KoF/ÖB 2024

Faculty of Science and Technology

Research Program Self-Evaluation

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| Research Program: | Chemical and Biomolecular Physics |
| Department: | Department of Physics and Astronomy |
| Section: | Physics |
| Program Responsible Professor: | Philippe Wernet |

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| **Goals:**   * Maintain and strengthen our **research quality**   + Through program and department self-reflection on strengths and weaknesses   + Through developing program and department priorities for the next 5 years   + Through internal and external feedback on our performance and plans * Strengthen our **collegial culture**   + By involving all research staff in the process and ensuring everyone is aware of the results   + By being respectful of everyone’s time at the faculty, department, and program levels   + By communicating clearly as to why we are doing this and how we expect everyone to contribute * Improve our **internal understanding**   + By collecting information on the different ways programs and departments are funded and operate   + By collecting explanations of why we work that way and how it supports our research * Improve our **resource usage**   + By generating bottom-up prioritized research plans at the program, department, section, and faculty-levels   + By allocating and re-allocating resources based our priorities and the potential to significantly improve research   + By identifying opportunities for intra- and inter-program/department/section collaboration and re-organization |

# General information

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Process for creating this self-evaluation

**Instructions**: Describe the process to generate this self-assessment, how it was collegial, and list which categories of employees (e.g., Professors, ULs, BULs, postdocs, PhDs, researchers, etc.) were significantly involved.

Motivation: To emphasize that this is to be a collegial process and that all members of the program should be included.

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| Building on our strategy work, the evaluation was a recurring topic at our regular program meetings (process and its value explained, discussed, input to sections 3-6 discussed and developed (all categories involved). A senior group representing the program in-depth discussed priorities 1-3 with input from the whole program. |

## Core of the research program

**Instructions**: Describe what makes the program a coherent research program. For example, shared methods, areas, questions, facilities, etc.

Motivation: To understand the essence of the program so that its plans and activities can be better understood in that context.

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| We address the fundamental properties and ultrafast processes in atoms, molecules, chemical systems, and proteins. With X-ray scattering and spectroscopy at X-ray Free-Electron Lasers (XFELs) and synchrotrons, we reveal how electrons and nuclei move and interact to explain how properties and function emerge. |

## Personnel (data provided centrally)

**Instructions**: Postdocs who are on stipend should be listed separately in parentheses. (Example: if there are 4 postdocs on salary and 3 on stipend, please enter “4 (+3)”. )

Motivation: To understand the program’s personnel distribution by career stage and gender. This data shows the number of FTEs (full-time equivalent) employees in each category.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made. Note that stipend postdocs are not present in the university salary system and will need to be manually accounted for if they are to be included. If this table is changed to add stipend postdocs, please note the changes in the “other important program-specific comments” section below as well.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Faculty FTEs** | | | | **Non-Faculty FTEs** | | | | | |
|  | **Professor** | **Associate (UL)** | **Assistant (BUL)** | **Total** | **PhD** | **Postdoc** | **Researcher** | **Other**  **Research** | **Other** | **Total** |
| **Female** |  |  |  |  | 1.2 |  |  |  |  | 1.2 |
| **Male** | 3.8 | 1.5 |  | 5.2 | 2.7 | 2.2 | 2.1 | 2.4 |  | 9.3 |

## Finances

### Overall research funding in MSEK (data provided centrally)

Motivation: To understand how a program is funded across the main sources of income. This data shows the long-term internal funding (FFF+SFO) vs. external (grant) research funding.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made.

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| --- | --- | --- | --- | --- | --- | --- |
|  | **FFF+SFO Internal Research** | **Other Internal Research** | **Total Internal Research** | **External Research** | **Total Research** | **External Research %** |
| **2023** | 6.1 | 2.7 | 8.8 | 12.9 | 21.7 | 59% |
| **2022** | 6.0 | 2.7 | 8.7 | 10.2 | 18.9 | 54% |
| **Average** | 6.1 | 2.7 | 8.7 | 11.5 | 20.3 | 57% |

### Other internal research funding

**Instructions**: If the other internal resources category above is significant, describe where it comes from: e.g., co-funding for various grants, starting packages for Assistant professors, studiestöd, department resources given, special funds from the vice rector, etc.

