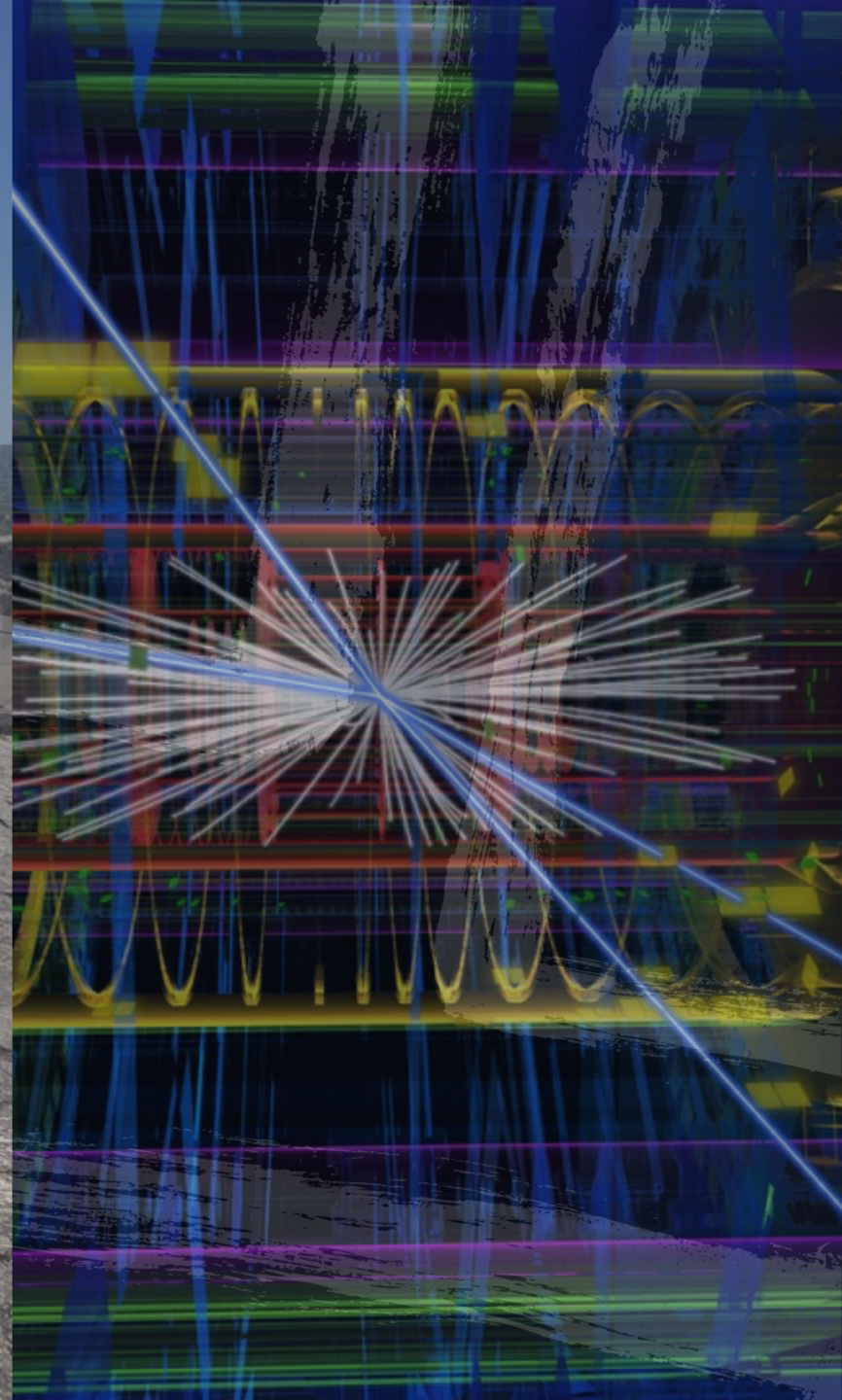


Marzieh Bahmani

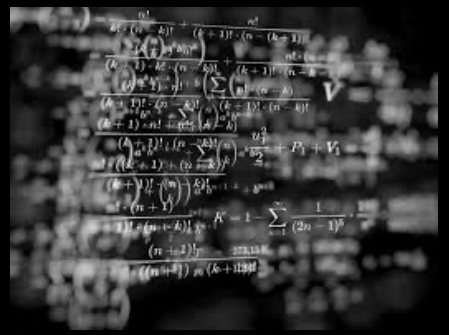
Postdoctoral researcher

Experimental particle physicist

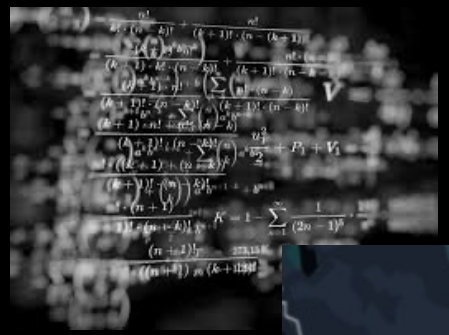
Humboldt University of Berlin

Mathematics Houses and Their Impact on Mathematics Education

Isfahan Mathhouse
خانه ریاضیات اصفهان



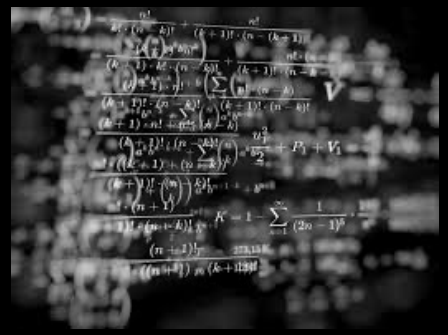
Isfahan Mathhouse



Tehran
تهران
Iran
Kuwait
Persian Gulf
Riyadh

time

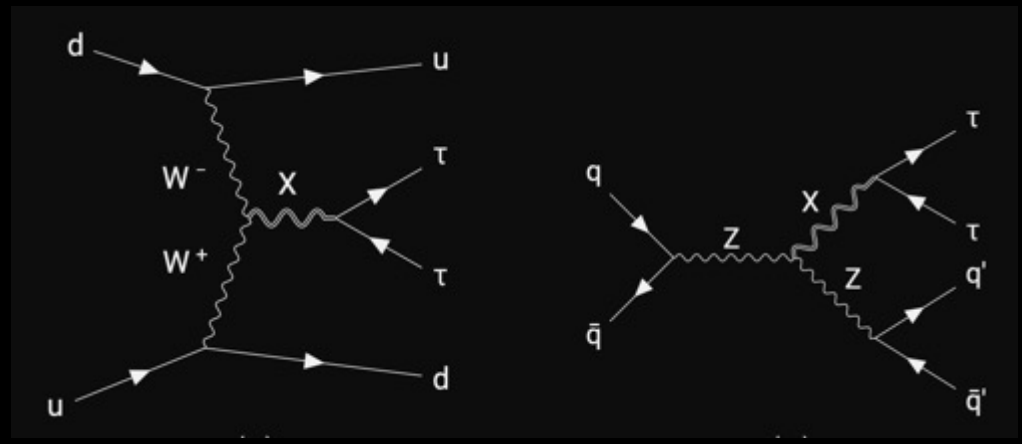
Isfahan Mathhouse
