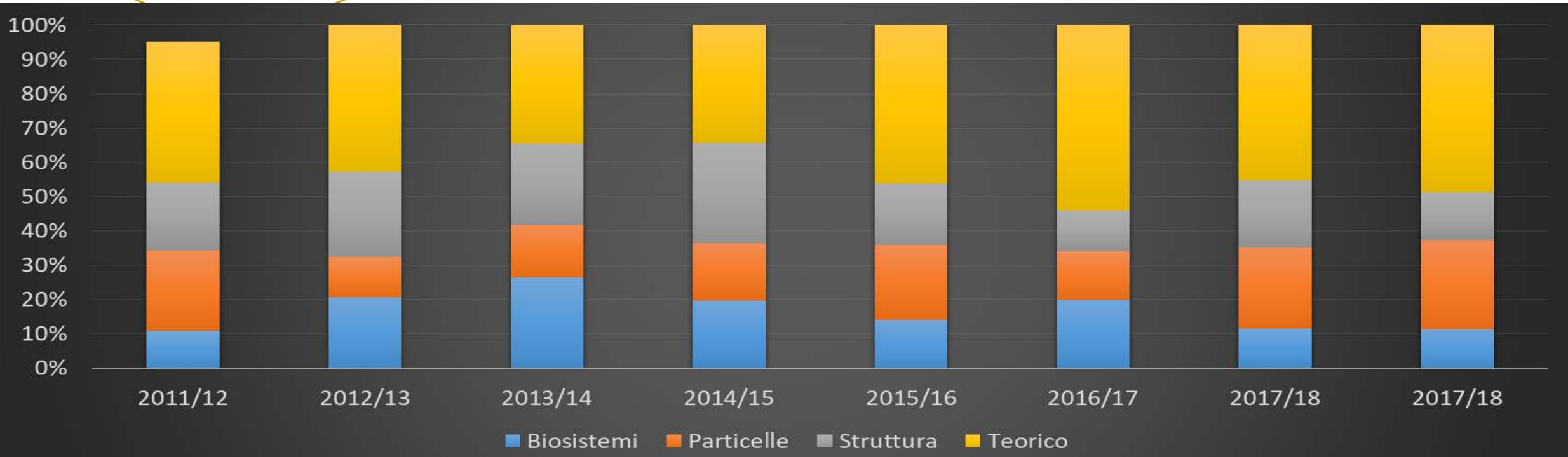


Riccardo Paramatti
Università Sapienza and INFN Roma
Retreat Fisica Particelle Elementari
18/6/2019

Particle and Astroparticle Physics Curriculum (LM-17)



Corsi di Laurea nel Dipartimento di Fisica

Offerta formativa in Sapienza (ordinamento D.M. 270/04):

- Laurea Triennale in Fisica (L-30)
- **Laurea Magistrale in Fisica (LM-17)**
 - 4 curricula: Biosistemi, Struttura, Teorico e **Particle and Astroparticle Physics (PAP)**
- Laurea Magistrale in Astronomia e Astrofisica (LM-58, Scienze dell'universo)