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| Department infrastructure fund, 5 MSEK shared 50:50 by our program (for a new ultrafast optical laser for our HELIOS lab for femtosecond ultrafast X-ray science with high harmonic generation, HHG) and by the Instrumentation program, H. Dürr, plus start-up funding to Ph. Wernet (recruited 2019) and studiestöd. |

### Basic funding expectations and policy for using internal resources

**Instructions**: Explain the standard funding distribution between internal research funding (FFFs), external grants, and teaching that faculty (Assistant, Associate, Professor) and non-tenure staff (researchers, adjuncts) receive. Describe the policy for distributing internal resources (FFFs and other 210 funds, including studiestöd, startbidrags, and co-funding). Include a description of how faculty members at each level (Assistant, Associate, Professor) receive research support and are funded. Explain any implicit or explicit policies regarding holding external grants and allocation of internal resources. Include a brief overview of other uses of internal resources, for example: extra support for particular roles (e.g., PAP, FUAP), startup packages (for new faculty), allocation of studiestöd, department policies for FFFs or institution resources, funding of joint facilities/infrastructure, co-funding for grants, paying for PhDs/postdocs, etc.

Motivation: To understand how programs use their internal resources to support members and activities.

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| We offer 40% FFF support for all tenured faculty staff, 20% for the program professor and the division head, none for dFUAP. Young researchers with grants like ERCs secure permanent positions. Starting packages are available for externally recruited faculty. "Studiestöd" strategically supports PhDs in areas utilizing and developing our infrastructure and engaging in interdisciplinary research. Under-financed grants with respect to overhead costs are typically covered by individuals using their allocated FFFs. We dedicate significant resources to developing new infrastructure and we allocate specific funding for laboratory duties running/developing the advanced infrastructures. PhDs and postdocs generally contribute to teaching (10%) |

### Use of internal research funds in MSEK (data provided centrally)

Motivation: To understand how the program is using internal research funding.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Faculty Salary | Non-Faculty Salary | Other Personnel Costs | Premises | Equipment Depreciation | Overhead | Running Costs | Total |
| 2023 | 4.4 (47%) | 1.6 (17%) | 0 (0%) | 0.5 (6%) | 0.6 (6%) | 1.8 (19%) | 0.4 (5%) | 9.3 |
| 2022 | 4.1 (48%) | 1.4 (16%) | 0 (1%) | 0.6 (7%) | 0.5 (6%) | 1.6 (18%) | 0.4 (4%) | 8.5 |
| Average | 4.2 (47%) | 1.5 (17%) | 0 (0%) | 0.6 (6%) | 0.5 (6%) | 1.7 (19%) | 0.4 (4%) | 8.9 |

### Personnel funding (data provided centrally)

Motivation: To understand how funding is used across different employment categories and genders. This data shows how staff are funded on average across internal and external research funding as well as teaching.

Responsibility: Data provided centrally; PAP to review to ensure no significant mistakes are made.

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| --- | --- | --- | --- | --- | --- | --- |
|  | Female | | | Male | | |
|  | Internal | External | Teaching | Internal | External | Teaching |
| Professor |  |  |  | 65% | 19% | 16% |
| Associate (UL) |  |  |  | 53% | 4% | 43% |
| Assistant (BUL) |  |  |  |  |  |  |
| PhD | 7% | 77% | 17% | 35% | 61% | 4% |
| Postdoc |  |  |  | 16% | 84% | 0% |
| Researcher |  |  |  | 17% | 78% | 4% |

### Major infrastructure usage

**Instructions**: Identify the five most significant research infrastructures used by the program. For this purpose, infrastructures are resources that are too expensive for an individual PI to afford and are therefore organized and funded as shared resources. Specify the level of sharing (program, department, university, national, or international) and whether it is located at Uppsala or elsewhere. Provide the approximate amount spent to pay for development of or access to the infrastructure each year, including both program funds and PI grant expenditures. Infrastructure costs should not include travel to the infrastructure (as travel for research is not infrastructure-specific) nor salary time while using the infrastructure (as research time is not infrastructure-specific), but can include salary costs of engineering staff and explicitly agreed upon in-kind salary contributions. If infrastructure is paid for outside of the program, specify who pays for it instead of the cost. (E.g., write “Faculty” or “VR”.) Note that it is not necessary to provide exact values, but please make an effort to be within ~10%.