خانه ریاضیات اصفهان



https://higgstools.org/ESR18

1-Development of TauSpinner in Production of $\tau\tau\ jj$; the spin2 case [Eur.Phys.J.C(2018)78:10]

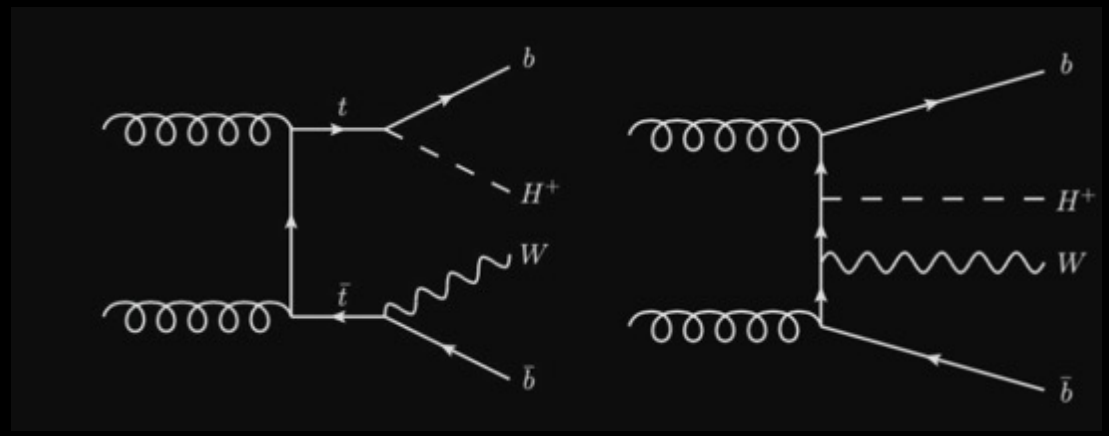
- MadGraph5 package
- τ signiture



2-Search for extended scenarios of electroweak symmetry breaking with the ATLAS experiment at LHC [J.High Energ.Phys.(2018)2018:139]

- charged Higgs bosons decaying via $H^{\pm} \rightarrow \tau^{\pm}\nu_{\tau}$
- *τ polarization Multi Variate Analysis based (MVA) signal selection*

