

COSMOMAG

A NEW COSMOLOGICAL PROBE with magnetic fields

> Axel Brandenburg Chiara Caprini Andrii Neronov Franco Vazza





Project goal: nail down cosmological magnetic field evolutionary track



The magnetized team



Synergy 6



Prior work 7



Prior work 8



Prior work 8

Project organisation







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COSMOMAG explorer





COSMOMAG

A NEW COSMOLOGICAL PROBE with magnetic fields

- clarify the origin of cosmic magnetism,
- explore the first microseconds after the Big Bang,
- unveil connection to puzzling processes in the early Universe.

Enabled by new astronomical observatories

..... and by the synergy of the PI's expertise.



Impact 17

Timelines of telescopes





Cos	t category		Corr. PI	2nd PI	3rd PI	4th PI	Total in Euro
PI I	ame		Neronov	Caprini	Vazza	Brandenburg	
Hos	t Institution	1	UPC	CERN	UNIBO	UNIST	
osts	P.I.		312 307 €	539 909,16 €	213 480,00 €	449 395,20 €	1 515 092 €
nel c	Senior Staf	f	0€	0€	0€	0€	0€
rson	Post docs		773 760 €	1 296 000 €	800 000 €	607 360 €	3 477 120 €
et pe	Students		498 220 €	151 200 €	181 800 €	485 888 €	1 317 108 €
Direc	Other		180 000 €	0€	0€	0€	180 000 €
A.]	Total Pers	onnel costs	1 764 287 €	1 987 109 €	1 195 280 €	1 542 643 €	6 489 320 €
B. S	ubcontractin	ng costs (No indirect costs)				0€	0€
	C.1 Travel a	nd substinence	120 000 €	40 000 €	168 000 €	170 000 €	498 000 €
	C.2 Equipm	ent - including major equipment	0€	0€	110 000 €	55 000 €	165 000 €
	C.3 Other goods,	Consumables incl fieldwork and animal costs	10 000 €	10 000 €	10 000 €	10 000 €	40 000 €
S	works and services	Publications (incl. Open Access fees) and dissemination	5. XI.00				
cost	3	dissemination	5 000 €	5 000 €	5 000 €	5 000 €	20 000 €
ase		Other additional direct costs	245 000 €	115 000 €	116 000 €	309 829 €	785 829 €
urch		C3. Total other goods, works and services	260 000 €	130 000 €	131 000 €	324 829 €	<mark>845 829</mark> €
C.F	Total pu	rchase costs (C.1+C.2+C.2)	380 000 €	170 000 €	409 000 €	549 829 €	1 508 829 €
D. 1	Internally in	voiced goods and sevices (No indirect costs)					0€
E	. Indirect Co	ost e=25%*(A+C1+C2+C3)	536071,8	539277,29	401070	523118,05	1999537,14
	То	tal eligible costs	2 680 359 €	2 696 386 €	2 005 350 €	2 615 590 €	9 997 686 €
	Reques	ted EU Contribution	2 680 359 €	2 696 386 €	2 005 350 €	2 615 590 €	9 997 686 €

