

FUNDING INITIATIVE QUANTUM AUSTRIA

ANNUAL REPORT 2022



$$i\hbar \frac{\partial}{\partial t} \psi(r,t) = \left[-\frac{\hbar^2}{2m} \Delta + V(r,t) \right] \psi(r,t)$$



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Sensengasse 1, 1090 Wien, www.ffg.at,

Fonds zur Förderung der wissenschaftlichen Forschung (FWF),
Georg-Coch-Platz 2, 1010 Wien, www.fwf.ac.at

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The QUANTUM AUSTRIA Funding Initiative

The Austrian Research Promotion Agency (FFG) and the Austrian Science Fund (FWF) are implementing the Quantum Austria Funding Initiative (Qu-AT) from 2021 to 2026. The initiative is carried out on behalf of the Federal Ministry of Education, Science and Research (BMBWF) and is funded by the European Union under the **NextGenerationEU Recovery and Resilience Facility** (RRF) (2020–2026). Austria is using RRF funding to invest EUR 107 million into developing quantum research and technologies. The aim is to stimulate research, development and innovation activities in the field of quantum research and technology, and to maintain competitiveness, in line with the research, technology and innovation policy objectives of the Austrian Federal Government. Funding will go towards both basic research and the development of practical applications. The FFG and the FWF are working closely together on allocating funding and are using a selection of their respective funding instruments for personnel and infrastructure. Part of the funding is earmarked for research infrastructure in the field of next generation high performance computing, quantum computing, and their intersections.

Funding is provided for projects with clearly defined goals, methods, durations and financing volumes, in accordance with the conditions of the respective funding

agency. Applications must address topics of quantum research and quantum technology. The research questions may include, for instance, the following topics:

- Specific preparation and control of quantum states;
- New algorithms and mathematical theoretical concepts that exploit the superposition and entanglement of quantum states;
- Developments and applications in quantum communication; quantum sensor technology, quantum metrology, quantum simulation, quantum computing and quantum information;
- Development of ideas based on quantum phenomena in the neighbouring fields of physics, mathematics, chemistry, and in biological systems.

Target group

The Quantum Austria Funding Initiative allows researchers, universities, non-university research institutions and companies working in the field of quantum research and technology to select from existing FFG and FWF funding instruments. Cooperation between the two funding agencies ensures the availability of a wide range of funding options for researchers at universities, universities of applied sciences, and non-university research institutions as well as for R&D activities conducted by start-ups, businesses and industry.

Implementation of Qu-AT and activities in 2022

Expressions of interest were obtained from stakeholders in the RTI sector prior to the initiative and submitted to the BMBWF on 22/12/2021. The launch of the initiative was announced in a press release on 25/11/2021, and publicised by the FFG and FWF in their communications. A virtual information event was held for the research community on 3/2/2022. This event provided an insight into the Call and the funding instruments offered by the two agencies, as well as an opportunity for participants working in quantum research and technology to network. The event was clearly a success, attracting around 100 participants.

Conclusion of the agreements and establishing the bodies

The agreements needed to implement the initiative were prepared by the agencies and coordinated with the stakeholders in 2021. For the FFG, these were the 'Special Directive Quantum Austria for the Promotion of Research, Technology Development and Innovation in Quantum Research and Technology (Qu-AT SRL)' and the associated Implementation Agreement for the Quantum Austria initiative for the years 2021 to 2027. The agreement was concluded in spring 2022, directly after the Special Directive came into force. The directive was drawn up by the BMBWF with the participation of the FFG, and coordinated with the Federal Ministry of Finance (BMF). It forms the legal basis for the FFG to award funding within the framework of the Quantum Austria initiative.

At the same time, the **1st Development Agreement for Quantum Austria 2021–2023** was concluded between the BMBWF and FWF to make the corresponding amendments to the existing Financing Agreement (FV) 2021-2023 in accordance with § 7 (11) in conjunction with § 5 (8) of the Research Financing Act (FoFinaG), Federal Law Gazette I 75/2020 (see also section 7 of FV 2021-2023).