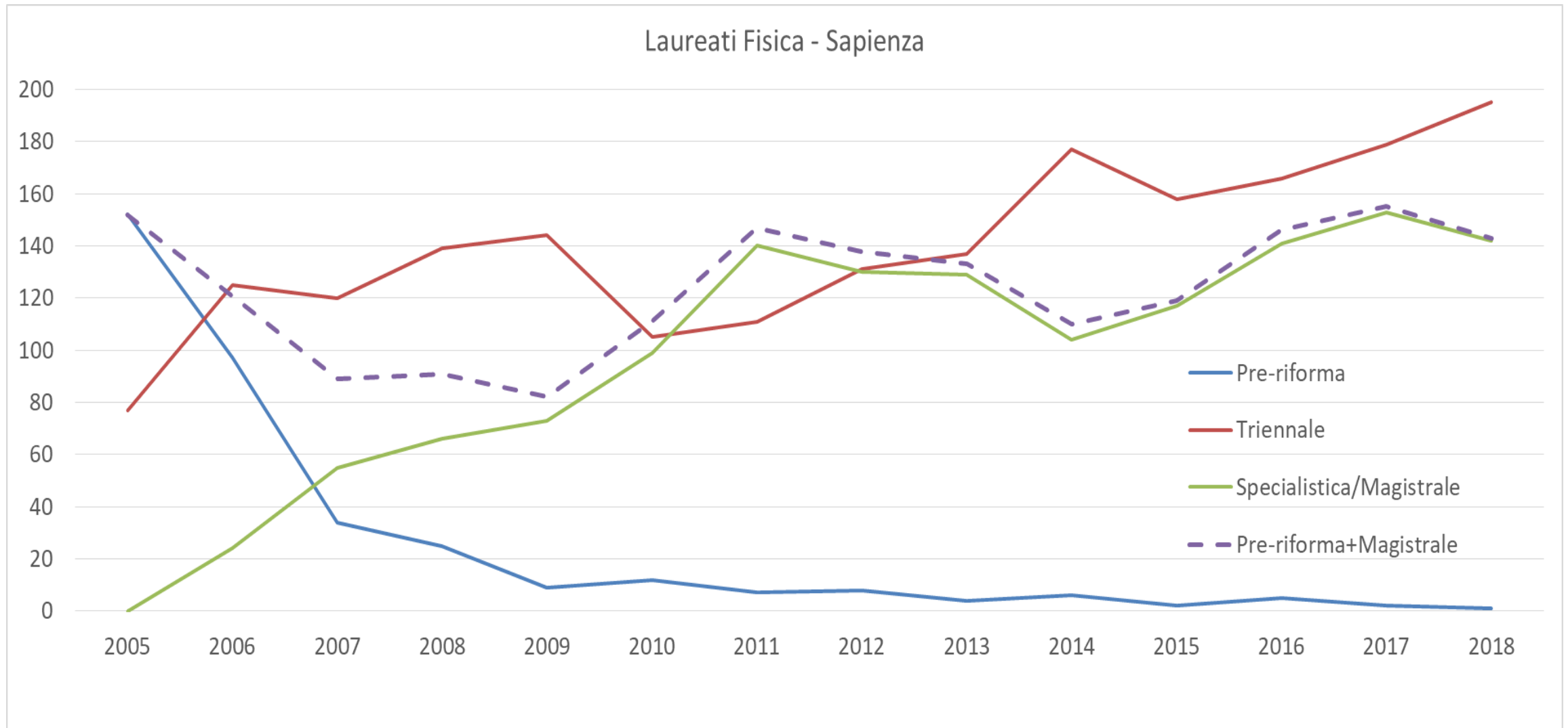


Numero laureati vs anno (dati Almalaurea)

Ordinamento	Corso di Laurea	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		totale
pre-riforma	fisica (ciclo unico)	152	97	34	25	9	12	7	8	4	6	2	5	2	1		364
DM 509/99	fisica (25)	56	79	89	100	111	88	47	19	12	15	8	4	1	0		629
DM 270/04	fisica (L-30)	0	0	0	0	0	0	49	94	92	131	129	154	170	190		1009
DM 509/99	fisica e astrofisica (25)	21	46	31	39	33	17	11	7	9	3	1	2	2	3		225
DM 270/04	fisica e astrofisica (L-30)	0	0	0	0	0	0	4	11	24	28	20	6	6	2		101
DM 509/99	astronomia e astrofisica (66/S)	0	4	9	16	18	19	18	8	4	0	0	2	0	0		98
DM 270/04	astronomia e astrofisica (LM-58)	0	0	0	0	0	0	7	12	11	11	26	20	26	21		134
DM 509/99	fisica (20/S)	0	20	46	50	55	80	79	35	13	8	1	1	1	1		390
DM 270/04	fisica (LM-17)	0	0	0	0	0	0	36	75	101	85	90	118	126	120		751
	Triennale	77	125	120	139	144	105	111	131	137	177	158	166	179	195		1964
	Pre-riforma+Magistrale	152	121	89	91	82	111	147	138	133	110	119	146	155	143		1737
	totale	229	246	209	230	226	216	258	269	270	287	277	312	334	338		3701