Budget

2025						2027			2028			2				2030		
Q1 Q2	Q3	Q4 (Q1 Q	2 Q3	Q4	Q1 Q2	Q3	Q4	Q1	Q2 Q	3 Q4		01 Q2	Q3	Q4	Q1	Q2 (Q3 Q4
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3	1				EO1.1.	1 E	01.1.4	EO1.	1.3		E	01.1	.2		EO1.1	.5		
PhD-N1						PhD-N2	2								-	•		
PD-NI			-	-	-			-	PD-	N2			-	_		-		-
PD-N1						PhD-N1			-PD-	N2			PhD-N	2	-	1		
CTA-LST									CTA									
								E	01.2.	EO1.			EO1.2.	2				
			PD-V	1	-		-	_		_	-	-	-	_		•		
						PD-N3	-				-	-	-			3		
,												S	KA					
												-	PD-N	3	_	EO1	.3.1	
Auger Pri	me, TA	x4																
Universe to	the pr	resent	epoch															
				E	02.1.	EO2.1.2												
PhD-B1	(co-sur	pervise	d by Br	andenbu	irg and	Caprini)										-		
PhD-B1			DD D				VP B1					=						
y			FD-D						EO2	.2.1		I	02.2.2					
PD-V2	-			_	-		-				-	-						
						PD-V3	-					-						
						EO2.3.1				EO2.	.2	I	02.3.3					
PhD-V1	(co-su	pervise	d by Vi	azza and	Neron	ov)		-						p	D-VS			
						PhD-N3	(co-su	pervis	ed by	Nerono	and V	azz	a)		0110			
					1			1						1				
22.2	-					EO3.1.1			EO3	.1.2					EO3.1.	.3 EO3	.1.4	
PD-C1	DD 1	P 2	-				PD	-C2								-		
	ru-	P4				PD-C3					PD-B	33			+	-		
						PhD-CI	100-50	ervise	-PD-	C4	nd Ne	TORO				-		VP
						1 1004 01	(10 04)			e aprili	ind pre	S	KA PT	N				-B2
					1				EO3.	2.1		Т			EO3.2	.2		
	1		PhD-	/2 (co-si	upervis	ed by Vazz	za and Q	aprin)									
		•	PhD-B	2 (co-su	pervis	d by Brand	lenburg	and C	aprin	i)	F	PD-B	4		WP	BA		
					1	1 11-05			Simo	ns Obse	rvator	y, Li	teBird	_		1.4		
PD-V4					1	PhD-V4	leo-eu	bervis	EO3.	3.1	nd Bra		EO3.3.2		1	1		
	-	FOLI		-	-	1 110 12	100 30	Pertis	1.2	· unred a	E	24.1	A		EOV	115	-	EO4.
		E04.1	.1		EO4	.1.2		EO4.	1.5		E	J4.1.			EUA	+.1.2		
PM-N	VP-	E04.1	.1	VI	EO4	.1.2	VP-	EO4.	1.5		VP-	J4.1.	-		EU4	1.5		PD N4
	2025 Q1 Q2 PHD-N1 PD-V2 PD-V2 PD-V1 PD-V1 PD-V1 PD-V2 PD-V1 PD	2025 Q1 Q2 Q3 PhD-N1 PD-N1 PD-N1 PD-N1 CTA-LST CTA-LST Auger Prime, TA Universe to the pr PhD-B1 PhD-B1 PhD-B1 PhD-V2 PhD-C1 PD-V2 PhD-V2 PhD-V2 PhD-V2 PhD-B1 PhD-V2	2025 Q1 Q2 Q3 Q4 PhD N1 PhD PD N1 PhD CTA-LST Image: Comparison of the present	2025 2026 Q1 Q2 Q3 Q4 Q1 Q PhD N1 2010 PD N1 2010 CTA-LST CTA-LST Auger Prime, TAX4 Universe to the present epoch PhD B1 2010 PhD PhD B1 2010 PhD PhD PhD PhD PhD PhD PhD PhD PhD PhD	2025 2026 Q1 Q2 Q3 Q4 Q1 Q2 Q3 PhD N1 2 2 2 CTA-LST CTA-LST Auger Prime, TAX4 Universe to the present epoch PhD B1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2025 2026 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 PhD-N1 Image: Second	2025 2026 2027 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 PhD N1 PD N1 PD	2025 2026 2027 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 PhD N1 E0111 E0111 E0114 E0114 E0114 PD N1 PD PD PD PD PD PD CTA-LST PD PD PD PD PD PD PD PD Auger Prime, TAx4 PD PD PD PD PD PD PD PD PDD <pd< td=""> PD P</pd<>	2025 2026 2027 Q1 Q2 Q3 Q4 PhD <n1< td=""> PhD<n1< td=""> PhD <</n1<></n1<>	2025 2026 2027 2028 2024 2028 2024 203 24 21 22 23 24 21 22 23 24 21 22 23 24 21 22 23 24 21 22 23 24 21 22 23 24 21 22 23 24 21 22 23 24 21	2025 2026 2027 2028 Q1 Q2 Q3 Q4 Q1 Q2 Q3	2025 2026 2027 2028 Q1 Q2 Q3 Q4 Q1 Q2 Q3	2025 2026 2027 2028 2 <	2025 2026 2027 2028 2029 2029 Q1 Q2 Q3 Q4 Q1 Q2 Q1 </td <td>2025 2026 2027 2028 2029 Q1 Q2 Q3 Q4 Q1 Q2<td>2025 2026 2027 2028 2029 Q1 Q2 Q3 Q4 Q1 Q2<td>2025 2026 2027 2028 2029 2030 Q2 Q3 Q4 Q1 Q2 Q3<td>2025 2026 2027 2028 2029 2030 Q1 Q2 Q3 Q4 Q1<!--</td--></td></td></td></td>	2025 2026 2027 2028 2029 Q1 Q2 Q3 Q4 Q1 Q2 <td>2025 2026 2027 2028 2029 Q1 Q2 Q3 Q4 Q1 Q2<td>2025 2026 2027 2028 2029 2030 Q2 Q3 Q4 Q1 Q2 Q3<td>2025 2026 2027 2028 2029 2030 Q1 Q2 Q3 Q4 Q1<!--</td--></td></td></td>	2025 2026 2027 2028 2029 Q1 Q2 Q3 Q4 Q1 Q2 <td>2025 2026 2027 2028 2029 2030 Q2 Q3 Q4 Q1 Q2 Q3<td>2025 2026 2027 2028 2029 2030 Q1 Q2 Q3 Q4 Q1<!--</td--></td></td>	2025 2026 2027 2028 2029 2030 Q2 Q3 Q4 Q1 Q2 Q3 <td>2025 2026 2027 2028 2029 2030 Q1 Q2 Q3 Q4 Q1<!--</td--></td>	2025 2026 2027 2028 2029 2030 Q1 Q2 Q3 Q4 Q1 </td

