

CosmoLattice

— School 2025 —

Local Organizers: Mohammad Ali Gorji, Masahide Yamaguchi, Dong-Won Jung

Overview & Discussion

IBS, Daejeon, South Korea, 22-26 September 2025

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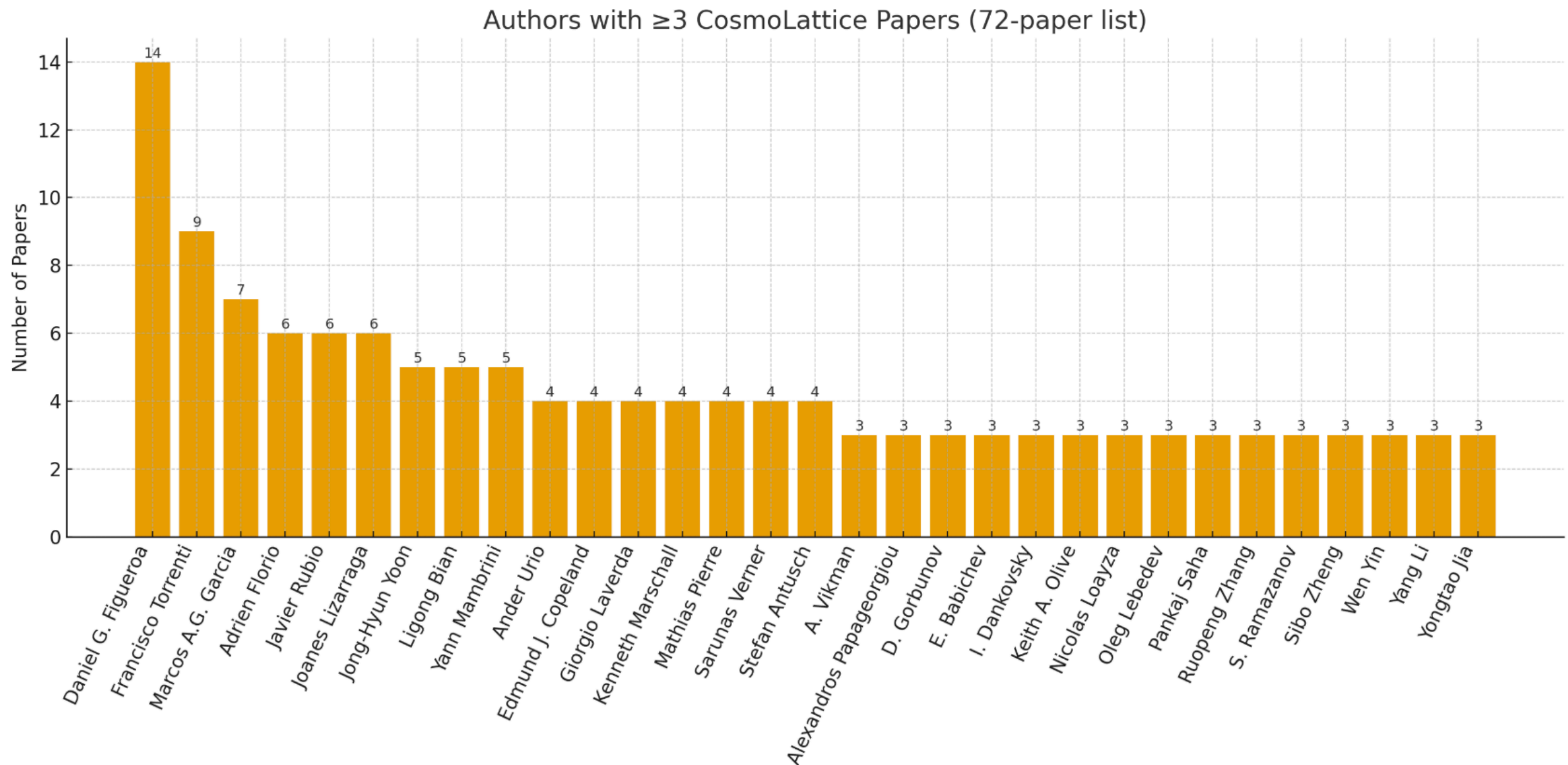