A cooperation agreement, together with a sideletter and a supplementary agreement to the cooperation agree-

ment, was concluded between the two funding agencies FFG and FWF in order to define the framework conditions for the joint implementation of the initiative. Under these agreements, the contracting parties have created the option of reallocating funding budgets under the conditions specified in the agreements in order to best meet the needs of the research community. This option is granted in the implementation agreement with the FFG and in the development agreement with the FWF.

Furthermore, a Steering Committee has been established for the Quantum Austria Funding Initiative. The Steering Committee acts as the primary point of contact of the BMBWF in its role as the initiative's contracting entity for the FFG, and as the supervisory body for the FWF. It will be used for the operational control of the Quantum Austria Funding Initiative. At the constituent meeting in July 2022, rules of procedure for the Steering Committee were finalised and adopted. At the second meeting of the Steering Committee in October 2022, the status of the Call and indicative funding requirements of the two funding agencies were presented, and the optimal allocation of the available funding budget discussed. The Steering Committee recommended that the BMBWF transfer funds from the FWF to the FFG, and this was undertaken in autumn 2022. Accordingly, an amount of EUR 10 million was redirected from the FWF to the FFG.

In November 2021 and July 2022, meetings of the initiative's Strategic Advisory Board (Qu-AT SAB) were held. The five Advisory Board experts (see Fig. 1, marked *) bring with them a broad spectrum of expertise from the various fields of quantum research and technology. Following the recommendation of the Advisory Board, a networking meeting was held for the research community on 30/11/2022. The event was aimed at all organisations, research institutions and researchers already active in a Quantum Austria project or who are interested in potential participation. More than 80 people took part in the event.



Group photo of Qu-AT SAB BMBWF (from left): Barbara Weitgruber, BMBWF, Mari Carmen Bañuls*, Max Planck Institute of Quantum Optics; Dieter Kranzlmüller*, LMU Munich; Glinos Konstantinos*, European Commission; Christof Gattringer, FWF; Michael Marthaler*, HQS Quantum Simulations GmbH; Stefan Hanslik, BMBWF; Henrietta Egerth, FFG; Daniel Weselka, BMBWF; Emmanuel Glenck, FFG; not in the picture: Christine Silberhorn*, University of Paderborn attended the meeting online)

Completed Calls

FFG Calls and project funding

The FFG uses a range of project types (funding instruments, cf. Special Directive) for the implementation of the Quantum Austria initiative. Established instruments were used for Qu-AT, with minor adjustments made to the framework conditions such as project duration and eligibility to apply.

The 1st Call was launched with a broad portfolio of instruments and covers the two key topics of the initiative (in accordance with the Austrian Recovery and Resilience Plan):

- Topic 1 – Research Cooperation and R&D Infrastructure
- Topic 2 – HPC Infrastructure Update and Transfer to Regular Operations
-

The Call documents were made publicly available via the [programme webpages](#). The 1st Call was oversubscribed, particularly for project proposals in the field of

R&D infrastructure. After evaluations by the independent evaluation committees, the recommended funding volume for the projects amounted to EUR 61.7 million, in contrast to the original budget of EUR 39.2 million allocated for the Call. Projects which could not be funded under the original budget were placed on a reserve list. Due to the tight timeframe imposed by the underlying Recovery and Resilience Facility, together with the multi-year durations of the projects, it was decided in consultation with the BMBWF as the contracting entity to bind the largest possible part of the operational funds at the beginning of the initiative in the form of Calls. This plan was successfully implemented over the course of 2022 and early 2023.

A smaller budget was available in the 2nd Call and only the R&D Infrastructure instrument was used. Furthermore, this Call was aimed specifically at project proposals implementing a quantum computer interface to the new HPC infrastructure as funded in Topic 2 (1st Call). As a result, it was possible to address this key element of the Quantum Austria initiative towards the end of 2022. Following the results of the two Calls, a total of 20 projects were approved in 2022.