- ML (BDT), Background estimation(fake factor method)



PoS CHARGED2018 (2019) 018

Next …

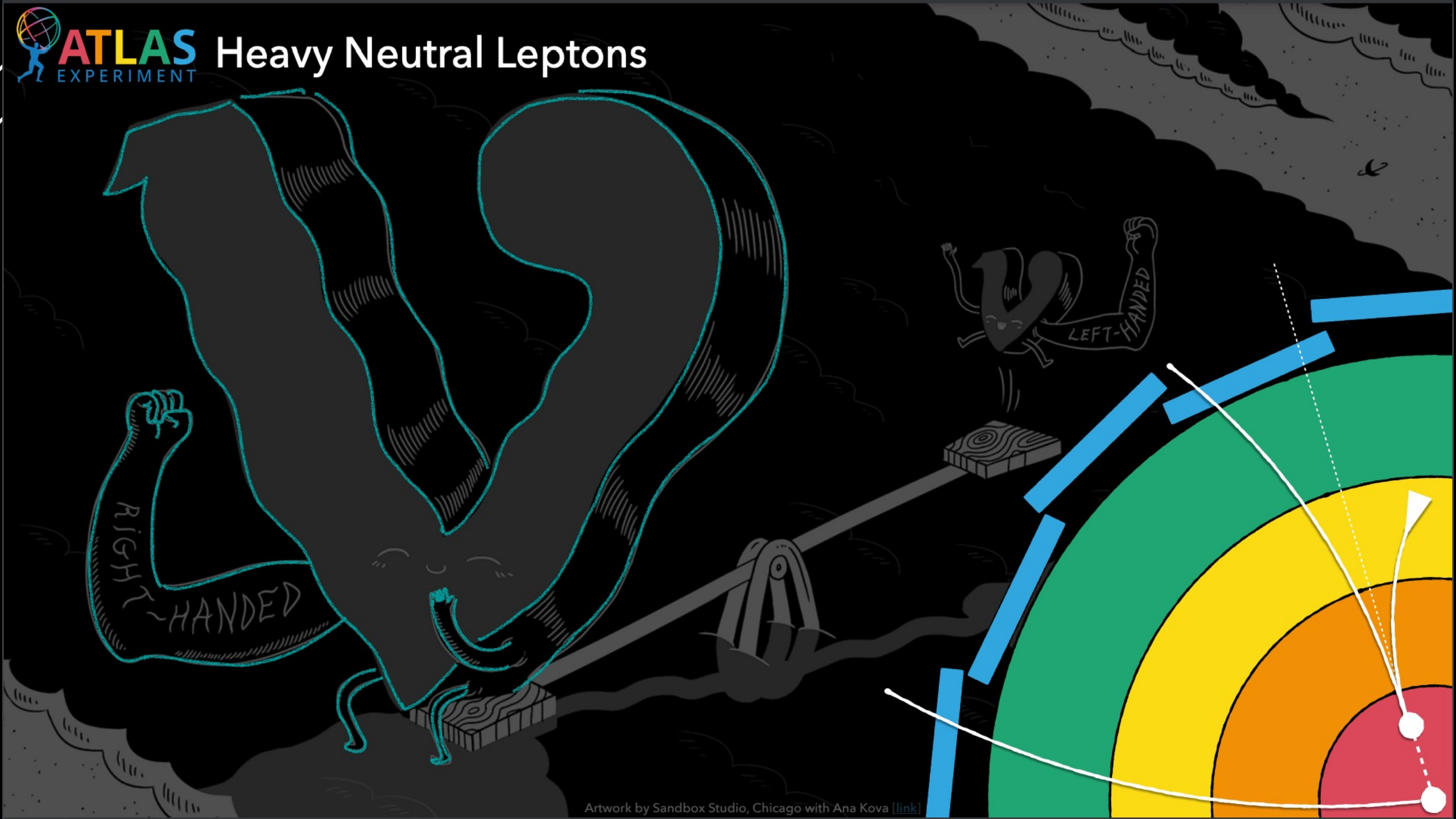
2- Postdoctoral position at Humboldt University of Berlin

1- phenomenology of heavy ion collision, properties of Quark Gluon Plasma (STAR Experiment), Warsaw University of Technology

A technique to study the elastic and inelastic interaction of quarkonium with hadrons using femtoscopic correlations