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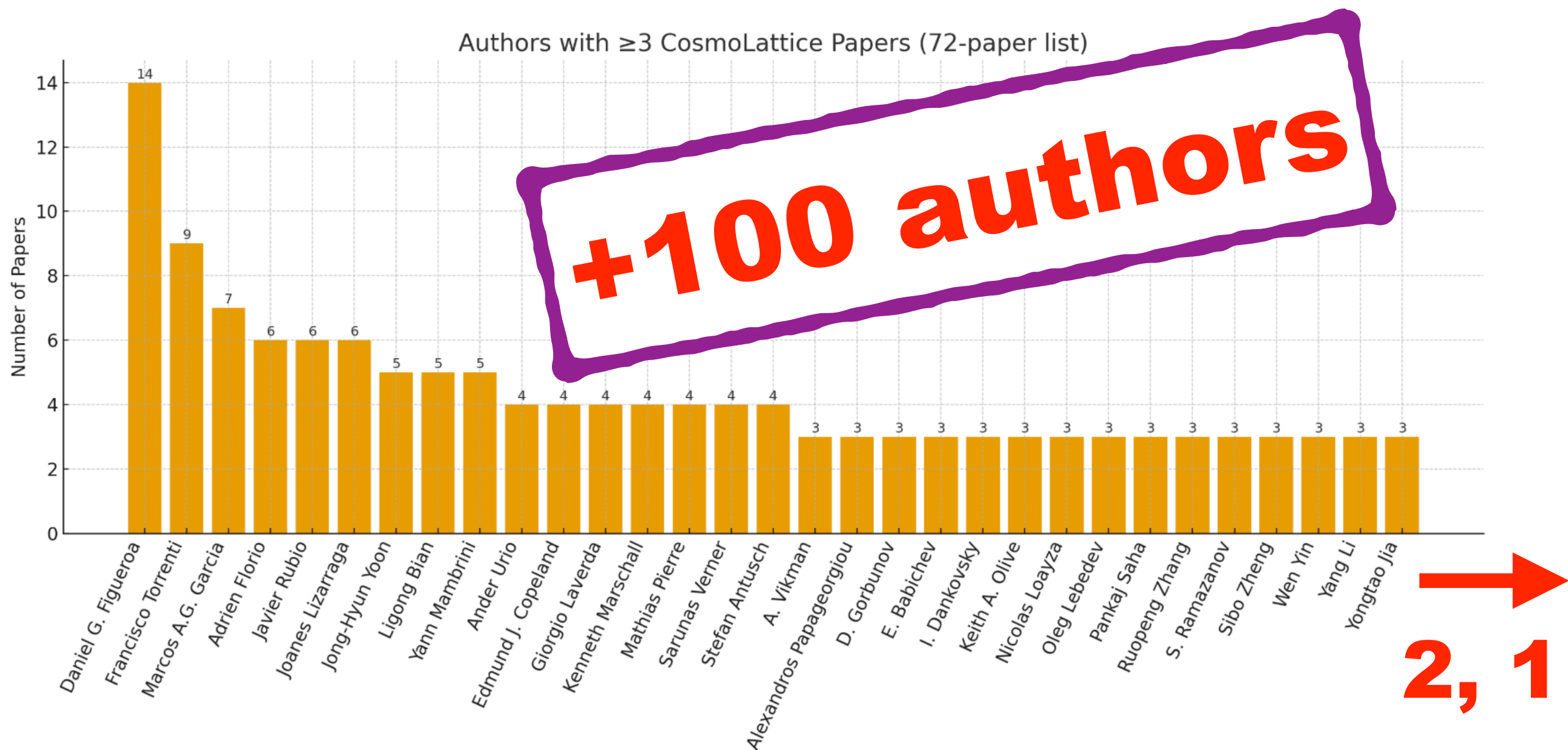