triennale
specialistica/magistrale
corso attivo

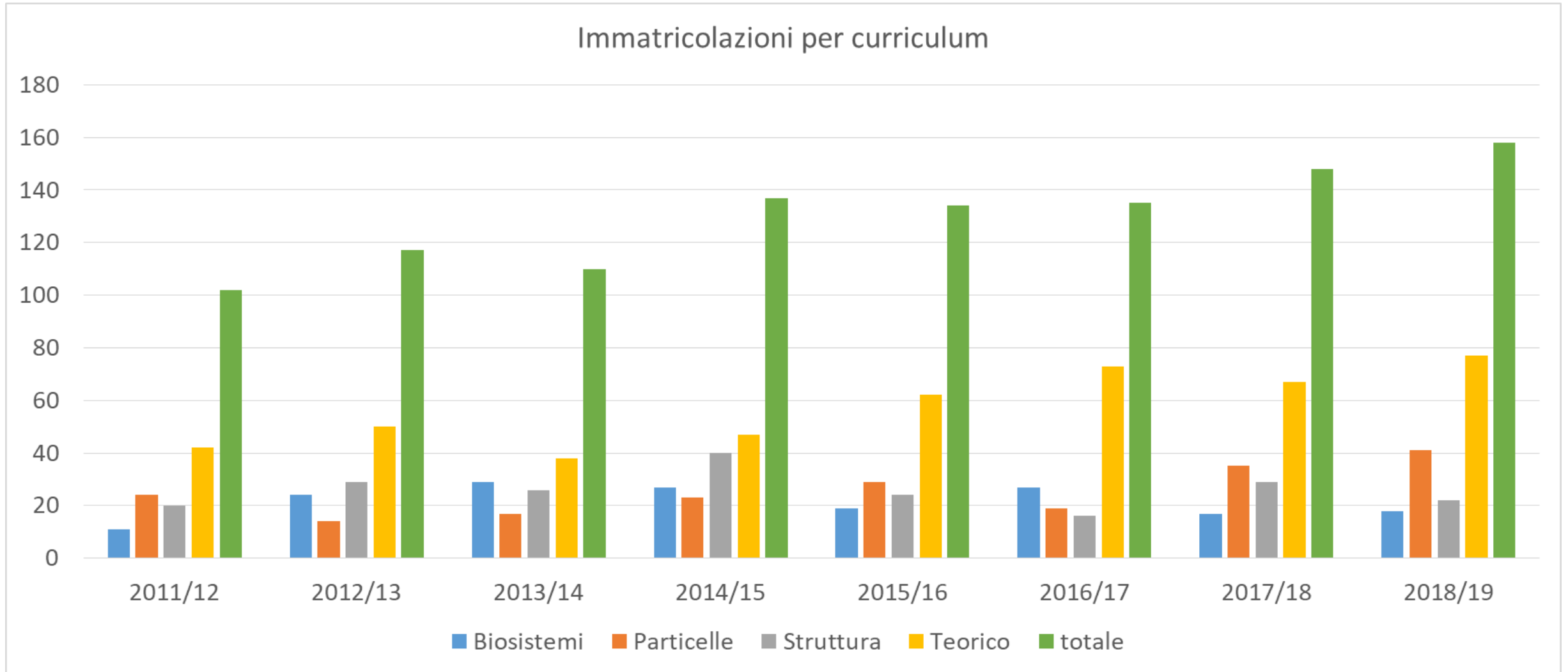
Numero laureati vs anno (dati Almalaurea)



Master Degree in Physics (LM-17)

- The Particle and Astroparticle is the only curriculum of LM-17 taught in English. The aim is twofold:
 - facilitate the entry in the research field
 - allow foreign student attendance
- Excellent opportunity to complete the master degree with a thesis project in an international laboratory in the world.
- A.A. 2017/18 and 2018/19: first two years of teaching in English (few data in slides 6-9)
- A.A. 2019/20: renovated curriculum (described in slides 10-15)

[Scelta piani formativi LM-17]





[Scelta piani formativi LM-17]

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	totale
Biosistemi	11	24	29	27	19	27	17	18	172
Particelle	24	14	17	23	29	19	(*) 35	(**) 41	202
Struttura	20	29	26	40	24	16	29	22	206
Teorico	42	50	38	47	62	73	67	77	456
Geofisica	5								5
totale	102	117	110	137	134	135	148	158	1041

(*) Primo anno in inglese; 2 studenti stranieri (+ un terzo che ha presentato un piano teorico nel secondo anno)

(**) 12 studenti stranieri (+ una studentessa che non ha presentato il piano formativo)

L'anno prossimo potremmo avere decine di studenti stranieri.