Eur.Phys.J.C 81 (2021) 4, 305

Heavy Neutral Leptons



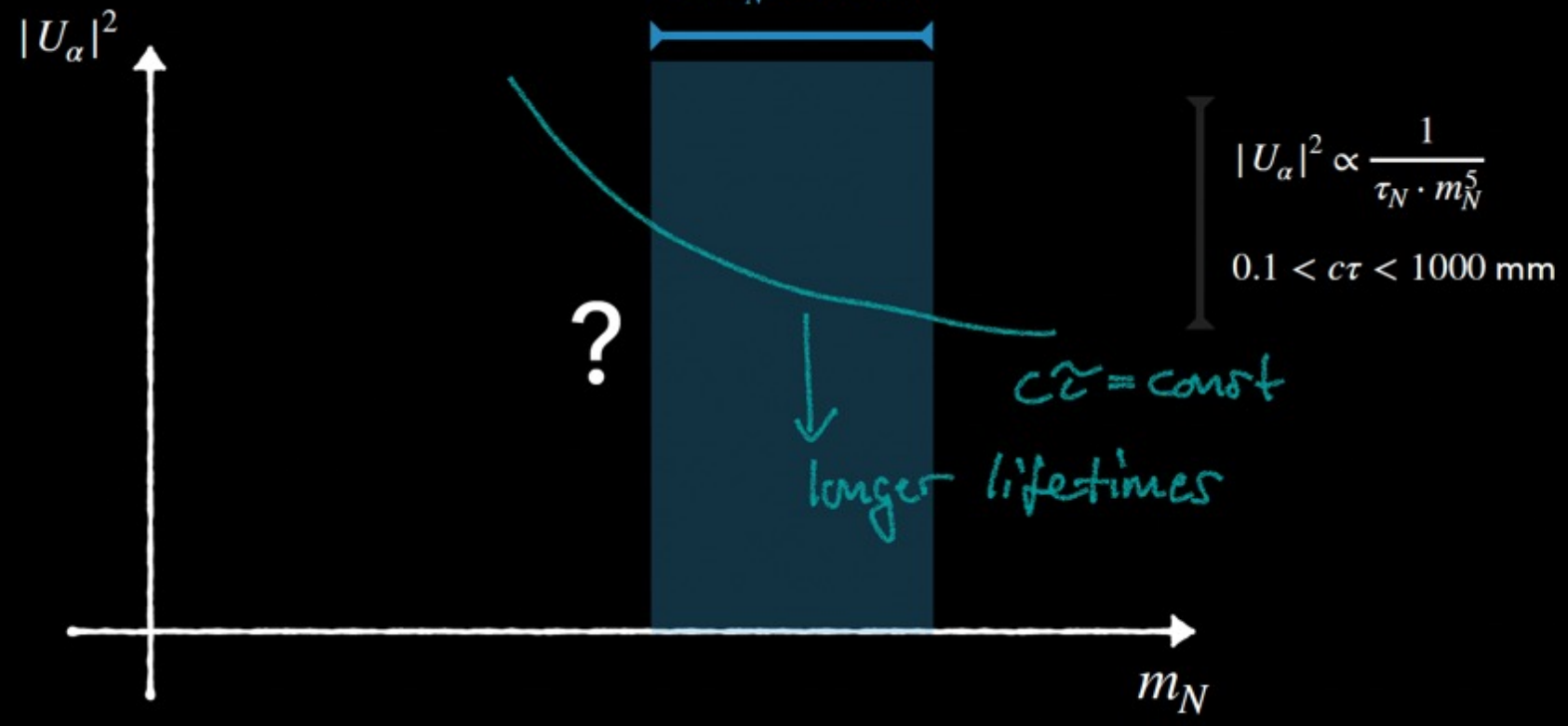
Artwork by Sandbox Studio, Chicago with Ana Kova [link]

- Neutrino oscillations
- Observed matter-antimatter asymmetry
- Dark matter

$\mathcal{N} \geq 2$

Add $\mathcal{N} \geq 3$ right handed Majorana neutrinos N_1, N_2, N_3 to the SM Lagrangian

Neutrino minimal SM (νMSM) [Asaka PLB 2005]