Overview of Calls carried out by FFG:

1st Call

Launch	15/12/2021		
Indicative budget	€39.2m Topic 1: €19.2m Topic 2: €20.0m	R&D Projects HPC Infrastructure	Requested funding: €64,740,486 €20,000,000
Submission deadlines 30/03/2022	Topic 2, R&D Infrastructure Topic 1, Bridge	1 submission 0 submissions	€20,000,000
27/04/2022 (Topic 1)	Individual Project of Industrial Research (IR) Cooperative R&D Project R&D Infrastructure	5 submissions 7 submissions 12 submissions	€2,938,954 €11,412,584 €40,878,673
31/05/2022 (Topic 1)	Flagship Project	2 submissions	€9,510,275
Total		27 submissions	€84,740,486
Evaluation committees		Funding recommendation	Max. funding
12/05/2022	Topic 2 – R&D Infrastructure	1 project	€20,000,000
13/06/2022	Topic 1 – Cooperative R&D Project	5 projects	€7,797,536
14/06/2022	Topic 1 – R&D Infrastructure	9 projects	€27,189,382
15/06/2022	Topic 1 – Individual Project (IR)	4 projects	€2,319,045
13/07/2022	Topic 1 – Flagship Project	1 project	€4,374,061
Funding recommendation		20 projects	€61,680,024

2nd Call

Launch	05/10/2022		
Indicative budget	€9.0m (allocated to Topic 1, R&D Infrastructure instrument)		
Submission deadline	25/11/2022	3 submissions	Requested funding €11,049,214
Evaluation committee	14/12/2022		Max. funding
Funding recommendation		1 project	€8,999,279

Summary 2022 – 1st and 2nd Call

Projects submitted	30
Total funding requested	€95,789,700
Projects recommended for funding	21
Total funding recommendation (max.)	€70,679,303
Total costs of the projects recommended for funding	€74,590,719

BMBWF funding decisions (up to 31/12/2022)

Approved projects and funding	20	€64,130,553
R&D Infrastructure	10	€49,639,911
Individual Project (IR)	4	€2,319,045
Cooperative R&D Project	5	€7,797,536
Flagship Project	1	€4,374,061
Participations (number of project partners)	55	
Universities	29	€53,204,264
Research organisations	9	€4,275,430
SMEs	11	€5,980,125
Large enterprises	5	€586,854
Other	1	€128,880
Of which total international partners	6	€1,090,377

FWF Calls and project approvals

The FWF uses existing funding programmes of the **FV 2021-2023** Financing Agreement (Qu-AT-relevant funding programmes and programme elements) for the Qu-AT Calls. After internal coordination, the FWF drew up the necessary work processes for implementing the Call and prepared **supplementary information** on submitting applications for the Quantum Austria Funding Initiative in 2021. Qu-AT was opened in elane, the FWF's electronic application portal, and the Call was opened on 26 November 2021. As the funding initiative ends in 2026, an application deadline of 30 June 2024 was set for Principal Investigator Projects. The application deadlines for the ESPRIT programme and the Erwin Schrödinger Fellowships including a return phase (when applying for the maximum funding period) were also set at 30 August 2022. Applicants applying after 30 August 2022 for an Erwin Schrödinger Fellowship including a return phase with a shorter duration than the maximum funding period were asked to contact the FWF in advance. Qu-AT applications within the framework of the 1,000 Ideas Programme (TAI) were based on the start and application deadlines for the TAI Call. However, due to budgetary measures, the FWF was forced to suspend the TAI programme Call planned for 3 November 2022.

Websites have been created for the **Quantum Austria Funding Initiative** and the Call. Information on the Call was made available to the public via press releases, the FFG and FWF newsletters, and news reports on social media. Approved FWF projects were listed on the "**Im Fokus**" website. Press releases and **newsletters** about the first project approvals were also published.

FWF project applications and project approvals

Since the start of the Call, a total of 47 researchers from Austria's universities and the Austrian Academy of Sciences (ÖAW) submitted quantum research projects totalling EUR 15.4 million to the FWF in 2021 and 2022. In the four approval rounds, a total of 22 projects in Graz, Innsbruck, Linz and Vienna, as well as two foreign universities, were funded to the tune of EUR 7.4 million as a result of their excellent scientific quality. This corresponds to an approval rate of 48%.

Details and figures on the Calls are shown in the following tables.