Gantt chart



N=Neronov



C=Caprini



V=Vazza



B=Brandenburg Backup 17

COSMOMAG objectives (B1)

O1 Perform multi-messenger measurements of intergalactic magnetic fields in different parts of the cosmic web.

O2 Understand the role of magnetic fields in the structure formation process and probe the cosmological origin of the magnetic field in cosmic voids and filaments.

O3 Establish a relation between the relic magnetic fields and the stochastic gravitational wave background in different frequency ranges, derive constraints on magnetic field during the quark confinement epoch from the stochastic gravitational wave background.

O4 Link the parameters of the relic magnetic field in the present-day Universe to its initial characteristics in the early Universe.

O5 Use multi-messenger observational constraints on the primordial magnetic fields to test theoretical models of cosmological magnetogenesis and constrain Beyond-Standard-Model processes in the early Universe.

WP1: Constraint on intergalactic MFs in the present-day Universe

COSMOMAG	2025				2020				2027				2028				2029				2030			
VP PD PD main secondary PhD PM	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP1. Constraints on IGMF in the low-redshift Universe									-									_						
T1.1. Gamma-ray measurements			- K		1		8	EO1.1.	1	E	01.1.4	4 EO	1.1.3			EOI	.1.2			EO1.1	.5			3
T1.1.1. Physics of the highest energy extragalactic sources	Ph	D-NI							Ph	D-N2														
T.1.1.2. Optimisation of CTA analysis	-PD	NI	-	-	-	-		-			-	-	PI	D-N2		-			-			-	-	
T1.1.3. IGMF-dependent extended and delayed signals	PD	NI							PhI	D-NI			3 - P	D-N2	_		PhI	D-N2			1			
LHAASO, MAGIC	CTA	LST											CT/	N.										
T1.2. Radio measurements				<u></u>									EO1.2	.1 E	01.2.3		EO	1.2.2						
T1.2.1. A new use of RM statistics					PI	D-V1		-			-	-	-	-	-	-	-		-	-	•			
T1.2.2. Modelling of the GMF									-PD	-N3			-				-			_				
LOFAR, MeerKAT, MWA, ASKAF	2																SKA							
T1.3. UHECR measurements												1					PD	D-N3	-	-	EO	.3.1		
PAO, TA	Auge	er Prin	me, T	Ax4																				

Workforce: 4PDs, 2PhDs

Risks and mitigations: Operation and data releases of the new observatories may be delayed:

- (i) tune our methods using simulated data and
- (ii) work with the data and public data products of prototype/pathfinder instruments

WP1: Constraint on intergalactic MFs in the present-day Universe



Figure 3: LOFAR observation of the evolution of RM with redshift [18], compared to numerical predictions by different MFs seeding models.