Motivation: To understand what important infrastructure is being used and how much it costs and to support the faculty’s ongoing work on developing an infrastructure policy

Responsibility: PAP in discussion with program members, economic administrator for costs.

|  |  |  |  |
| --- | --- | --- | --- |
| Infrastructure | Sharing | Location | Approximate Yearly Cost (MSEK) |
| HELIOS lab for ultrafast X-ray science | program (division) | UU | 0.7 |
| MAX IV (Veritas RIXS spectrometer) | international | Lund | 20 (KAW, Swedish univ., VR, SSF) |
| European XFEL (imaging RIXS spectrometer) | international | Hamburg | 1.7 (VR, EuXFEL) |
| BESSY II and PETRA IV | international | Berlin, Hamburg | 0 |
| SwissFEL and Swiss Light Source | international | Villigen (Switzerland) | 0 |

## Other important comments

**Instructions**: Explain any important issues not addressed above or misrepresented by the above data that need to be clarified for the panel to give valuable feedback. If the program has an important role in supporting the university or department, such as a mandate from the government or university, please describe it here. Please keep these precise and relevant.

Motivation: To bring important and special issues to the view of the panel and department.

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| We recognize that our program has no professor, BUL/UL who identifies as female (see 1.4.5). We have the intention of improving our gender balance at the BUL/UL/professor level in future recruitments within our topic of ultrafast X-ray science by reaching out to our international networks at large-scale X-ray facilities. |

# Follow up on goals set in the last evaluation

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Reflections on accomplishments and setting goals this time

**Instructions**: Reflect on whether the goals from the last evaluation (ÖB Section D1 for programs and KoF17 Section 1b for departments) were appropriate in retrospect, what has been accomplished towards them since the evaluation, and what we can learn from them about setting effective goals this time. The previous evaluations [are available on the faculty KoF webpage](https://www.uu.se/en/staff/faculty/science-and-technology/the-facultys-research-evaluation---quality-and-renewal---kof24) to support this reflection for the programs, departments, and panels.

Motivation: Try to learn from what we did last time to be able to set more effective goals this time.

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| Our main research goal defined in the last evaluation was to explore and understand the dynamics, non-linear phenomena, and structures of (complex) systems using novel X-ray sources (XFELs, synchrotrons, and short-pulse X-ray lab sources with high-harmonic generation of ultrafast lasers). This was appropriate, as our research has grown in that direction (as also shown by the recruitments of Ph. Wernet and N. Timneanu as new professors with corresponding research). We achieved our goal to split the program Molecular and Condensed Matter Physics into the two focused programs Chemical and Bio-Molecular Physics and Condensed Matter and Energy Materials Physics which we make grow in our X-ray Photon Science division. |

# Area 1: Research Quality (evaluation of outcomes and processes)

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Main research areas

**Instructions**: List the largest research areas in the program, including approximately what percent of the program’s total research they cover, the approximate number of FTE faculty (Assistant/Associate/Professor, split according to their approximate activities and not double-counted), and whether the research is mostly Applied, Basic Science, or Mixed. These four areas combined should be broad enough to cover at least 75% of the program’s research activities.

Motivation: To understand the program’s research heterogeneity and how the program sees its own research profile and to help in assigning panel members.

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| --- | --- | --- | --- | --- |
| Main Research Areas | | % of program | FTE Faculty | Type |
| 1 | Biophysics | 40 | 2.5 | basic |
| 2 | Chemical Physics and Dynamics | 26 | 1 | basic |
| 3 | Atomic, Molecular and Optical Physics | 17 | 2.5 | basic |
| 4 | Light-matter interactions (quantum chemistry) | 17 | 0.5 (senior) | basic |

## Research Activities

**Instructions**: Describe the key research activities in the program. This should focus on the types of research done, with the important results described later in the Research Results section. Briefly describe how the research is important for science and society. Describe how the program balances incremental (e.g., safe, easy-to-publish) research with higher-risk projects with more potential for breakthroughs. Note that the limited space will require prioritizing the text based on the main research activities listed above.

