

*TECHNICAL SCHEDULE OF THE INTERNATIONAL ACADEMIC  
COOPERATION AGREEMENT*

*between*

*University of L'Aquila (Italy)*

*and*

*Ivane Javakhishvili Tbilisi State University (Georgia)*

*regarding*

*the bi-national Double Master's Degree Studies in*

*PHYSICS*

**Academic Year 2018/19**

Taking into consideration the International Academic Cooperation Agreement between the **University of L'Aquila**, hereinafter referred to as UNIVAQ, and the **Ivane Javakhishvili Tbilisi State University**, hereinafter referred to as TSU, signed in L'Aquila on April the 6<sup>th</sup> 2018 and in Tbilisi on March the 5<sup>st</sup> 2018, in order to carry out the bi-national double degree Masters' studies in *Physics*, as well as to enable their students to expand their curricula through gaining important experience abroad, the Parties hereby agree as follows.

## **DEFINITIONS**

Unless otherwise stated:

- UNIVERSITY OF ORIGIN refers to the University at which the student has been enrolled prior to the exchange.
- HOST UNIVERSITY refers to the University which has agreed to admit the student for the period of study abroad.

## **PROCEDURE FOR STUDENTS' EXCHANGE**

According to the European as well as both Partner universities regulations, during the two-year Master course the student must accumulate a total of at least 120 ECTS credits (about 60 ECTS credits per academic year). It is unnecessary, and impossible, to seek accurate correspondence between analogous courses of the partner Universities, however, the courses exhibiting the most similarities will be identified. Should the student fail to pass several courses or groups of courses provided by the Host University, only the examinations that have been passed and the corresponding ECTS credits will be recognized.

The students participating in the exchange must follow the rules and regulations that apply at the Host University.

The Host University will provide the students with the necessary logistical support. However, the University is not obliged to provide accommodation or financial assistance.

The students participating in the exchange must personally complete bureaucratic formalities required for the period of living abroad.

### **Selection of candidates**

For the academic year 2018/2019, the University of Origin will be responsible for finding and selecting the students eligible for the exchange Programme, as well as for allowing the students to attend courses and write a master's thesis abroad. Each University reserves the right to seek available places for exchange program, agreeing with the Partner University on the procedure for carrying out the exchange in accordance with the signed International Academic Cooperation Agreement.

In order to be admitted to the selection process, the student is required to demonstrate a good knowledge of English.

## **ENROLMENT, ATTENDANCE AND EVALUATION OF STUDENTS**

The Host University, having examined student's career track in order to award related credit points, decides whether the student can be admitted in accordance with proper regulations and reports any differences in the curricula of analogous courses provided by both Universities and listed in the Tables below, according to the track chosen. At the end of the period of stay, the Host University will issue official certificates with a transcript of credit points earned by the student.

The University of Origin will review the overall curriculum of the student, including the period that the student intends to spend at the Host University, in order to determine the eligibility of the student in accordance with proper regulations and taking into account similarities in the curricula of the courses provided by both Universities and listed in Tables below, according to the track chosen by each student. At the end of the period of stay abroad, the University of Origin will prepare a transcript of the credit points earned by the student at the Host University.

Correspondence between the courses is illustrated in the following way. Table I lists the mandatory courses in Year 1 at the ‘home’ institution; Tables II (a, b, c), III (a,b,c) list all courses of the Master programs that can be attended by the student at home (Table II) and host (Table III) Institution and according to the following tracks:

- a) Condensed Matter Physics (UNIVAQ) → Condensed Matter Physics (TSU Tbilisi),
- b) Particle and Astroparticle Physics (UNIVAQ) / Atomic Physics and Elementary Particle Physics (TSU Tbilisi),
- c) Space Physics (UNIVAQ) → Astrophysics and Plasma Physics (TSU Tbilisi).

### Year 1

In Year 1, the student will attend mandatory courses listed in Table I at the Home University (i.e. the University of Origin), as well as courses at his/her choice among those listed in Tables II a, or b or c, according to the chosen track.