Figure 2: Measured (black) and intrinsic (blue) spectra of the twc closest blazars, Mrk 421 and Mrk 501, compared to CTA North sensitivity for point sources (thin green solid line). Green thick line shows the sensitivity for extended emission, green dotted line is the expected secondary flux [169].

WP1: Constraint on intergalactic MFs in the present-day Universe



Name	TeVCat (C.U.)
1ES 1959+650	0.64
Mrk 421	0.3 🗸
Mrk 501	0.3 🗸
1ES 1218+304	0.08
1ES 2344+514	0.07 🗸
1ES 1426+428	0.03
1ES 2037+521	0.03
RGB J0710+591	0.03
RBS 0723	0.025
1ES 1727+502	0.021
RGB J0152+017	0.02
1ES 0229+200	0.018
1ES 1741+196	0.016
RX J1136.5+6737	0.015
1ES 1440+122	0.01
PGC 2402248	0.01
1ES 0414+009	0.006

WP2: End-to-end modelling of MF evolution from the early Universe to the present

COSMOMAG	2025				2026	1			2027	12.			2028	}			2029	į			2030			
VP PD main PhD PM PM	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP2. End-to-end modelling of magnetic field evolution from the early	Unive	rse to	the p	resen	t epoc	h			_															N.
T2.1. Evolutionary tracks throughout cosmological epochs							I	EO2.1.1	EO2	.1.2														
T2.1.1. Evolutionary tracks of magnetic field parameters	Ph	D-B1	(co-si	ipervis	sed by	Bran	denbu	irg and	Capri	ni)														
T2.1.2. Evolution endpoints	Phi	2-B1			PD	-B1					B1]							
T2.2. Co-evolution of PMF with the LSS from recombination to present da	у												EO	2.2.1			EO2	.2.2						
T2.2.1. A key survey of magnetisation models by galaxy feedback	-PD	-V2	-		-		-	-			-	-	-	-	-	-								
T2.2.2. Influence of the phase transition induced fields on the LSS									-PD	-V3	-	-	-	-			-		-			=	=	
T2.3. Modelling of γ-ray, radio and UHECR observables of WP1									EO2	.3.1				EC	02.3.2		EO2	.3.3						
T2.3.1. Constrained simulations of the real LSS	Ph	D-V1	(co-st	ipervis	sed by	Vazz	a and	Neron	ov)		-			1.1					PI	-V5			1	
T2.3.2. Modelling of the γ -ray and UHECR signals									Phi	D-N3	(0-5	upervi	sed by	Nerc	nov ai	d Va	zza)							

Workforce: 4PDs, 3 PhDs

Risks and mitigations: we would not be able to determine the decay exponent κ or locations of the endpoints *B*, I_B unambiguously for all cosmological epochs:

(i) rely on previous analytical understanding of the evolution, adding the modelling uncertainty of new simulations as systematic error in the synthesis work of WP4.

WP2: End-to-end modelling of MF evolution from the early Universe to the present



Figure 4: Parametric representation of p(t) (decay exponent of magnetic energy) and q(t) (exponent of the correlation length) adapted from [117] for time-dependent magnetic hyperdiffusion (blue) and ordinary magnetic hyperdiffusion that is constant (red). Symbol sizes increase with time. Dotted, dashed, and solid coloured lines mark different evolutionary tracks.



Figure 5: Comparison of feedback models by the Camels project (https://www.camel-simulations.org/), showing the projected gas density (blue) and very different distribution of hot gas (red) for the same cosmic volume.