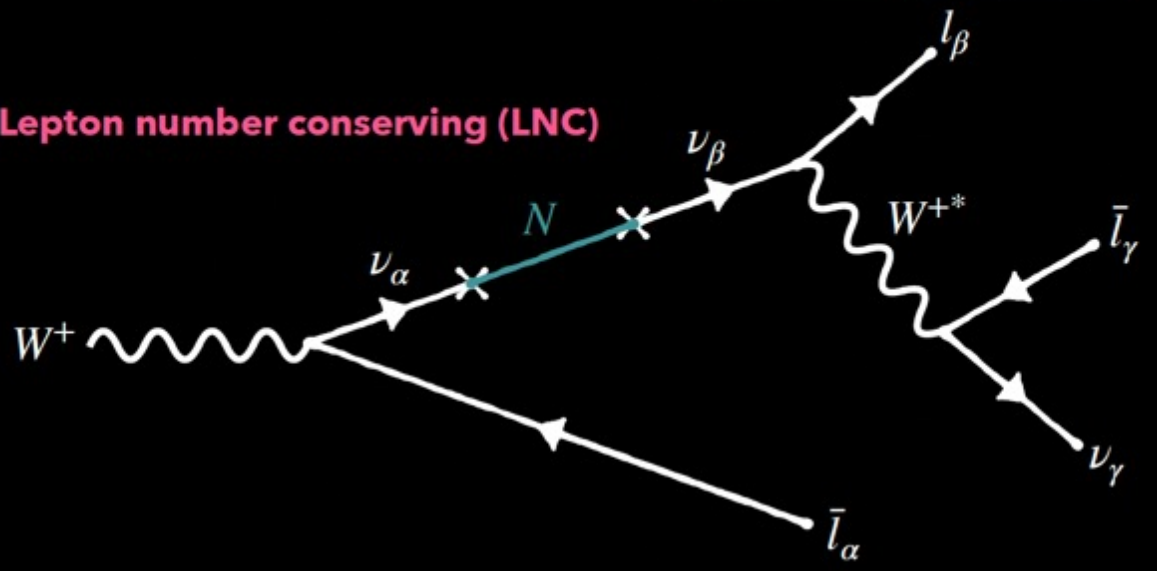


Signature

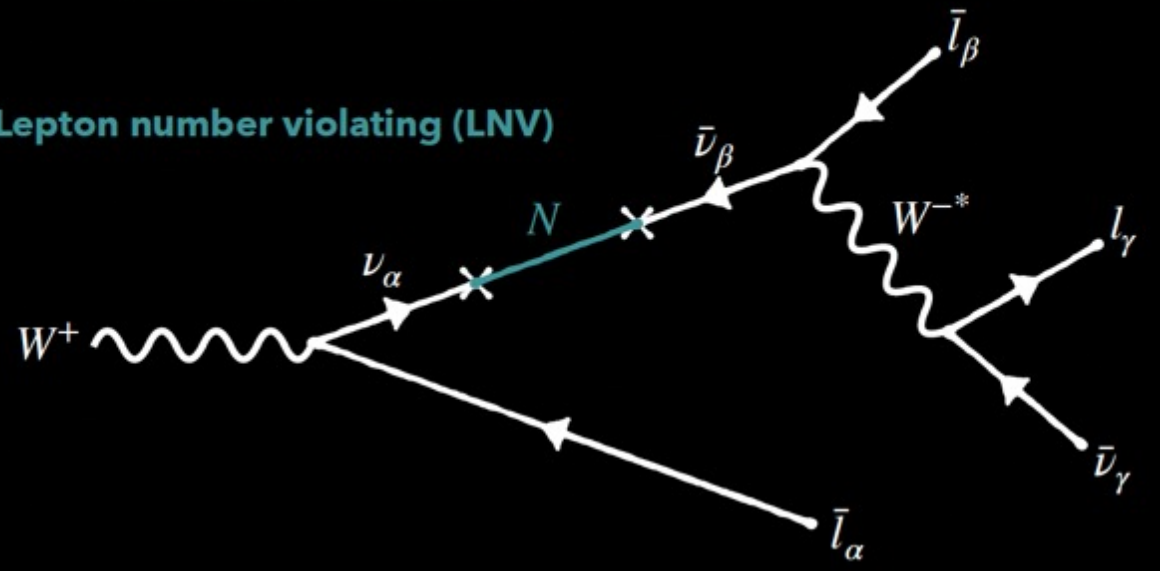
Majorana HNLs: 50% LNC | 50% LNV

Dirac HNLs: 100% LNC

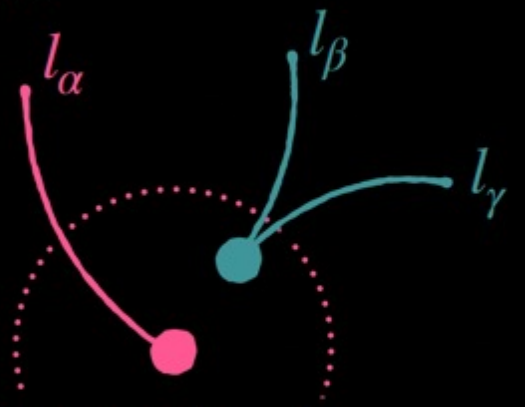
Lepton number conserving (LNC)



Lepton number violating (LNV)



Signal:



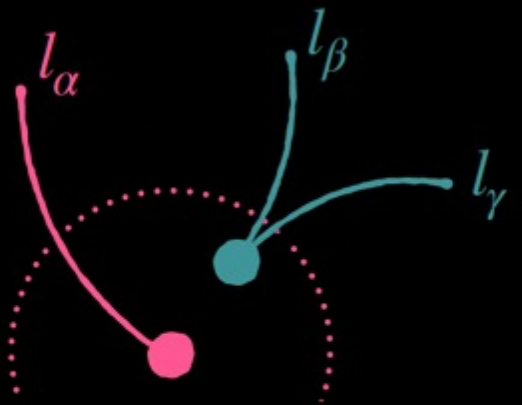
Prompt lepton with opposite-sign displaced vertex.