Motivation: Provide a more detailed view of the key research directions in the program.

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| Our program addresses **fundamental aspects in atomic, molecular, chemical, and biological systems**. We develop and apply novel X-ray methods and instrumentation to reveal how transient electronic structures and nuclear dynamics determine properties and function. We use **X-ray scattering and spectroscopy at XFELs and synchrotrons** to understand and control the photophysics and photochemistry of atoms and molecules, aqueous solutions, metal complexes, and proteins. Our interdisciplinary research program is based on strong collaborations in experiment and theory and aims at applications in environmental, biophysical and the chemical sciences. The 5 groups in our program focus on **light-matter interactions – quantum chemistry** (Ågren, development and applications of theory in biomarkers of neurodegenerative diseases, X-ray spectroscopy, nanoparticle plasmonics, light upconversion for energy harvesting), **molecules and liquids** (Björneholm, X-ray-induced dynamics in biomolecules in gas phase and solution, radiation damage and intermolecular Coulombic decay, properties of aerosol and liquid surfaces), **biophysics** (Caleman and Timneanu, structure of biomolecules by “diffraction before destruction” and single particle imaging, experiments and simulations of ultrafast fragmentation and non-thermal heating), **atomic, molecular, and optical physics** (Söderström and Rubensson, basics of electronic and nuclear dynamics in molecules to test models of quantum mechanics with non-linear X-ray spectroscopy and high-resolution RIXS), and **chemical physics and dynamics** (Wernet, chemical reactions in real time, coupling of electronic, spin and nuclear degrees of freedom in molecules, photochemical bond activation with metal complexes, and bond-activation in metalloenzymes). Our studies with cutting-edge X-ray methods at novel X-ray sources often have text-book character, they demonstrate the value of new tools to broad and interdisciplinary communities, and they impact societies by paving the way to discoveries of new materials. Our research is project-oriented and combines plans for incremental and high-risk components in sequences of steps with increasing complexity and risk. We are in charge of the HELIOS lab for ultrafast soft X-ray spectroscopy, we belong to the X-ray Photon Science division (with Condensed Matter Physics on Energy Materials program). |

## Research Results

### Contributions to the field

**Instructions**: Describe the research results that the program is particularly proud of that indicate the quality and breadth of the research. Explain the importance of the program’s contribution to the field in the international context.

Motivation: Identify the results the program is most proud of and provide the program’s perspective on how important they are. This allows the panel to see how the program sees itself and provide feedback to help the program better understand how it is viewed internationally.

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| Our program builds on and by itself reflects the new interdisciplinary collaborations, approaches, and fields that are emerging at the international XFEL and synchrotron light sources where physics, chemistry and biology meet and where experiment and theory are used to unveil hitherto elusive information. We work on constantly pushing the boundaries currently limiting experimental and theoretical X-ray methods and we explore and establish new information content in X-ray spectroscopy and diffraction. We are proud of the innovative spirit of our program which spans from our senior professor Hans Ågren and his team in theory (one of the founders of theory for ESCA and X-ray spectroscopy) to our experimental achievements in making accessible new regimes in spatial, temporal, and spectral resolutions for interdisciplinary studies at the latest X-ray sources worldwide. Our pioneering contributions, concepts and investigations resulted in a number of now permanent instruments at large-scale X-ray facilities (amongst which are RIXS spectrometers at the SQS at the European XFEL and the VERTIAS and SPECIES beamline at the MAX IV synchrotron). |

### Bibliometrics for 2017-2021/2022 (data provided centrally)

Motivation: Provide an overview of how the program is performing that is reasonably comparable to other programs and departments. (See the Base Data definitions file for the meaning of each statistic.)