WP3: Observational imprint of magnetic field on past cosmological epochs

COSMOMAG	2025				2026	i.			2027	12			2028	}			2029	k.			2030	Š		
VP PD main secondary PhD PM	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP3. Effect of magnetic field across cosmological epochs				3 2	10 10			-0) -12	-				1		20 				17 18					
T3.1 Primordial magnetic field and the SGWB									EO3	<mark>.1.1</mark>			EO	3.1.2					E	03.1.	BEO3	1.4		
T3.1.1. Study of initial conditions	PD	-C1	PD	-B2							P	D-C2												
T3.1.2. Modelling of the SGWB signal			1.0	T					PD	-C3					Р	D-B3								
T3.1.3. Detection of the SGWB signal									Ph	D-CI	(0-51	pervis	PD	-C4 Capri	ni and	1 Nero	nov)						VI	
NANOGrav, EPTA, PPTA, CPTA, InPTA, MeerTime	6. T													1000			SKA	PTA					-B2	
T3.2. Primordial magnetic field and the CMB													EO	3.2.1					1	303.2.	2			
T3.2.1. CMB constraints on inflationary magnetic field					Ph	D-V2	(co-s	upervi	sed by	Vazz	a and	Capri	ni)											
T3.2.2. Magnetic field effect on recombination, Hubble tension					Phi)-B2 ((co-su	pervis	ed by V	Branc P-B3	lenbu	g and	Capri	ni)		PD	-B4			VP-F	4			1
Planck, SPT		2			Ĵ						art : 	-	Sim	ons O	bserv	atory,	LiteBi	ird					(
T3.3. Structure formation and reionisation	-PD	-V4			1			1	Ph	D-V3	(co-s	upervi	EO3	.3.1 Vazz	and	Branc	EO3	.3.2 g)						

Workforce: 8 PDs, 4PhDs

Risks and mitigations: The PTA GW background may be due to supermassive black holes binaries:

(i) consider other generation scenarios at LISA, and/or derive constraints on (instead of measurements of) the early Universe signal component at PTA

WP3: Observational imprint of magnetic field on past cosmological epochs



Figure 7: From [101]. The Stochastic GW Background measurement by PTAs in 2021 (green, red, magenta) compared to the predictions of the same signal from a primordial MF at the QCD energy scale (blue) and from supermassive black hole binaries with different orbital eccentricities e (grey).



Figure 6: From [101]: The Stochastic GW Background power spectrum from MHD simulations (coloured points) performed with the PENCIL CODE, spanning from super-Hubble scales to wave numbers in the inertial range, compared with a physics-informed analytical fit (dashed-dotted line). The large scale break of the spectrum $k_{\rm br}$ corresponds to the source duration, while the spectral peak corresponds to the MF correlation scale $k_{\rm GW} \sim k_* = 2\pi/l_B$.

WP4: New cosmological probe

COSMOMAG	2025			2026				2027				2028				2029				203			
VP PD main secondary PhD PM	Q1 Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP4. New cosmological probe		10	EO4.	1.1			EO4	.1.2			EO4	.1.3			EO4	.1.4			EO4	.1.5			EO4.1.6
T4.1. Synthesis of observational and numerical results	PM-N	VP				VP				VP.			-	VI	2							Р	D-N4
T4.2. Cosmological magnetogenesis scenario		N				N2	2			NS				N	4	PD	-N5						PD-V3

Workforce: 3PD

- **Risks and mitigations**: measurements of WP1 and WP3, and the modelling of WP2, give discordant results and no self-consistent picture emerges. It may also be that none of the previously proposed MF generation processes are consistent with the data.
- (i) critically asses systematic uncertainties of each measurement, before reporting a new cosmological "tension" providing insight into beyond-Standard-Model phenomena, or possibly multiple cosmological sources of MFs.



Figure 1: *Front face* of the cube shows observational constraints on the primordial MF strength and correlation length (grey shading) [11]. Green lines show alternative theoretical predictions for the endpoints of the primordial MF evolution [12, 13]. Green regions show the sensitivity reach of GW detectors [11]. Red dot shows an example of initial field parameters consistent with the primordial Stochastic GW Background interpretation of the PTA data [14]. Red arrows show alternative predictions for the evolution of the PTA data [14]. Red arrows show alternative predictions for the evolution of the primordial MF parameters before Recombination [12, 13][15]. The "Hubble tension" interval on the endpoint line shows the observational hint from Ref. [16]. Blue shaded region shows the parameter space that we will explore in COSMOMAG. *Right face* shows numerical calculations of the field strength scaling with the matter overdensity (grey band and black line) [17]. The red cross shows the estimated field strength in the filaments [18]. The red dashed curve shows a possible scaling of the field strength, to be constrained by COSMOMAG. *Top face* shows parameters of MFs in galaxies and galaxy clusters.

