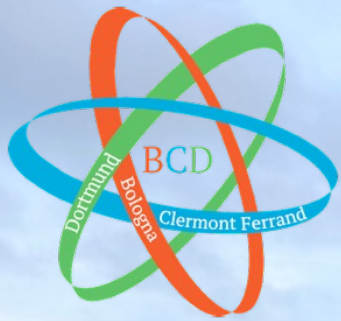




27-31 March, 2023

**8TH BOLOGNA CLERMONT
DORTMUND INTERNATIONAL
SCHOOL OF HIGH ENERGY PHYSICS**



Closing remarks: 8th BCD school 2023



**Johangelo Albioli (3-flavor mixing)
for the collaboration of TU Dologna, Bomand & Clermund**

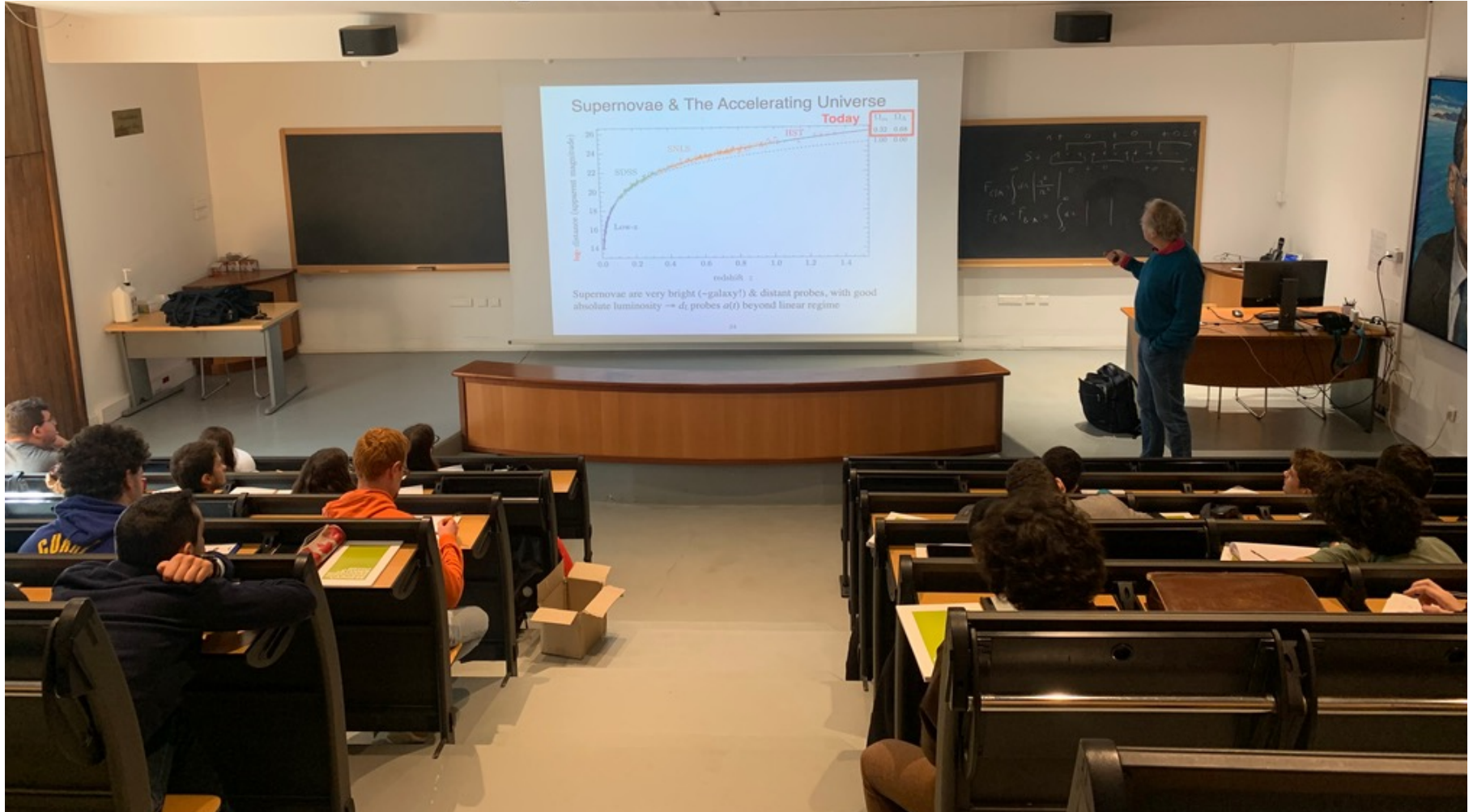


ISHEP 2023

Global Program

2023	Monday 27/03	Tuesday 28/03	Wednesday 29/03	Thursday 30/03	Friday 31/03
08:45 - 10:15	8:30: Intro + Cosmology (<i>J. Orloff</i>)	Flavour Physics: quarks & SM (<i>A. Carbone +</i> <i>J. Albrecht</i>)	Student Talks	BSM theory (<i>E. Stamou</i>)	Machine Learning (<i>J. Donini</i>)
10:45 - 12:15					
12:15 - 14:00	Lunch break				
14:00 - 15:30	Standard Model (SM) & H-pheno (<i>F. Maltoni</i>)	Flavour Physics: BSM & neutrinos (<i>J. Albrecht +</i> <i>M. Sioli</i>)	Student Talks	Hadron colliders & Top Physics (<i>K. Kroeninger</i>)	SM & Future (<i>S. Monteil</i>) + Conclusions
16:00 - 17:30			Future Projects (<i>All teachers</i>)		