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| --- | --- | --- |
|  | Type of Indicator | 2017-2022 |
| Number of publications, full publication set (full / fractional counts) | Quantity | 285 / 54 |
| Proportion of publication fractions at the Norwegian model level 2 (%) | Impact | 42% |
|  |  | 2017-2021 |
| Coverage (fractionalized): Proportion of publications from DiVA included in citation statistics, weighted by fractional counts | Coverage | 70% |
| Mean normalized number of citations per publication (MNCS) | Impact | 1.04 |
| Proportion of frequently cited publications (top 10%) (PP(top 10%)) | Impact | 11% |

### Most frequent publishing channels (raw data provided centrally)

**Instructions**: Using the provided raw data of publication frequency per channel (a channel is the name of a conference or journal) for each program, list the most frequent publishing channels with more than two publications during the evaluation period. This data can be found in the Base Data Excel document.

Motivation: To see where the program is most frequently publishing.

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| --- | --- | --- |
| Channel | Number | % of Total Publications |
| Physical Chemistry Chemical Physics | 34 | 12 |
| Physical Review A | 15 | 5 |
| Journal of Physics B | 14 | 5 |
| Journal of Chemical Physics | 12 | 4 |
| Journal of Physical Chemistry Letters | 10 | 4 |
| Journal of Physical Chemistry C | 10 | 4 |
| Physical Review Letters | 9 | 3 |
| Nature Communications | 8 | 3 |
| Journal of Physical Chemistry A | 6 | 2 |
| Journal of Physical Chemistry B | 6 | 2 |

### Most important publishing channels

**Instructions**: Provide the most important publishing channels (a channel is the name of a conference or journal) according to the program, the number of publications in each channel during the evaluation period, and the % of the total publications based on the centrally provided bibliometrics. For each channel, specify both the total number of publication and the number where a program member was the lead-author. (The lead-author is the primary driver of the particular publication, which is often denoted as the “corresponding” author or the first author in the publication list, and is typically the originator of the core idea of the work and/or the person who wrote the majority of the text in the publication.)

Motivation: Enable the program to indicate what publishing channels they see as most important and how much they publish in them for panel feedback.

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| --- | --- | --- | --- | --- |
| Channel | Number | % of Total Publications | Lead-author | Lead-author % of Total |
| Physical Chemistry Chemical Physics | 34 | 12 | 22 | 65 |
| Physical Review Letters | 9 | 3 | 3 | 30 |
| Nature Communications | 8 | 3 | 1 | 14 |
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### Publishing impact on the field

**Instructions**: Describe the impact of the program’s publishing on the field by elaborating on the provided bibliometrics, the most frequent publishing channels, and the self-identified most important publishing channels. Explain the importance of the program’s contribution to the field in the international context. (See the Base Data definitions file for the meaning of the bilbiometric statistics.)

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| We are continuously publishing in leading journals in our fields and we are key players in large collaborations at large X-ray facilities, primarily at XFELs, but also at synchrotrons. The fact that we publish in a broad range of diverse journals illustrates the interdisciplinary character of our program (and the journals themselves often are interdisciplinary in nature). Our well-cited papers in the most prestigious journals often define new research areas. During the last years we have been developing instruments for the European XFEL and MAX IV that are now starting to produce unique results. These achievements will impact our future publication record, not only in our program but also in the communities using these instruments. |

### Participation, recognition, and leadership in the field

**Instructions**: Describe how the program interacts with the larger field in terms of its participation (e.g., through collaborations, professional organizations, positions of trust, etc.), recognition (e.g., through awards, keynote presentations, etc.), and leadership (e.g., through steering positions in international organizations, professional bodies, etc.) in the field. Explain the importance of the program’s contribution to the field in the international context.

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| Our expertise is recognized internationally by invitations to numerous international conferences and scientific advisory committees (LCLS XFEL in Stanford, European XFEL in Hamburg, Elettra in Trieste, MAX IV) and proposal review panels (European XFEL, FLASH, PETRA IV). Of the programs at Uppsala University, ours is one of the most broadly and prominently represented research program from outside Germany at the European XFEL (at the latest users’ meeting of this facility in January 2024, of the 10 science talks, 4 where from researchers from Uppsala University of which 2 were from our program). |

## Synergies within the research program

**Instructions**: List up to three examples of synergies (interactions that provide more value than the individual contributions alone) within the research program itself that can be seen through specific on-going collaborations. Synergies can include using similar or complementary methods, facilities, partners, goals, etc. Briefly describe the synergy and extent of the current collaboration. Due to the limited, programs will need to work internally to identify the collaborations that are most important to the program.