Scelta esami (suggeriti nei gruppi A/B)

	Anno	Semestre		A.A. 2017/18	A.A. 2018/19	totale
Computer Architecture for Physics	2	1	INF/01	1	4	5
Current Topics in Particle Physics	2	1	FIS/01	9	8	17
Surface Physics and Nanostructures (*)	2	1	FIS/03	0	0	0
Nuclear Physics	1	2	FIS/04	17	27	44
Methods in Experimental Particle Physics	1	2	FIS/01	12	14	26
Computing Methods for Physics	1	1	INF/01	33	38	71
Detectors for particle physics	2	1	FIS/01	21	28	49
Quantum Field Theory (*)	2	1	FIS/02	0	0	0
Particle and astroparticle Physics (mutuato da LM-58) (*)	2	1	FIS/01	13	16	29
Experimental Gravitation (mutuato da LM-58) (*)	2	1	FIS/01	1	2	3
Digital electronics	2	1	FIS/01	0	5	5
Medical Applications of Physics	2	1	FIS/01	11	14	25

(*) corso nel quale gli studenti del curriculum PAP sono una minoranza



[Scelta esami (fuori dai gruppi A/B)]

	Corso di Studi	Docente		A.A. 2017/18	A.A. 2018/19	totale
Plasma Physics and Nuclear Fusion	LM-30 Ing, Energ	Atzeni	FIS/01	0	1	1
Reti Neurali	LM-17	Del Giudice	FIS/02	1	0	1
Observational Cosmology	LM-58	Lamagna	FIS/05	1	0	1
Quantum Electrodynamics	LM-17	Benhar	FIS/02	2	4	6
Simmetrie e Interazioni Fondamentali	LM-17	Polosa	FIS/02	8	2	10
Relatività Generale	LM-58	Ferrari	FIS/02	4	0	4
Matematiche Elementari da un punto di vista superiore	LM-40 Matemat	Menghini	MAT/03	1	0	1
Simulazioni atomistiche	LM-17	Sciortino	FIS/03	1	0	1
Weak Interactions in the Standard Model and Beyond	LM-17	Silvestrini	FIS/04	1	0	1
Elettrodinamica del plasma	LM-17	Montani	FIS/01	1	0	1
Filosofia della scienza I A	L-5 Filosofia	Gagliasso	M-FIL/02	0	1	1
Antropologia culturale	vari	vari	M-DEA/01	1	0	1
Didattica Generale	L-19 Scienze dell	Sposetti	M-PED/03	1	0	1

24 cfu per l'insegnamento

Gruppo di lavoro sul curriculum PAP

- A.A. 2019/20: renovated curriculum. Two main innovations:
 - All courses are 6 CFU (except Physics Lab. II – 9 CFU)
 - Five elective courses (was 4 until last year)

[Report conclusivo del gruppo di lavoro](#)

	CFU corsi obbligatori	CFU corsi facoltativi	Frazione di obbligatori	Numero di insegnamenti opzionali nei gruppi A/B/C
Biosistemi	33	42	44%	23
Struttura	45	30	60%	17
Particelle	51 →45	24 →30	68% →60%	12 →14
Teorica	33	42	44%	24

Tabella 1: Ripartizione del numero di CFU tra i corsi obbligatori e opzionali nei quattro curricula della LM in Fisica. Nell'ultima colonna è riportato il numero di insegnamenti opzionali, cioè appartenenti ai gruppi A, B e C quando presente; non vengono conteggiate le ripetizioni.