WP4: New cosmological probe





Workforce

Workforce

	Team	Expertise	
	PI: A. Neronov	γ-ray, UHECR,	Instruments: Fermi-LAT, MAGIC,
APC	Members (in-kind): S.Babak, O.Kalashev, Y.Revaz, D. Semikoz	Simulations, Theory, GW	CTA, LHAASO, TA,
	PI: C. Caprini	GW, Theory, CMB,	EPTA, LISA,
CERN	Members (in-kind): V.Domcke, A.Roper Pol, U.Wiedermann	Simulations	LOFAR, ASKAP, SKA
	PI: F. Vazza	Simulations, Radio,	BICEP, LiteBIRD
UNIBO	Members (in-kind): A. Bonafede, E. Carretti, F. Finelli, D. Paoletti	UHECR, CMB	Codes:
	PI: A. Brandenburg	Simulations, MHD,	ENZO
LSINU	Members (in-kind): , K. Bondarenko, O. Ghosh, O. Iarygina, F. Niedermann	GW	



APC Team - 1 PI, 5 Post-Docs, 3 PhDs

PI		2026	2027	2028	2029	2030	2031	work package	activity
PhDN1								WP1	Transients and GRBs with CTA, LHAASO; EBL, delayed emission
PhDN2								WP1	Extreme blazars (CTA, LHAASO), EBL, extended emission
PDN1								WP1	CTA analysis optimization, search for delayed emission
PDN2								WP1	CTA analysis optimization, search for extended emission
PDN3								WP1	Galactic magnetic field, UHECR
PhDN3								WP2 (co-supervision Vazza)	Modelling of UHECR and gamma-ray signals (CR beam, ENZO)
PDN4								WP4	Synethesis of observables and modelling of WP1-WP3
PDN5 +4 visit	ina profes	ssors in 2	2025 202	6 2027	2028			WP4	Theoretical magnetogenesis models
			,0	~, ~~~, , ,				•	Backup 30



CERN Team , 1 PI, 4 Post-Docs, 1 PhD

PI	2025	2026	2027	2028	2029	2030	work package	activity
PDC1							WP3	Study of QCD magnetogenesis
PDC2							WP3	Study of EW and inflationary magnetogenesis
PDC3							WP3	MHD simulations of GW production
PDC4							WP3	Pipelines for SGWB detection with LISA
PhDC1							WP3 (co-supervision Neronov)	Pipelines for SGWB detection with PTA



UNIBO Team: 1 PI, 5 Post-Docs, 3 PhDs

PI	2025	2026	2027	2028	2029	2030	work package	activity
PDV1							WP1	radio analysis, LOFAR, ASKAP, SKA
PDV2							WP2	ENZO simulations: feedback testing
PDV3							WP2-WP4	ENZO AMR simulations: magnetic effects on structure formation
PhDV1							WP2 (co-supervision Neronov)	ENZO simulations: constrained simulation of Local Universe
PDV5							WP2	ENZO simulations & radio: validation with radio data
PhDV2							WP3 (co-supervision Caprini)	CMB constraints and predictions for LiteBird
PhDV3							WP3 (co-supervision Brandenburg)	ENZO simulations: reionisation in local Universe
PDV4							WP3	ENZO simulations: magnetic effects on reionisation



UNIST Team, 1 PI, 4 Post-Docs, 2 PhDs

PI	2025	2026	2027	2028	2029	2030	work package	activity
PhDB1							WP2 (w/ Caprini & Neronov)	Evolution track and endpoints
PDB1							WP2	endpoints
PDB2							WP3	initial conditions (magnetogenesis mechanisms)
PDB3							WP3	SGWB modeling
PhDB2							WP3 (w/ Caprini)	Magnetic field effect on Recombination, Hubble tension, with focus on numerical simulations
PDB4							WP3	magnetic field effect on Recombination and Hubble tension, with focus on magnetic effects on CMB

+4 visiting professors in 2026, 2027, 2028, 2029

Advisory board

- Four senior researchers in the field
- One of them will play the role of ombudsperson
- Meet yearly to
 - monitor development of the project from scientific and managerial sides
 - mitigate unlikely conflicts among the team

Meetings

- Yearly COSMOMAG workshops (synthesis work, challenges, PhD and postdoc training, outreach)
 - 20 kEuro per event
- 2 international PhD schools
 - 50 kEuro per event
- 2 topical conferences open to broad community
 - 50 kEuro per event
- 2nd edition of program "Generation, evolution and observations of cosmological magnetic fields"
 - 100 kEuro for the event (co-funding)