Motivation: Identify how the program’s diversity supports its research.

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| 1 | Type of synergy | Radiation damage, molecular fragmentation, X-ray spectroscopy and theory development |
|  | Specific  collaboration | Biophysics (Caleman/Timneanu) – Molecules and liquids (Björneholm) – AMO (Söderström, Rubensson) |
| 2 | Type of synergy | Spectroscopy development and quantum theory of X-ray spectroscopy |
|  | Specific  collaboration | AMO (Söderström/Rubensson) – Light-matter interactions - Quantum chemistry (Ågren) |
| 3 | Type of synergy | Spectroscopy development for photoemission (HAXPES) of molecular materials |
|  | Specific  collaboration | Chemical physics and dynamics (Wernet) – Energy materials (Rensmo, partner program) |

## Synergies across research fields

**Instructions**: List up to three examples of synergies (interactions that provide more value than the individual contributions) the research program has with research fields other than those of the program itself. Synergies can include using similar or complementary methods, facilities, partners, goals, working across theory/experimental, grants together with people in different fields, etc. These synergies can be here in Uppsala or at other universities. Provide the university (cross-field synergies within Uppsala are fine) and the different field, and briefly describe what the synergy is and the extent of the specific current collaboration. Due to the limited space, programs will need to work internally to identify the collaborations that are most important to the program.

Motivation: Identify current activities that are broader than the research programs to promote broader research initiatives and understand what is done across Uppsala vs. externally.

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| --- | --- | --- |
| 1 | University and Field | Uppsala University, biophysics |
| Type of synergy | Biophysics network as a cross-disciplinary effort to strengthen biophysics research in Uppsala, focused in determining structure and function of biological systems with various methods |
| Specific  collaboration | Biophysics (Caleman, Timneanu), Cell and Molecular Biology (Maia), Chemistry – BMC (Marklund), Materials Engineering (Wohlert) |
| 2 | University and Field | Uppsala University, ultrafast X-ray photon science |
| Type of synergy | Common HELIOS laser lab for ultrafast science with femtosecond XUV and short THz pulses (with 2 amplified femtosecond laser systems for high-harmonic generation and THz sources) |
| Specific  collaboration | Chemical and Bio-Molecular Physics (Wernet) and Condensed Matter and Energy Materials Physics (Rensmo) (upgrade commissioning ended in April 2024, science campaigns starting) |
| 3 | University and Field | Uppsala University and international partners, Ultrafast Processes  (on a broader scale this includes international collaborations of the participating programs) |
| Type of synergy | Common roadmap for the strategy of one of the strategic directions (thematic groups) at the department (“Roadmap towards ultrafast x-ray science at UU 15 June 2020.pdf”) |
| Specific  collaboration | Chemical and Bio-Molecular Physics (Wernet), Condensed Matter and Energy Materials Physics (Rensmo), Instrumentation (Dürr), Materials Theory (Eriksson) |

### Reflections on synergies across research fields

**Instructions**: Reflect on the program’s initiatives and challenges with regards establishing research activities that cross between the program’s field and other fields. Are there particular benefits to such collaborations or particular costs? Describe the formal and informal initiatives the program takes to encourage these and the pros and cons of working within and outside of Uppsala.

Motivation: Understand how the program views its synergies across research fields.