Corso di laurea in Fisica (LM-17) - Curriculum Particle and Astroparticle Physics

N.	Insegnamenti	CFU	anno	sem.	SSD	eng	ambito
1	Relativistic Quantum Mechanics	6	1	1	FIS/02	Y	caratt.
2	Electroweak interactions	6	1	1	FIS/02	Y	caratt.
3	Condensed Matter Physics	6	1	1	FIS/03	Y	caratt.
4	Elective (within group B)	6	1 / 2	1 / 2		Y	aff.-int.
5	Physics Laboratory I (propedeutic teaching to Physics Laboratory II)	6	1	1	FIS/01	Y	caratt.
6	Particle Physics	6	1	2	FIS/04	Y	caratt.
7	Mathematical Physics	6	1	2	MAT/07	Y	aff.-int.
8	Elective (within group A)	6	1 / 2	1 / 2	FIS/01	Y	caratt.
9	Elective (free choice)	6	1	2		Y	
10	Physics Laboratory II	9	1	2	FIS/01	Y	caratt.
11	English language	4	1	2		Y	AAF
12	Elective (within group B)	6	1 / 2	1 / 2		Y	aff.-int.
13	Elective (free choice)	6	2	1		Y	
14	Internship	3	2	1		Y	AAF
15	Thesis Project	38	2	2		Y	AAF

CFU = number of credits

SSD: Settore Scientifico Disciplinare

- FIS: Physics course
 - FIS/01: experimental physics
 - FIS/02: theoretical physics
 - FIS/03: condensed matter physics
 - FIS/04: nuclear and subnuclear physics
- MAT: Mathematics course

The student must choose at least 12 CFU (2 courses) labelled INF (Computer science), MAT, CHIM (Chemistry), BIO (Biology)

Courses of Particle and Astroparticle Physics curriculum

first semester, first year

1	Relativistic Quantum Mechanics	6	1	1	FIS/02
2	Electroweak interactions	6	1	1	FIS/02
3	Condensed Matter Physics	6	1	1	FIS/03
4	Elective (within group B)	6	1 / 2	1 / 2	
5	Physics Laboratory I (propedeutic teaching to Physics Laboratory II)	6	1	1	FIS/01

Mandatory courses:

- Relativistic Quantum Mechanics: prof. Roberto Bonciani (compressed course ending at the beginning of November)
- Electroweak interactions: prof. Guido Martinelli (starting just after end of RQM)
- Condensed Matter Physics: prof. Antonio Polimeni and prof. Sergio Caprara
- Physics Laboratory I: prof. Gianluca Cavoto

Suggested elective course: Computing Methods for Physics (INF/01), prof. Shahram Rahatlou

Courses of Particle and Astroparticle Physics curriculum

second semester, first year

6	Particle Physics	6	1	2	FIS/04
7	Mathematical Physics	6	1	2	MAT/07
8	Elective (within group A)	6	1 / 2	1 / 2	FIS/01
9	Elective (free choice)	6	1	2	
10	Physics Laboratory II	9	1	2	FIS/01

Mandatory courses:

- Particle Physics: prof. Paolo Bagnaia
- Mathematical Physics (MAT)
- Physics Laboratory II: prof. Gianluca Cavoto

An elective course within group A. In this semester:

- Detectors and Accelerators in Particle Physics: prof. Stefano Giagu
- Methods in Experimental Particle Physics: prof. Antonio Di Domenico

An elective course (free choice)

Courses of Particle and Astroparticle Physics curriculum

first semester, second year

12	Elective (within group B)	6	1 / 2	1 / 2
13	Elective (free choice)	6	2	1

- Although it is suggested to plan two exams in the second year, moving one exam from first to second year (or viceversa) is allowed.
- The two free choices should preserve the consistency of the course plan; courses in italian can be selected as free choice.

Courses of Particle and Astroparticle Physics curriculum

Gruppo B (aff.-int.)