**TABLE I: 1<sup>st</sup> year, 1<sup>st</sup> semester COMMON TO ALL TRACKS at the Home University**

1 <sup>st</sup> year, 1 <sup>st</sup> semester <i>University of L'Aquila</i>		1 <sup>st</sup> year, 1 <sup>st</sup> semester <i>Ivane Javakishvili Tbilisi State University</i>		
<i>Course</i>	<i>ECTS</i>	<i>Course</i>	<i>ECTS</i>	<i>T SSD</i>
Nuclear and Sub-nuclear Physics	6	Supplementary Topics of Quantum Mechanics	5	B Fis04
		Radiation Theory	5	B Fis04
Condensed Matter Physics	6	Introduction to Condensed Matter Physics	5	B Fis03
Statistical Mechanics	6	Supplementary Topics of Statistical Physics	5	B Fis03
Quantum Electrodynamics	6	Quantum Field Theory I	5	B Fis02
Experimental Methods in Physical Research	6	Nonlinear Phenomena I	5	B Fis01
English B2	3	English B2*	3*	1-lin/12
<b>Total (first semester)</b>	<b>33</b>	<b>Total (first semester)</b>	<b>33</b>	<b>30B +3F</b>

\*Knowledge of the English language at level B2 will be recognized at UNVIAQ upon submission of certification awarded at TSU

**Table II a: 1<sup>st</sup> year 2<sup>nd</sup> semester at the Home University - TRACK: Condensed Matter Physics**

1 <sup>st</sup> year 2 <sup>nd</sup> sem <i>University of L'Aquila</i>			1 <sup>st</sup> year 2 <sup>nd</sup> sem <i>Ivane Javakishvili Tbilisi State University</i>			
<i>Course</i>	<i>Sem</i>	<i>ECTS</i>	<i>Course</i>	<i>Sem</i>	<i>ECTS</i>	<i>T SSD</i>
Solid State Physics	2	10	Theory of Phase Transitions and Critical Phenomena	2	5	B Fis03
			Physics of Magnetism I	2	5	
Spectroscopy or Advanced methods in Condensed Matter	2	6	Optical Properties of Condensed Matter	2	5	C Fis03

<i>1<sup>st</sup> year 2<sup>nd</sup> sem University of L'Aquila</i>			<i>1<sup>st</sup> year 2<sup>nd</sup> sem Ivane Javakhishvili Tbilisi State University</i>			
Physics of the Atmosphere, or Magnetohydrodynamics, or Astrophysics	1,2	6	Nonlinear Phenomena II	2	5	B Fis06
Advanced Physics Lab or Choice in 'C'	2	6	Quantum Statistics	2	5	C Fis01,03
			Radiospectroscopy I	2	5	C Fis03
<b>Total</b>		<b>28</b> <b>16B 12C</b>	<b>Total</b>			<b>30</b> <b>15B 15C</b>

TABLE III a: 2<sup>nd</sup> year at the Host University TRACK: Condensed Matter Physics

<i>2<sup>nd</sup> year 1<sup>st</sup> sem Ivane Javakhishvili Tbilisi State University</i>			<i>2<sup>nd</sup> year 1<sup>st</sup> sem University of L'Aquila</i>		
<i>Course</i>	<i>Sem</i>	<i>ECTS</i>	<i>Course</i>	<i>Sem</i>	<i>ECTS T SSD</i>
Radiospectroscopy II	3	5 C	Spectroscopy or Advanced methods in Condensed Matter	4	6 C Fis03
Classical and High Temperature Superconductivity	3	5 C	Advanced Physics Lab or Choice in 'C'	3,4	6 4CFis03 2D
Physics of Magnetism II	3	5 3C,2D	Free Choice	3,4	6 D C Fis03
Nuclear Magnetic Resonance Methods in Solid State Physics	3	14 (selective)			
Quantum Fields and Quantum Systems in Low Dimensions	3	5 ECTS			
Symmetry and Group Theory in Solid State Physics	3	each 6D+8F			
Low Temperature Physics and Technology	3				
Quantum Plasma					
<b>Total</b>		<b>29</b> <b>13C,8D,8F</b>	<b>Total</b>		<b>18</b> <b>10C 8D</b>