Overview of Calls carried out by FWF:

FWF Calls

Launch	26/11/2021		
Indicative budget	Topic 1: €20.66m		Requested funding
Submission deadlines 30 June 2024	Principal Investigator Projects	24 submissions	€10,105,089.73
30 August 2022	ESPRIT	11 submissions	€3,548,625.50
30 August 2022	Erwin Schrödinger Fellowships including a return phase	6 submissions	€888,295.00
	1,000 Ideas Programme (TAI)	6 submissions	€874,873.50
Total		47 submissions	€15,416,883.73
FWF Board meetings		Project approvals	Funding amounts
	Principal Investigator Projects		
88th FWF Board Meeting, May 2022	ESPRIT Programme	2 projects	€588,031.96
	Schrödinger Programme		
	1,000 Ideas Programme		
89th FWF Board Meeting, June 2022	Principal Investigator Projects	3 projects*	€1,331,387.37
	ESPRIT Programme	2 projects	€692,947.96
	Schrödinger Programme	1 project	€185,340.00
	1,000 Ideas Programme	2 projects	€303,577.84
90th FWF Board Meeting, October 2022	Principal Investigator Projects	5 projects	€1,755,172.13
	ESPRIT Programme	2 projects	€693,031.96
	Schrödinger Programme	1 project	€198,090.00
91st FWF Board Meeting, November 2022	1,000 Ideas Programme		
	Principal Investigator Projects	3 projects	€1,380,353.00
	ESPRIT Programme	1 project	€294,015.98
	Schrödinger Programme		
	1,000 Ideas Programme		
Approved projects and total funding		22 projects	€7,421,948.20

* One Principal Investigator Project was transferred to the German Research Foundation (DFG) in accordance with the **Money follows Researcher** regulation

Summary of Calls 2022

Projects submitted	47
Total funding requested	€15.417m
Approved projects	22
Total approved project funding	€7.422m

FWF funding decisions (up to 31/12/2022)

Approved projects and funding	22	€7,421,948.20
Principal Investigator Projects	11	€4,466,912.50
ESPRIT	7	€2,268,027.86
Schrödinger Programme	2	€383,430.00
1,000 Ideas Programme	2	€303,577.84
Research institution of principal investigator	Approved projects	Approved funding amount
Universities	21	€7,223,858.20
Austrian Academy of Sciences (ÖAW)	1	€198,090.00
Total	22	€7,421,948.20

Indicators according to the CID Annex (jointly for FFG and FWF)

A total of 42 future-oriented, transformative and innovative projects of basic and advanced research are receiving funding under the Quantum Austria initiative.

Element i	Number	Funding amount
Projects of basic research	22	€7,421,948.20
Projects of industrial research	10	€14,490,642.00
R&D infrastructure projects	10	€49,639,911.00
Total	42	€71,552,501.20

The projects are investing in 20 research infrastructures (including software development) and research collaborations, with the aim of expanding the knowledge base for the (further) development of quantum computing, quantum simulation, quantum communication, quantum optics, quantum sensor technology, quantum metrology and fundamental quantum developments. 42 projects** are establishing or developing technologies for the entire field of quantum science in the above areas, as well as quantum information.

Element ii	FFG projects	Funding amount	FWF projects**	Funding amount**
Quantum computing	9	€40,660,887*	5	€1,289,350.03
Quantum simulation	2	€3,550,862	7	€2,576,644.59
Quantum communication	4	€4,115,544	2	€558,728.63
Quantum optics	1	€3,999,626	9	€3,168,093.54
Quantum sensor technology	2	€6,109,983	1	€151,434.25
Quantum information			6	€2,171,898.92
Quantum metrology	1	€3,251,634		
Fundamental quantum developments	1	€2,442,017	12	€4,808,352.96
Total	20	€64,130,553	42	€14,724,502.92

*including HPC upgrade at €20m

** The basic research projects (FWF) include multiple assignments.

Quantum Austria was also able to strengthen cross-border cooperation with the following countries:

Element iii	Consortium partners in FFG projects	Collaborations in FWF projects
Australia		1
China		1
Germany	2	4
France	1	1
Great Britain		2
Italy	1	2
Ireland		1
Canada		1
Sweden		1
Switzerland	1	3
Slovenia	1	
Spain		2
USA		1

With regard to cooperation with relevant European initiatives and projects, the FFG and FWF are also supervising applied research activities in the QuantERA programme. Furthermore, the FFG supports Austrian stakeholders in European formats such as Quantum Flagship, Horizon Europe, Digital Europe Programme (including EuroQCI), and Connecting Europe Facility.

