=0.021
z

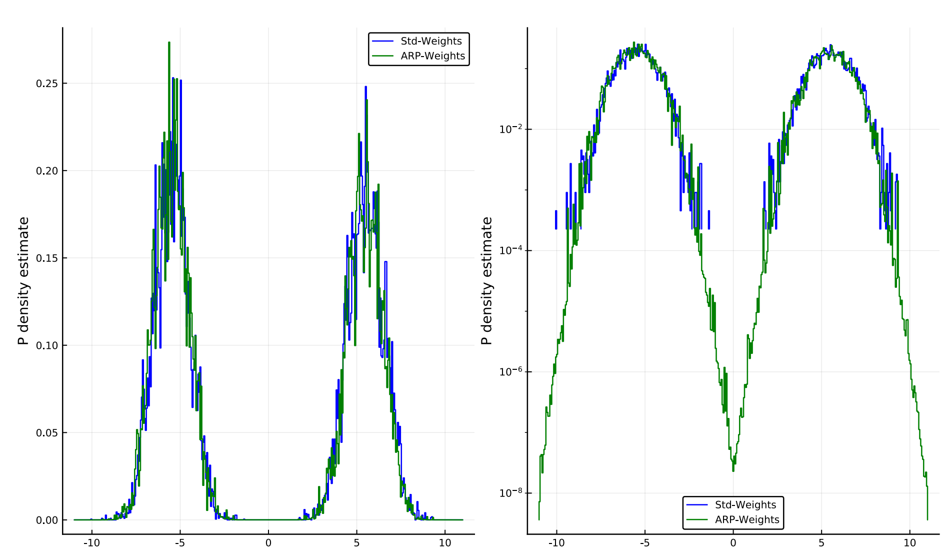

$p(\lambda_1|\vec{D})$
$p(\lambda_2|\vec{D})$
λ_2
λ_1
0.025
0.02
0.015
0.01
0.005
0
1.2
1.4
1.6
1.8
2
2.2
2.4

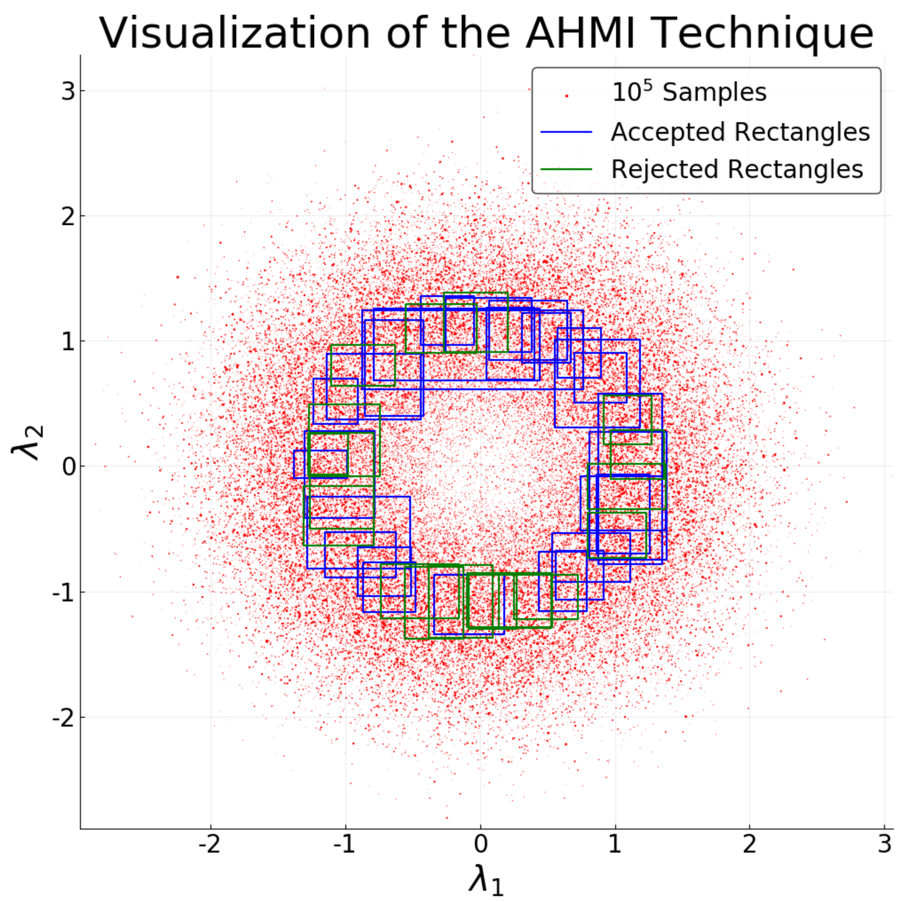

p0
par0 vs. iteration
iteration
4
3
2
1
0
-1
-2
-3
-4
1
10
10^2
10^3
10^4
10^5
10^6