Main discriminating variable:
HNL mass

use $p_W = p_{l_\alpha} + p_{l_\beta} + p_{l_\gamma} + p_\nu$ to calculate

$$m^2_{HNL} = (p_{l_\beta} + p_{l_\gamma} + p_\nu)^2$$

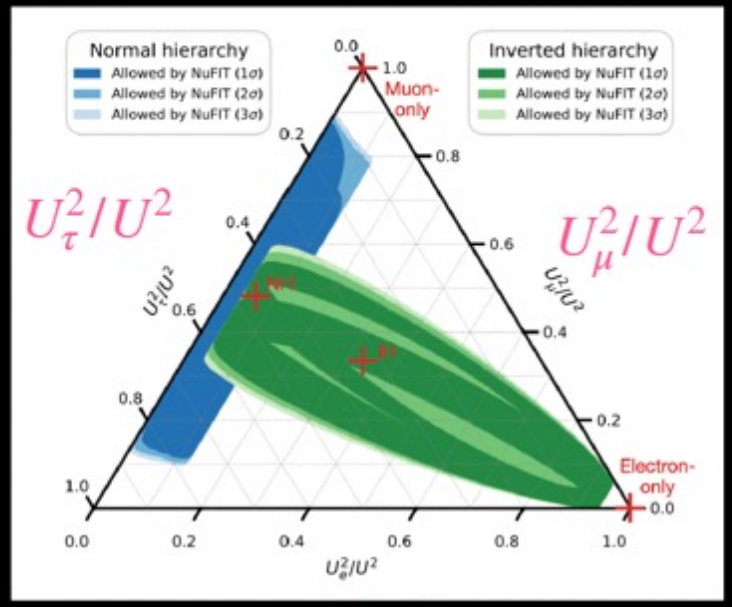
Model



Prompt lepton with opposite-sign displaced vertex.

Channel X
$\alpha - \beta\gamma$

Quasi Dirac pair of HNLs: $M_1 \approx M_2$, see [Tastet et al, 2021]



One Dirac / Majorana HNL with **single flavour mixing**

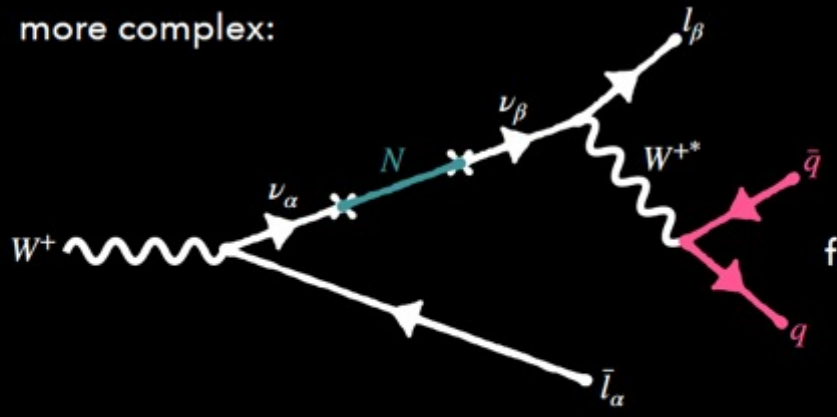
Channel 1 $\mu - \mu\mu$
Channel 2 $\mu - \mu e$
Channel 3 $\mu - ee$

Channel 1 $e - ee$
Channel 2 $e - e\mu$
Channel 3 $e - \mu\mu$

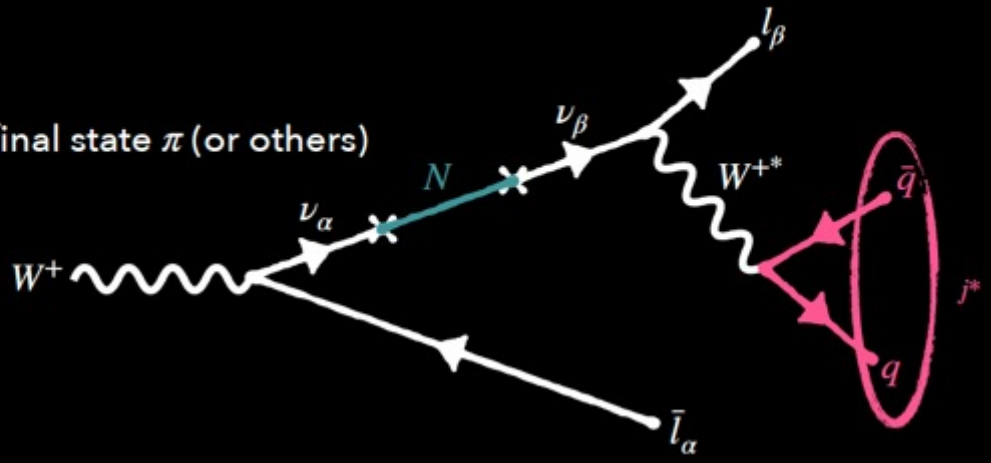
Channel 1 $\mu - \mu\mu$
Channel 2 $\mu - \mu e$
Channel 3 $\mu - ee$
Channel 4 $e - ee$
Channel 5 $e - e\mu$
Channel 6 $e - \mu\mu$