Table II b: 1<sup>st</sup> year 2<sup>nd</sup> semester at the Home University - TRACK: Particle and Astroparticle Physics (L'Aquila) – Atomic Physics and Elementary Particle Physics (Tbilisi) [Specialties depending on thesis: Atomic Physics or Elementary Particle Physics]

<i>1<sup>st</sup> year 2<sup>nd</sup> sem University of L'Aquila</i>			<i>1<sup>st</sup> year 2<sup>nd</sup> sem Ivane Javakhishvili Tbilisi State University</i>		
<i>Course</i>	<i>Sem</i>	<i>ECTS</i>	<i>Course</i>	<i>Sem</i>	<i>ECTS T SSD</i>
Particle physics	2	10	Theoretical Nuclear Physics	2	5 B Fis04
			Gravitation and Cosmology I	2	5 C Fis02
Gauge Theories	2	6	Quantum Field Theory II	2	5 C Fis02
Choice 'C' or Advanced Physics Lab	2,3	6	Experimental Research Methods in Particle Physics	2	5 C Fis01
Physics of the Atmosphere, or Magnetohydrodynamics, or Astrophysics	1,2,3	6 Fis05, Fis06	Experimental Nuclear Physics (Selective)	2	10 B
			Physics of Cosmic Rays (Selective)	2	
			Standard Model (Selective)	2	5 ECTS
			Basics of Plasma Physics I (Selective)	2	each
			Physics of the Accelerators (Selective)	2,3	
			Elementary Particles Experimental Physics (Selective)	2,3	
<b>Total</b>		<b>28</b>	<b>Total</b>		<b>30</b>

TABLE III b: 2<sup>nd</sup> year at the Host University TRACK: Particle and Astroparticle Physics (L'Aquila) - Atomic Physics and Elementary Particle Physics (Tbilisi)

3 <sup>rd</sup> semester Ivane Javakhishvili Tbilisi State University			3 <sup>rd</sup> semester University of L'Aquila			
Course	Sem	ECTS	Course	Sem	ECTS	T SSD
Theory of Elementary Particles	3	5	General Relativity and Cosmology	3	6	C Fis02
Scattering Theory	3	5	Advanced Physics Lab or Choice 'C'	2,3	6	4C 2D Fis01,02
Gravitation and Cosmology II	3	5 3C 2F				C Fis01
Statistical Modeling and Data Statistical Analysis	3	5 F				
Experimental Research Methods in Physics of Atomic and Molecular Processes ( <i>Selective</i> )	3	9 8D 1F 5ECTS each	Free choice	3,4	6	D
Advanced Problems in Atomic and Nuclear Physics ( <i>Selective</i> )	3					
Physics of the Accelerators ( <i>Selective</i> )	2,3					
Elementary Particles Experimental Physics ( <i>Selective</i> )	2,3					
<b>Total Mandatory</b>		<b>29</b> 13C 8D 8F				<b>18</b> 10C 8D

Table II c: 1<sup>th</sup> year 2<sup>nd</sup> semester at the Home University - TRACK: Space Physics (L'Aquila) - Astrophysics and Plasma Physics (Tbilisi)

1 <sup>st</sup> year 2 <sup>nd</sup> sem University of L'Aquila			1 <sup>st</sup> year 2 <sup>nd</sup> sem Ivane Javakhishvili Tbilisi State University			
Course	Sem	ECTS	Course	Sem	ECTS	T SSD
Space Physics	1	10	Basics in Plasma Physics I	2	5	B Fis06
Physics of the Circumterrestrial Space or Physics of the Magnetosphere	2,4	6	Magnetic Hydrodynamics I	2	5	B Fis06
Astrophysics/Physics of the Atmosphere	2	6	Gravitation and Cosmology I	2	5	B Fis05
Advanced Simulations Techniques	2	6 Fis05	Modeling in Astrophysics and Plasma Physics I	2	5	C Fis05
			Optical Properties of Condensed Matter	2	5	CFis03
			Nonlinear Phenomena II ( <i>Selective</i> )	2	5	C
			Quantum Statistics ( <i>Selective</i> )		5ECTS each	Fis02
<b>Total</b>		<b>28</b> 16B 12C	<b>Total</b>			<b>30</b> 15B 15C