> 17:30	Welcome Aperitive Dinner & Music (19.00)		<u>Volley ball cup</u> (18:00)	Social Dinner (19:30)	

Cosmology – Jean Orloff





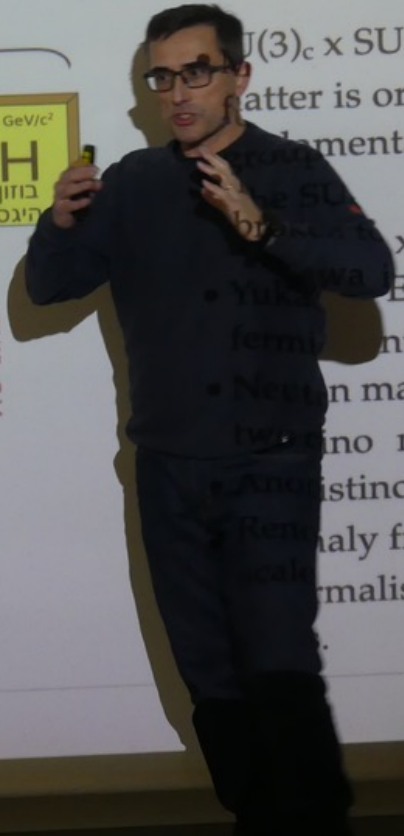
Standard Model – Fabio Maltoni

The SM in a nutshell



$$\mathcal{L}_{SM}^{(4)} = -\frac{1}{4}F^{\mu\nu}F_{\mu\nu} + \bar{\psi}i\not{D}\psi + (y_{ij}\bar{\psi}_L^i\phi\psi_R^j + h.c.) + |D_\mu\phi|^2 - V(\phi)$$

פרמיונים			בוזונים	
דור-I	דור-II	דור-III		
2.4 MeV/c ² 2/3 1/2 u למעלה	1.27 GeV/c ² 2/3 1/2 c קסום	171.2 GeV/c ² 2/3 1/2 t עליון	0 0 1 γ פוטון	125 GeV/c ² 0 0 H בוזון הייבס
4.8 MeV/c ² -1/3 1/2 d למטה	104 MeV/c ² -1/3 1/2 s מוזר	4.2 GeV/c ² -1/3 1/2 b תחתון	0 0 1 g גלואון	לואי כוונים
<2.2 eV/c ² 0 1/2 ν_e נייטרינו אלקטרוני	<0.17 MeV/c ² 0 1/2 ν_μ נייטרינו מיואוני	<15.5 MeV/c ² 0 1/2 ν_τ נייטרינו טאואוני	91.2 GeV/c ² 0 1 Z⁰ בוזון Z	
0.511 MeV/c ² -1 1/2 e אלקטרוני	105.7 MeV/c ² -1 1/2 μ מיואוני	1.777 GeV/c ² -1 1/2 τ טאו	80.4 GeV/c ² -1 1 W[±] בוזון W	