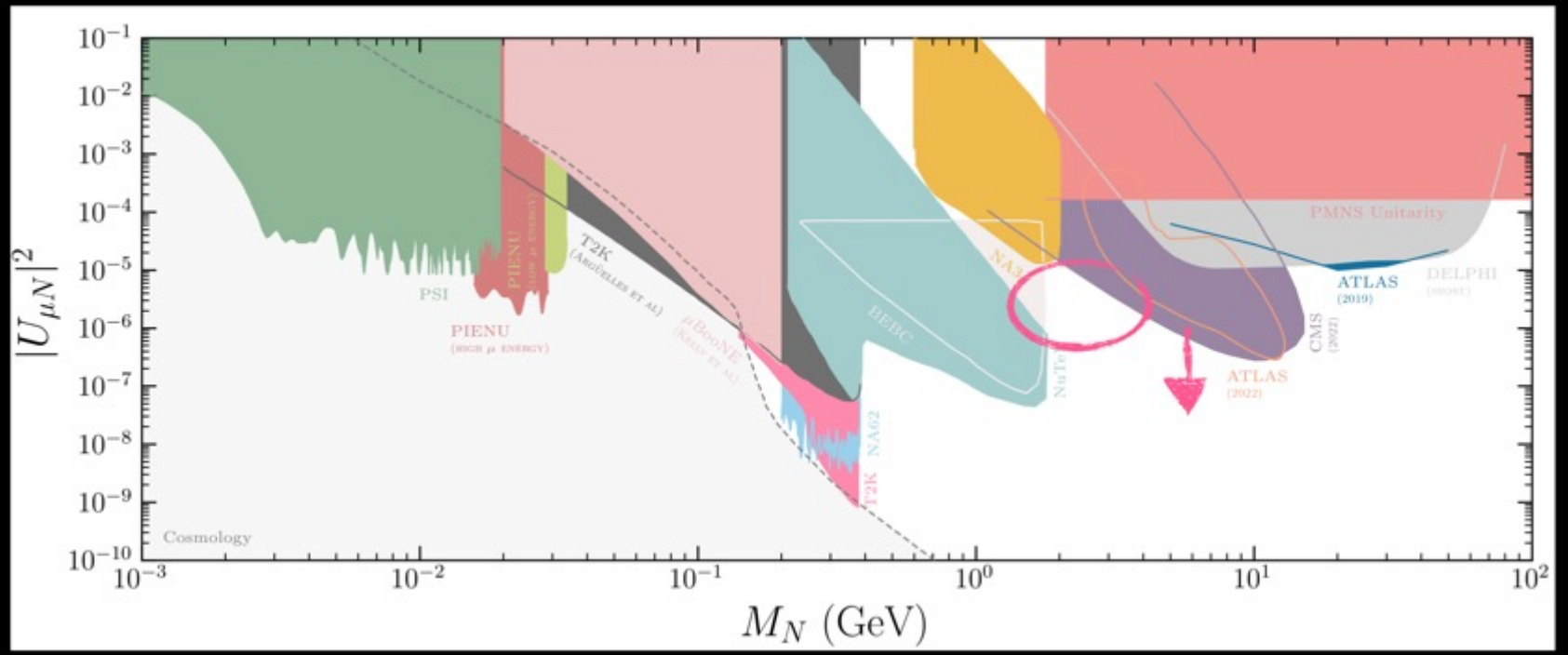
Quasi Dirac pair of HNLs with **IH / NH** mixing in **Dirac / Majorana** Limit

more complex:

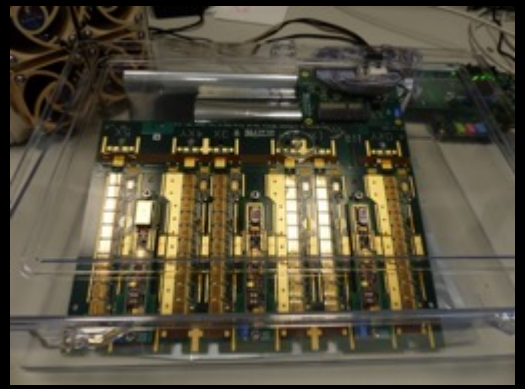


final state π (or others)