TABLE III c: 2<sup>nd</sup> year at the Host University TRACK: *Space Physics (L'Aquila) - Astrophysics and Plasma Physics (Tbilisi)*

<i>3<sup>rd</sup> semester Ivane Javakishvili Tbilisi State University</i>			<i>3<sup>rd</sup> semester University of L'Aquila</i>			
<i>Course</i>	<i>Sem</i>	<i>ECTS</i>	<i>Course</i>	<i>Sem</i>	<i>ECTS</i>	<i>TSSD</i>
Basics in Plasma Physics II	3	5	Physics of the Circumterrestrial Space or Physics of the Magnetosphere	4	6	C Fis05,06
Magnetic Hydrodynamics II	3	5	Advanced Physics Lab or Choice 'C' (e.g. General Relativity and Cosmology)	2,3	6	4CFis01,06 2D
Gravitation and Cosmology II	3	5 3C 2F				
Modeling in Astrophysics and Plasma Physics II	3	5 5F				
Relativistic Plasma ( <i>Selective</i> ) Astrophysical Flows ( <i>Selective</i> ) Experimental Plasma Physics ( <i>Selective</i> ) Solar Physics ( <i>Selective</i> ) Quantum Plasma ( <i>Selective</i> ) Relativistic Optics and Super-strong Radiation Plasma Physics ( <i>Selective</i> ) Physics of Compact Objects ( <i>Selective</i> ) Solar-Terrestrial Connections ( <i>Selective</i> ) Waves in Earth Crust and Atmosphere ( <i>Selective</i> ) Nonlinear Phenomena Modelling in Ionosphere and Earth Atmosphere ( <i>Selective</i> )	3	9 8D 1F  5ECTS each	Free choice	3,4	6	6D
<b>Total Mandatory</b>		<b>29</b> 13C 8D 8F				<b>18</b> 10C 8D

TABLE IV: 4<sup>th</sup> semester all TRACKS at HOST University

<i>4<sup>th</sup> sem. Ivane Javakishvili Tbilisi State University</i>		<i>4<sup>th</sup> sem. University of L'Aquila</i>	
<i>Course</i>	<i>ECTS</i>	<i>Course</i>	<i>ECTS</i>
Thesis(Condensed Matter Physics / Astrophysics / Plasma Physics / Atomic Physics / Elementary Particle Physics / Nonlinear Phenomena Physics)	30	Thesis (3 <sup>rd</sup> , 4 <sup>th</sup> sem)	33
		Other activities (3 <sup>rd</sup> , 4 <sup>th</sup> sem)	6
<b>Total 4<sup>th</sup> semester</b>	<b>30F</b>	<b>Total</b>	<b>39F</b>
<b>TOTAL</b>	<b>120</b> 46B 25C 8D 41F	<b>TOTAL</b>	<b>120</b> 45B 25C 8D 42F

## Year 2

The Georgian and Italian students will attend courses listed in Tables I, II+III (a, or b, or c, according to the chosen track) and Table IV, in order to fulfil, in total, the 120 ECTS required for the Master degree including thesis (30 ECTS at Tbilisi, 33 ECTS at UNIVAQ). If the student so requests, some of the elective courses from Year 2 can be attended in Year 1, provided that the prerequisites for each course

are met. In addition, the Host Institution will provide the students participating in the programme with additional intensive courses in language and culture, as well as internships and language stays.