1	Computing Methods for Physics	6	1	1	INF/01
2	Computer Architecture for Physics	6	1	2	INF/01
3	Detectors and Accelerators in Particle Physics	6	1	2	FIS/01
4	Methods in Experimental Particle Physics	6	1	2	FIS/01
5	Nuclear Physics	6	1	2	FIS/04
6	Quantum Electrodynamics	6	1	2	FIS/02
7	Collider Particle Physics	6	2	1	FIS/01
8	Current Topics in Particle Physics	6	2	1	FIS/01
9	Experimental Gravitation	6	2	1	FIS/01
10	Medical Applications of Physics	6	2	1	FIS/01
11	Particle and astroparticle Physics	6	2	1	FIS/01
12	Quantum Field Theory	6	2	1	FIS/02
13	Solid State Sensors	6	2	1	FIS/01
14	Weak Interactions in the Standard Model and beyond	6	2	1	FIS/02

New web site:

<https://web.infn.it/area-particelle-roma/>

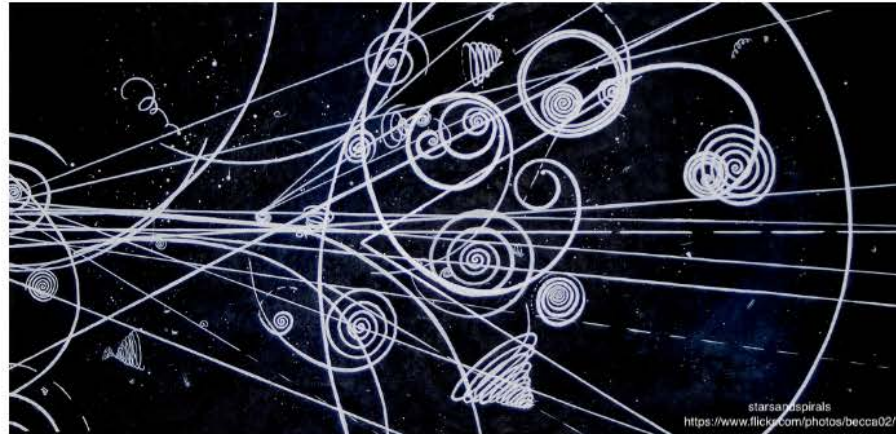
Particle and Astroparticle Physics

Dipartimento di Fisica - Sapienza Università di Roma

This page collects information on the Particle and Astroparticle Physics group of the Sapienza University of Rome.

The Particle and Astroparticle Physics group comprises various research teams involved in many experiments in the **Particle physic**, **Astroparticle physics** and **Gravitational waves** areas.

Information on programs and courses for master students and opportunities for master theses are available **here**.



- The site collects recommended courses for different specializations of the master student program.

Suggested specializations.

EXPERIMENTAL PARTICLE PHYSICS

- 1st year, 1st semester: Computing Methods for Physics
- 1st year, 2nd semester: Detectors and Accelerators in Particle Physics
- 1st year, 2nd semester: Methods in Experimental Particle Physics
- 2nd year, 1st semester: Collider Particle Physics
- 2nd year, 1st semester: one course among Current Topics in Particle Physics and Solid State Sensors

ASTROPARTICLE AND GRAVITATIONAL WAVES

- 1st year, 1st semester: Computing Methods for Physics
- 1st year, 2nd semester: Detectors and Accelerators in Particle Physics
- 1st year, 2nd semester: one course chosen among Methods in Experimental Particle Physics and Nuclear Physics
- 2nd year, 1st semester: Particle and Astroparticle Physics
- 2nd year, 1st semester: Experimental Gravitation

Suggested specializations.

PHENOMENOLOGY

- 1st year, 1st semester: Computing Methods for Physics
- 1st year, 2nd semester: one course chosen among Methods in Experimental Particle Physics and Nuclear Physics
- 1st year, 2nd semester: Quantum Electrodynamics
- 2nd year, 1st semester: Quantum Field Theory
- 2nd year, 1st semester: Weak Interactions in the Standard Model and beyond

APPLIED PHYSICS

- 1st year, 1st semester: Computing Methods for Physics
- 1st year, 2nd semester: one course chosen among Detectors and Accelerators in Particle Physics, Methods in Experimental Particle Physics, and Nuclear Physics
- 1st year, 2nd semester: Computer Architecture for Physics
- 2nd year, 1st semester: Medical Applications of Physics
- 2nd year, 1st semester: Solid State Sensors