$U(3)_c \times SU(2)_L \times U(1)_Y$ gauge symmetries.
 Matter is organised in chiral multiplets of the fundamental representation of the gauge group.
 $U(1)_Y$ symmetry is spontaneously broken by the Higgs VEV.
 fermion interactions are present that lead to fermion masses and CP violation.
 neutrino masses can be accommodated in two distinct ways.
 Renormalisable = valid to "arbitrary" high energy scales.



Master of Flavor: Angelo Carbone

KM MATRIX

$$= \begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix} \begin{pmatrix} d \\ s \\ b \end{pmatrix}$$

$$V^\dagger V = \mathbb{1}$$

MATRIX
ELEMENTS

$$V_{CKM} = \begin{pmatrix} 1 - \lambda^2 & \lambda & \lambda^2 \\ \lambda & 1 - \lambda^2 & \lambda \\ -\lambda^2 & \lambda & 1 - \lambda^2 \end{pmatrix}$$





Flavour 2: BSM search – Johannes Albrecht





Flavor 3: Neutrino – Max Sioli





BSM Theory– Emanuel Stamou





Hadron Colliders – Kevin Kröninger

Zoom Meeting

View

A Zoom meeting window showing a video feed of Prof. Dr. Kevin Alexander Kröninger. He is a man with a beard and glasses, wearing a dark blue zip-up hoodie. The video feed is framed by a yellow border. A name tag at the bottom left of the video feed reads "Prof. Dr. Kevin Alexander Kröninger". The Zoom interface includes a top bar with window controls and a "View" button, and a bottom toolbar with various meeting controls.

Prof. Dr. Kevin Alexander Kröninger

Mute Stop Video Security Participants 1 Chat Share Screen Polls Record Breakout Rooms Reactions Apps Whiteboards End