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| By combining 5 groups with their research directions (see 3.2), our program is successful in very diverse science fields from atomic/molecular/optical physics, to chemistry, biology, and materials science. To be successful in each field (to work at the fore-front of research for selected aspects in each field), we need to ensure having critical mass in each group. By combining diverse fields with different concepts, needs, and interests, we are able to broadly push the frontiers in the development of X-ray methods at novel X-ray sources creating high visibility internationally. We thus publish broadly, attract external funding from various sources, and educate our personnel broadly (in scientific presentations in our regular program meetings). |

## Reflections on ensuring good research ethics

**Instructions**: Reflect on the program’s initiatives and challenges with regards to ensuring good research ethics. Describe the formal and informal initiatives the program takes to teach and promote good research ethics across all research staff, and what particular challenges the program faces in these regards.

Motivation: Understand how the university’s priority for ensuring good research ethics is addressed.

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| We are developing ethics courses for the department and are continuously working on ensuring good research ethics by having this a topic at our program meetings and at our common activities in our division with our partner program (roughly every 3 months). |

## Reflections on creating and ensuring research freedom

**Instructions**: Reflect on the program’s initiatives and challenges to create and ensure research freedom. Describe the formal and informal initiatives the program takes to create opportunities for research freedom across all research staff, and what particular challenges the program faces in these regards.

Motivation: Understand how the university’s priority for ensuring research freedom is addressed.

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| With broadly accessible scientific presentations at our program meetings, we develop our open and curious atmosphere in basic science across traditional disciplines. We need to continuously balance our interest in fundamental science with opportunities for external funding that are often related to more applied science. |

## Reflections on research program size

**Instructions**: If the research program has 4 or fewer faculty (Assistant, Associate, Professor), describe the program’s process for ensuring a sufficient critical mass of faculty long-term, current and planned activities in this direction, and discuss whether there are other programs where collaboration could be of assistance. Similarly, if the research program has 10 or more faculty members, describe how the program works to develop a coherent research agenda and collaborations. If the program has between 5 and 9 faculty, describe if increasing or decreasing the size could be beneficial.

Motivation: A reasonable number of faculty members is required for research programs to achieve their purpose of providing a collegial environment that can develop and support diverse ideas and knowledge around a shared core research direction. For research programs with very few faculty, or very many, it is important to reflect on how this can be achieved.

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| With 7 faculty (of which 1 senior) we cover 5 complementary research directions in our interdisciplinary pro-gram resulting in, on average, 1.4 faculty per direction. Increasing the number of faculty (BUL and UL in par-ticular) by 2-3 will strongly benefit our growing program, securing critical mass and impact in each direction. |

## Top external funding sources (data provided centrally)

Motivation: To see the amount spent on each financier during the year.

|  |  |  |  |
| --- | --- | --- | --- |
| Funding Agency | 2022 | Funding Agency | 2023 |
| Swedish Research Council (VR) | 6.0 | Swedish Research Council (VR) | 7.3 |
| Swedish Foundation for Strategic Research (SSF) | 1.8 | Swedish Foundation for Strategic Research (SSF) | 1.5 |
| American non-profit | 0.8 | Swedish Energy Agency | 1.5 |
| Carl Trygger Foundation | 0.6 | Company (within the EU) | 0.7 |
| Swedish Energy Agency | 0.3 | American non-profit | 0.7 |
| Company (within the EU) | 0.3 | STINT | 0.4 |
| STINT | 0.3 | Carl Trygger Foundation | 0.4 |
| EU commission (H2020) | 0.2 | Uppsala University Foundations Management | 0.1 |
| Olle Engkvist Foundation | 0.0 | EU commission (H2020) | 0.1 |
| Uppsala University Foundations Management | 0.0 | Olle Engkvist Foundation | 0.0 |

## External funding sources

**Instructions**: List the source and number of significant research grants to the program during the evaluation period. Include only grants that awarded at least 3M SEK to a program member and were active (used) during the evaluation period (2019-2023, inclusive). If a program member was awarded at least 3M SEK, but was not the PI on the grant, list the grant on a separate line and state “Co-PI”.