### Evaluation scores

Grades will be converted in the following way:

TSU	UNIVAQ
100	30 cum laude
91-99	30
81-90	28
71-80	25
61-70	22
51-60	19
< 51	< 18

### Path for students starting in Tbilisi and moving to L'Aquila

After moving to L'Aquila, the student will be enrolled in the local master's degree programme in *Fisica* (Physics), curriculum *Microfisico* (Microphysics) or *Geofisico Spaziale* (Geophysics), tracks: a) Condensed Matter Physics, b) Particle and Astroparticle Physics, c) Space Physics, depending on his choice. During the study in L'Aquila, the student will attend courses listed in Tables II+III (a, or b, or c) and IV and write a master's thesis in order to earn at least 120 ECTS credits necessary to complete the curriculum. *At the end of the first term, students not holding any Italian Language certificate are encouraged to take an oral aptitude test of Italiano per Principianti (Italian for Beginners)*. The student, who will fulfil the terms of the International Academic Cooperation Agreement, i.e. earns the required number of credits and defends the thesis, shall be awarded a master's degree in *Fisica* (Physics) from the University of L'Aquila. Upon return to Tbilisi, the 120 ECTS credits earned will be recognized and, as a consequence, the student will be awarded a Master's degree from the Ivane Javakhishvili Tbilisi State University, provided that the thesis defence in L'Aquila took place in accordance with the terms of the International Academic Cooperation Agreement, i.e. before a committee including at least one academic teacher from Tbilisi. In such a case, the Georgian degree is legally valid from the date of the defence in L'Aquila; otherwise, in order to obtain the Georgian degree, the student must re-defend his/her thesis within the year of the defence in L'Aquila.

### Path for students starting in L'Aquila and moving to Tbilisi

After moving to Tbilisi, the student will be enrolled in the local master's degree programme in *Physics*, curriculum *Fundamental Physics* in one of the tracks: a) Condensed Matter Physics, b) Atomic Physics and Elementary Particle Physics, c) Astrophysics and Plasma Physics, according to his choice.

During the year of study in Tbilisi, the student will attend courses as listed in Tables I, II+III (a, or b, or c), and IV and write a Master's thesis in order to earn 120 ECTS credits necessary to complete the curriculum. *At the end of the first term, students not holding any Georgian Language certificate are encouraged to take an oral aptitude test of Georgian for Beginners*. The student fulfilling the terms of

the International Academic Cooperation Agreement, i.e. earns the required number of credits and defends the thesis, shall be awarded a master's degree corresponding to the curriculum of the Physics Department of the Ivane Javakhishvili Tbilisi State University.

Upon his/her return to L'Aquila, the credits earned will be recognized and, as a consequence, the student will be awarded a master's degree from the University of L'Aquila, provided that the defence of the thesis in Tbilisi took place in accordance with the terms of the International Academic Cooperation Agreement, i.e. before a committee including at least one academic teacher from L'Aquila. In such a case, the Italian degree is legally valid from the date of the defence in Tbilisi; otherwise, in order to obtain the Italian degree, the student must re-defend the thesis within the year of the defence in Tbilisi.

### FEES, ADDITIONAL COSTS AND SCHOLARSHIPS

The students participating in the exchange will be enrolled at both Universities; however, any fees will be paid at the University of Origin. Unless otherwise stated, the student will be responsible for any other personal expenses incurred at the Host University, including travel and accommodation.

### CHANGES AND DURATION

All changes to this appendix will be made in writing with the consent of both Partners and will require the signatures of the Parties.

This appendix is valid starting this coming academic year 2018/2019 and will be updated when requested by one of the parties, anyhow no later than next two academic years.

Signed in L'Aquila  
on 13/7/2018

On behalf of the University of L'Aquila

Associate Dean for Education in Physics  
Prof.ssa **Alessandra Continenza**, PhD



Signed in Tbilisi  
on 13.07.2018

On behalf of the Ivane Javakhishvili Tbilisi State University

Dean of the Faculty of Exact and Natural Sciences  
Assoc. Prof. **Ramaz Khomeriki**, PhD