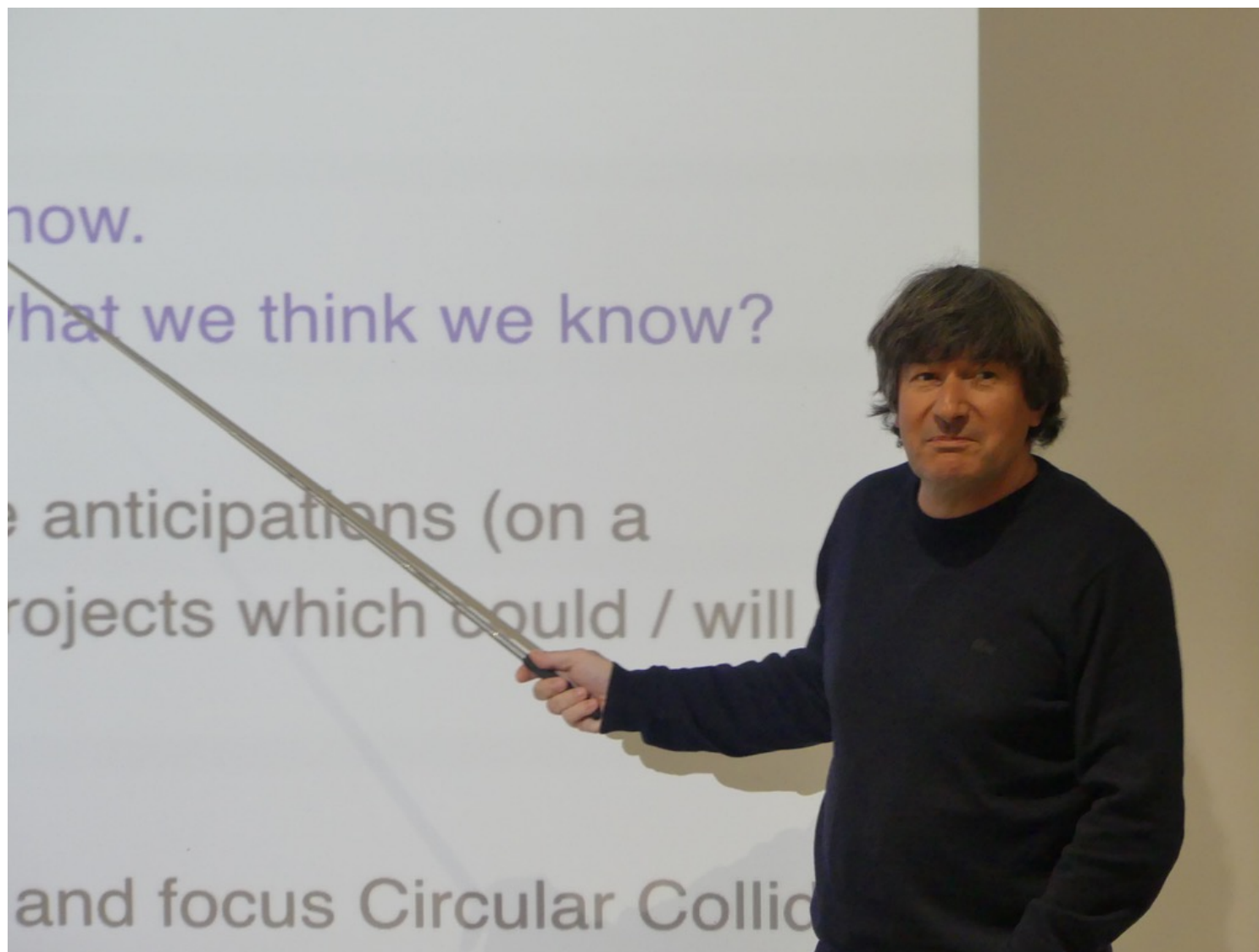


Machine Learning - Julien Donini





SM future – Stephane Monteil



A sunset scene over a body of water. The sun is low on the horizon, partially obscured by a dark silhouette of a coastline. The sky is filled with warm, orange and yellow light, with some clouds catching the light. The water in the foreground is dark blue with white foam from a wave breaking. The overall mood is serene and dramatic.

Now, lets come to the real, important stuff



Volleyball tournament



Your PC ran into a problem and needs to restart. We're just collecting some error info, and then we'll restart for you.

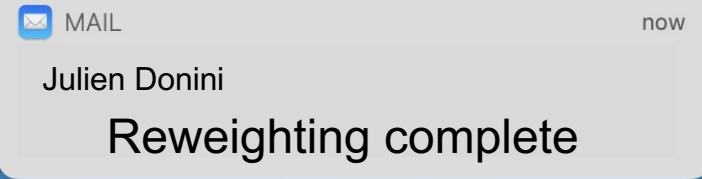
20% complete



For more information about this issue and possible fixes, visit <https://www.windows.com/stopcode>

If you call a support person, give them this info:

Stop code: CRITICAL_PROCESS_DIED



Slide from BCD '19 summary

But what happened 2023?

BSM, or were we not careful enough
with our data analysis?

(you remember, systematics, physical
backgrounds, event normalizations)

Volleyball tournament – or – Never bet against the Standard Model

Examples of correct reweighting

Textbook example of correct data interpretation

Prominent example: Sports tournament:

Rescale results by:

- **Experience** (e.g students points count double)
- **Team well rehearsed**
(e.g. rehearsed teams points / 2)
- **Training**

Scale points by accumulated team members training days (teachers: 1, students: $(2\pi)^4$)





Price for winning the



MAIL now

Corsican State police

WARNING: Corsican bandits



WARNING: Bandits reappearing

Avis de recherche:
Attention à tous les corses





BOUNTY HUNTERS ATTENTION!
WANTED



\$5,000 REWARD!
NOTIFY NEAREST LAW ENFORCEMENT AGENCY

BOUNTY HUNTERS ATTENTION!
WANTED



BOUNTY HUNTERS ATTENTION!
WANTED



REWARD!
LAW ENFORCEMENT AGENCY



BOUNTY HUNTERS ATTENTION!
WANTED



\$5,000 REWARD!
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Don't relax, its your turn to break
the Standard Model



Best student award



Oh, sorry,
wrong pic