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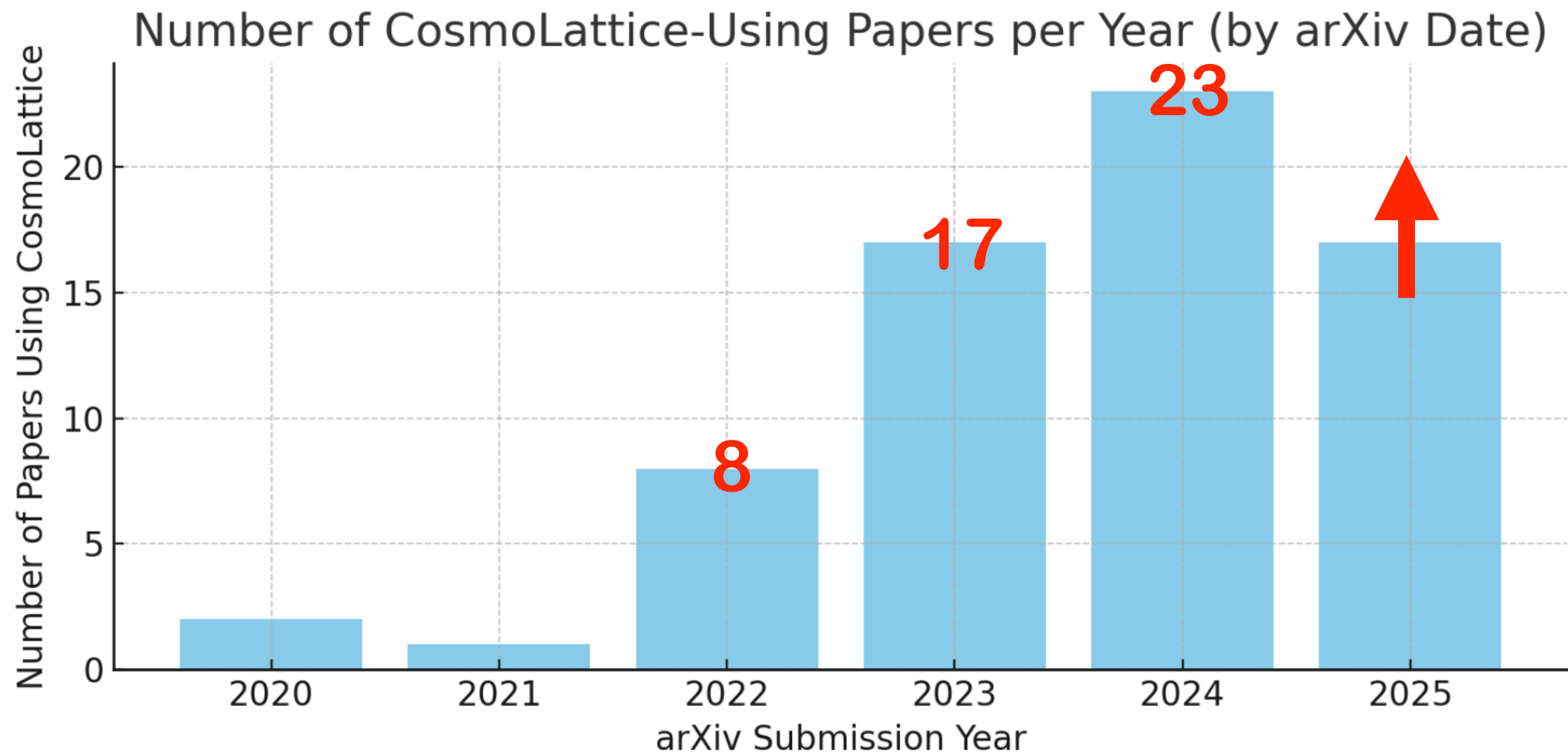
Papers/author using CL