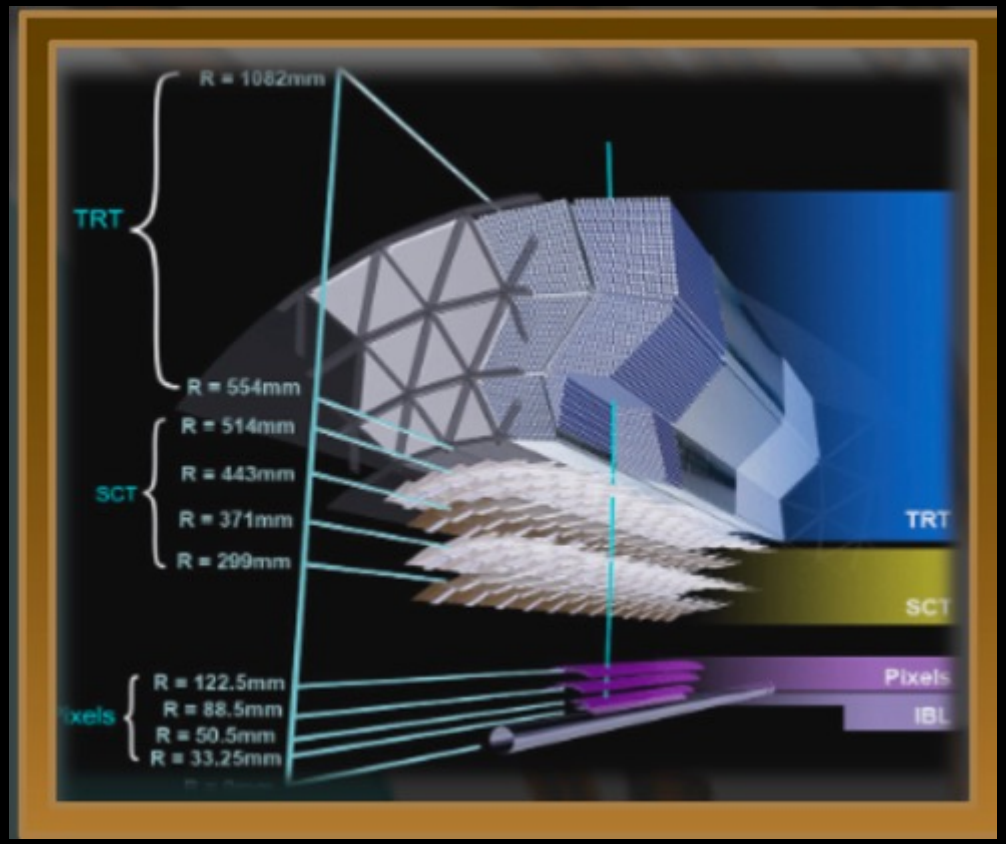


ITK upgrade

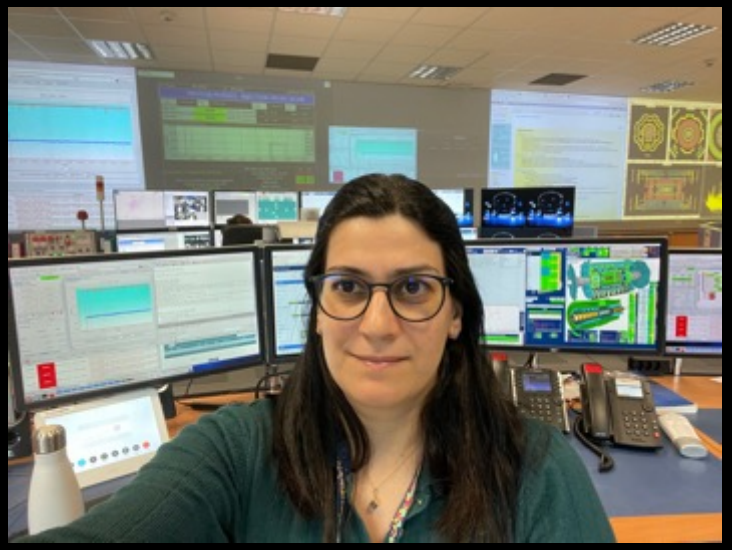


ABCStar Hybrid Module Tests

Beam Induced Background Identification in ATLAS detector By Tracking System



ATLAS operation



Iranian scholars for Liberty

Outlook

0- Learn more and develop my own career path

1- Help discovering HNLs

2- Become a leader