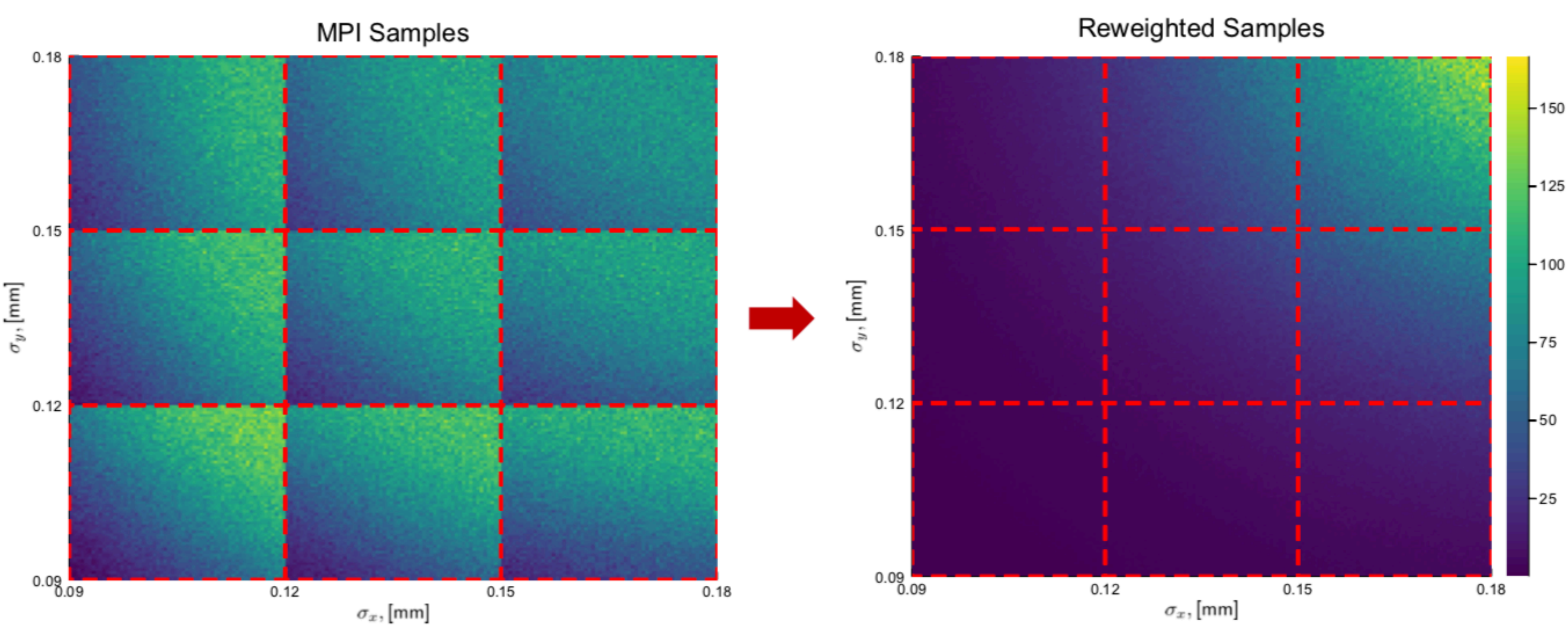

Traditional MCMC
Proposed
Current
1
2
3
4
5
6
0
1
1
3
4
4


Multi-proposal MCMC (MPMCMC)
Proposed
Proposed
Current
Proposed


Standard Metropolis MCMC States
proposed new sample
P_{acc}
$u \le P_{acc}$
$1 - P_{acc}$
$u > P_{acc}$
last accepted sample
ARP-Weights MCMC States


Std-Weights
ARP-Weights
P density estimate
x


Visualization of the AHMI Technique
10^5 Samples
Accepted Rectangles
Rejected Rectangles
λ_1
λ_2
-2
-1
0
1
2
3


MPI Samples
Reweighted Samples
σ_x, [mm]
σ_y, [mm]
0.09
0.12
0.15
0.18
25
50
75
100
125
150