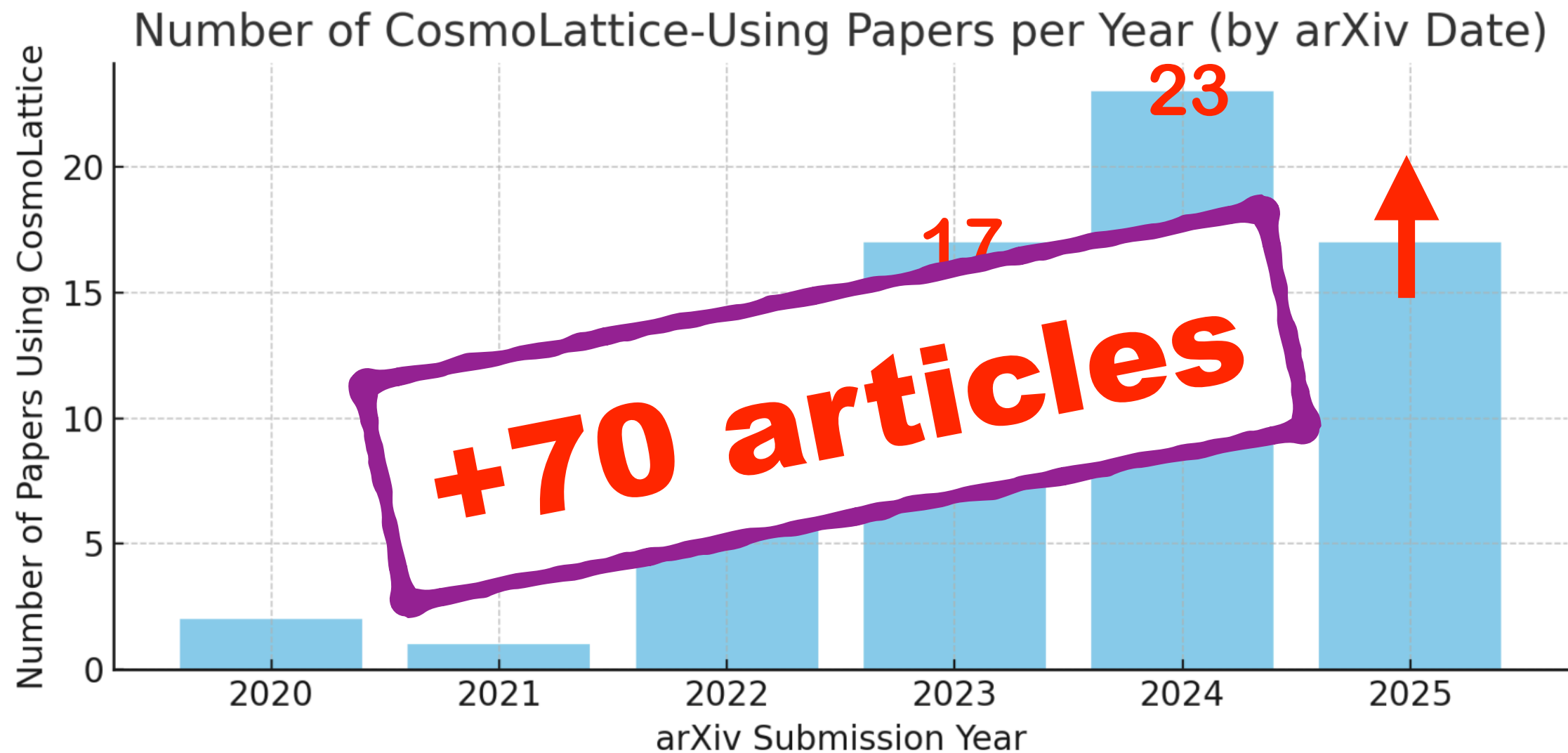
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Total # Papers using CL



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Discussion

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* When is Lattice Cosmology not Valid ?

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Statistical-Classical
Approach

(+ QFT Init. Cond.)