Budget

List of the approved funding amounts

Overview of the projects approved in the Quantum Austria initiative by the end of 2022:

Number of projects:

FFG: 20 projects (with 55 participations)

FWF: 22 projects

Qu-AT total: 42 projects

Overall situation on 31/12/2022

	Funding (€ million)	Approved	Approval rate
FFG	79.55	64.13	80.62%
FWF	20.66	7.42	35.91%
Qu-AT total	100.21	71.55	71.40%

The detailed operational budget is shown in the tables in the previous section („[Completed Calls](#)" page 7). In 2022, the FFG paid out operational funding of EUR 10,892,631 to the funding recipients (first instalments

for 11 projects); the remaining first instalments were disbursed in the year 2023. The total funding paid out for 11 FWF projects in 2022 amounted to EUR 731,889.16.

Call implementation

The Call was implemented in accordance with the relevant guidelines and agreements, in particular the [Special Directive](#) (FFG) and the [1st Development Agreement for Quantum Austria 2021–2023](#) (FWF).

Both agencies use existing funding instruments to implement the Calls. Variations which needed to be considered due to the particular characteristics of the Quantum Austria initiative were laid out in the relevant Call guidelines. The Calls were implemented in accordance with the needs of the community, and the consulting services offered by both agencies were proactively communicated by means of information events. Individual consulting services were provided via various channels including telephone, email, video conferences, etc. The projects were selected according to the established processes in both agencies ([Funding Law and Finances](#) (FFG), [General Principles of the FWF Decision-Making Procedure](#)). Independent international experts are involved in the review process.

The funding decisions for FFG projects are made by the BMBWF, and for the FWF by the FWF Board.

The funding agreements for most FFG projects were signed by the end of 2022 and the first instalments specified in the instrument guidelines were paid out. As yet no cost statements have been submitted for the projects. The first interim accounts are presented one year after the start of the project.

The funding agreements were signed and first funding amounts paid out to the 22 FWF projects approved in 2022. The annual accounts must be presented by 30/4/2023 or submitted as part of the annual financial report (as at the end of the calendar year) via the Austrian Federal Computing Center (BRZ) interface by April of the following year.

The FWF and FFG cooperate closely to implement the funding initiative. At the start of the initiative, this cooperation took the form of regular programme management meetings which, over the course of 2022, were reduced to meetings as required. Once the FFG had received the funding recommendations, the projects were compared with the FWF projects in order to identify any potential duplicate funding.

Outlook

In Q1/23 the FFG received a funding decision for another project (R&D Infrastructure instrument) from the BMBWF. This allowed the FFG to provide funding to all the projects on the reserve list from the first Call and to use the entire duration of the initiative. As of 9/3/2023, funding agreements had been concluded for 20 projects, and all the projects have started. The first interim reports are expected from Q4/23.

Together with the contracting entity BMBWF, work is currently underway to explore how the further use of funds can be optimised in order to meet both the Quantum Austria objectives and the requirements of the European Union's NextGenerationEU Recovery and Resilience Facility (2020–2026). Here, the focus will be on a further Call.

The FWF approved one further Principal Investigator Project during the 92nd FWF Board Meeting in March 2023. As of 9/3/2023, funding agreements had been concluded for 22 projects, and 20 projects have started.

Furthermore, subject to the requirements of the European Commission relating to projects under the recovery and resilience plan NextGenerationEU, part of the Qu-AT funds will be allocated to the 'excellent = austria' initiative. The 'Quantum Science Austria' Cluster of Excellence seeks to unravel the mysteries of the quantum world. It promotes basic research in the quantum sciences with the aim of expanding the boundaries of knowledge to become a motor for future innovations. It focuses on fundamental questions about the quantum nature of space, time and gravity, new paradigms in quantum information science, and the physics of quantum many-body systems. The scientists in Innsbruck, Vienna, Linz and Klosterneuburg pose innovative, elementary questions that can only be solved by combining the unique know-how available in Austria. The new Cluster of Excellence will enable the research groups to further intensify their cooperation and establish an internationally respected centre for quantum sciences in Austria.

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