["Exact" QFT in linear regime, (only growth)]

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- * When is Lattice Cosmology not Valid ?
- * **GR effects: when are they needed?**

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HPC ; CPU \rightarrow GPU ; 3D \rightarrow 2D

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Learning how to "lattice size"

Learning how to "latticesize"

Reading:

Our theory review 'The Art': 2006.15122

Coming soon... 'The Art II': 25XX.YZYZ

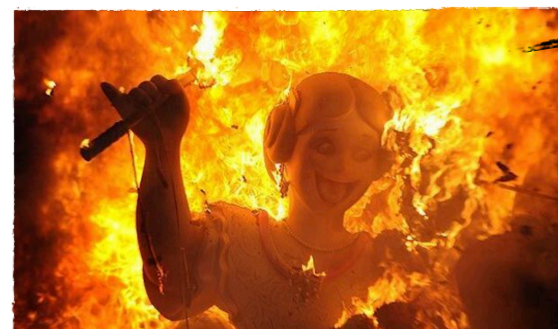
Learning how to "latticeize"
= coming to our CL schools !

Come to some of our CL Schools !

CosmoLattice

1st CL School 2022: Sept 5-8

@Valencia:



Come to some of our CL Schools !

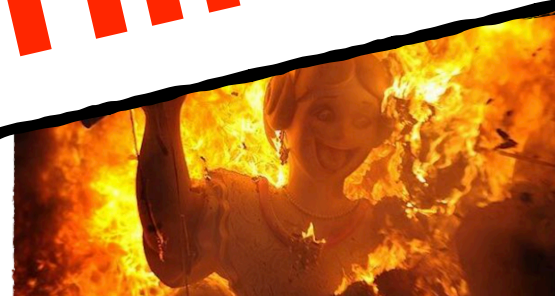
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2nd CL School 2023: Sept 25-29

@Valencia:



Online !

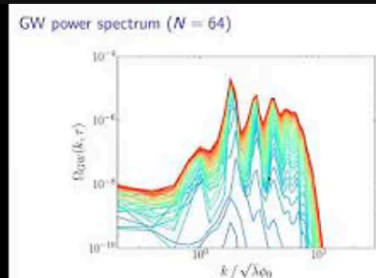


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2nd CL School 2023: Sept 25-29

<https://www.youtube.com/@CosmoLattice/videos>



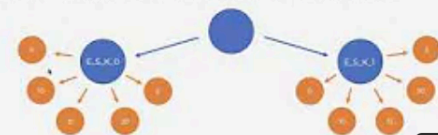
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CosmoLattice School 2023, Day 4: Practice 3
(Simulating Gravitational Waves)

17 views • 4 months ago

Structure of HDF5 files in CosmoLattice

HDF5 files are structured in Groups and Datasets.
Example: The kinetic_energy_snapshot_scalar.h5 file of a simulation with two real scalar fields is structured as follows



54:28

CosmoLattice School 2023, Day 4: Lecture 8
(Plotting Features of CosmoLattice)

36 views • 4 months ago

① SU(2) gauge fields:

$$S = -\frac{1}{4} \text{Tr} (F_{\mu\nu} F^{\mu\nu}) = \frac{1}{2} \sum_{\mu < \nu} \sum_a (F_{\mu\nu}^a)^2$$
$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu - i g [A_\mu, A_\nu]$$
$$A_\mu = A_\mu^a T^a, \quad T^a = \frac{1}{2} \sigma^a$$

② Fermions:

$$S = \int d^4x \bar{\psi} (i \not{D} - m) \psi$$
$$D_\mu = \partial_\mu - i g A_\mu^a T^a$$

③ Scalar fields:

$$S = \int d^4x \left(\frac{1}{2} \partial_\mu \phi \partial^\mu \phi - V(\phi) \right)$$
$$V(\phi) = \frac{1}{2} m^2 \phi^2 + \frac{\lambda}{4!} \phi^4$$

1:33:04

CosmoLattice School 2023, Day 3: Lecture 7
[SU(2) Scalar-Gauge Theory Lattice...]

10 views • 4 months ago

Evolution of GWs modes

non-local operations are computationally expensive!

Solution: we define a set of unphysical tensor modes u 's

1) Evolve equation of motion of u 's

$$\ddot{u}_{ij} + 3H\dot{u}_{ij} - \frac{\nabla^2}{a^2} u_{ij} = \frac{2}{m_p^2 a^2} \Pi_{ij}$$

2) When needed, (compute power spectrum energy density) we apply transformation

$$h_{ij}(k, t) = \Lambda_{ij,kl}(k) u_{kl}(k, t)$$

1:19:39

CosmoLattice School 2023, Day 3: Lecture 6
(Creation and Propagation of Grav. Waves)

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Come to some of our CL Schools !

CosmoLattice

3rd CL School 2025: Sept 22-26



IBS, Daejeon !

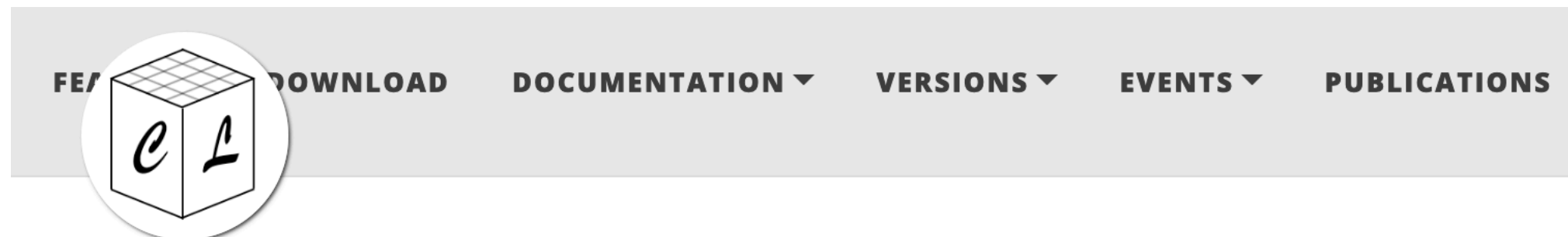
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4th CL School ... 2027 ? Where ?

Details for next CL School at:

<https://cosmolattice.net>



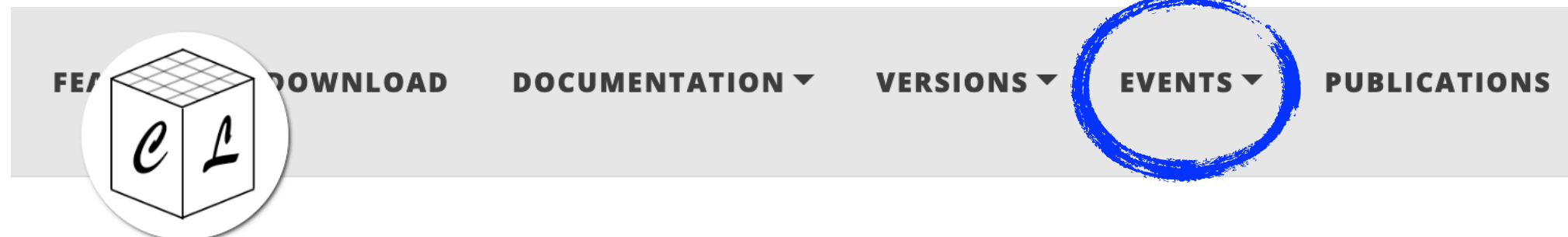
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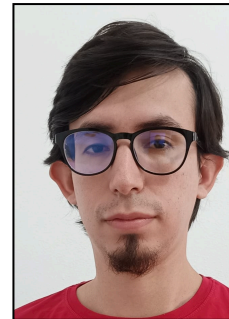
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Nicolás LOAYZA
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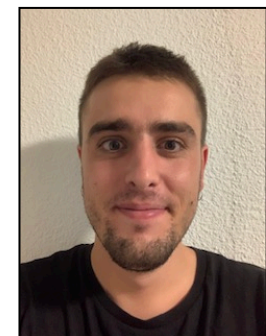
Alberto ROPER POL
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Francisco TORRENTI
(UB, Barcelona, Spain)



Ander URIO
(UPV/EHU, Bilbao, Spain)

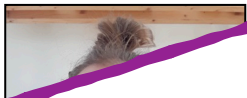
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매우 감사합니다