Motivation: This list complements the top external funding sources by providing consistent data for significant (>3M SEK) basic science grants available to all programs and by identifying the number of PIs vs. the total amount of funding. This is important as the absolute amount of money available to different fields varies enormously.

|  |  |
| --- | --- |
| Grant | Number of awards to PIs in the program |
| Basic science grants (available to all fields in the faculty) | |
| ERC-StG, ERC-CoG, ERC-AdG, ERC-SyG |  |
| KAW Project |  |
| KAW Scholar |  |
| WAF/WAFx |  |
| VR Project | 4 |
| VR Starting |  |
| Other grants (may include field-specific grants and Co-PIs) | |
| VR consolidator | 1 |
| FET-open (EU) | 1 |
| MCSA doctoral network | 2 |
| VR Röntgen-Ångström cluster | 2 |
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## Reflections on external funding

**Instructions**: Reflect on what the program expects from its staff (Assistant, Associate, Professor, postdoc, and researcher levels) in regards to applying for and receiving external funding, how the program communicates those expectations, how the program supports staff in applying for funding through feedback and mentoring, and what opportunities and challenges the program sees in the future for continued and new external funding. Describe initiatives the program takes to form consortia to apply for larger grants.

Motivation: Connect how the program works with external funding to the achieved funding results.

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| The program expects all staff to apply for every relevant grant (including PhD students for travel grants) and we have tried to improve by supporting each other's application (reading, giving feedback, presentations, discussions). All staff are motivated to apply, good examples and successes are celebrated (at program meetings), mentoring of young researchers by faculty is common practice in our groups. We strongly depend on external funding (the biophysics group has, during the evaluation period, doubled in size based on external funding only, the Chemical physics and dynamics group is new to the program and growing). We are continuously working on attracting funding with other programs at UU and internationally. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| VR is an important funding source for our program (we had continuous funding from VR and want to keep this). Our 2 VR Röntgen-Ångström-Cluster grants reflect our good collaborations with groups in Germany and our recognized expertise in developing X-ray methods (which is a focus of the Röntgen-Ångström-Cluster) and we also want to keep this, if available. We have been successful in acquiring grants to build specific and highly specialized instrumentation (Veritas high-resolution RIXS instrument at MAX IV by Wallenberg foundation, and SSF, an imaging RIXS spectrometer delivered as an in-kind contribution to European XFEL The social environment in both program and division are very good (positive attitude, nice social setting, co-workers feel welcome). Weekly social events provide a platform where we discuss science and interpersonal matters. This raises the awareness of what the other groups are working on. The group leaders are developing good practices for program internal prioritization (recently for KAW applications and also within the KoF/ÖB evaluation). This improved our communication and we want to continue this. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| We want to improve in acquiring grants from the EU (we need expert help here). We want to explore new funding sources (related to applied science, sustainability, energy science, from US funding agencies). We want to improve in getting grants from the Wallenberg foundation. An application does not guarantee external funding but without applications, no external funding is guaranteed: We want to send in more applications in all our research directions. We want to continue our strategic discussions (as here within KoF/ÖB) for better benefiting the program from its diversity. The distribution of PhD students in the program is not uniform (the majority of PhD students are within the biophysics group with, e.g., none in the atomic, molecular and optical physics group). This needs improvement since much of the daily research is performed by/with our PhD students. The teaching load on Swedish-speaking PhD students and faculty is higher than for those who do not speak Swedish, making working conditions the program uneven. We want to improve the gender balance at the PI/faculty level in our program (see section 1.5). |

# Area 2: Career Paths (evaluation of processes)

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

## Career stage distribution implications and plans for the next 5 years

**Instructions**: Describe the implications of the current distribution of faculty across career stages (e.g., Assistant, Associate, Professor from Section 1) for the program currently and in the next 5 years. In particular, identify up-coming faculty retirements and/or recruitments and discuss and how the program plans to work with those changes to maintain the program’s core strengths as well as evolve in new directions.

Motivation: Provide perspective on the current status and future changes in personnel in the program.

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| Our faculty is heavy on male (100%) and on professors (no assistant professors, 2 associate professors, 4 professors, total of 375% active, plus 2 senior professors, 60% active, externally funded). We identify the need to recruit young and female faculty. In the next 5 years, we will have 1 professor retirement and 2 possible promotion from associate professor to professor (the senior professor will continue for 2-3 years with decreasing activity thereafter). We need to recruit at the assistant professor level (BUL, possibly UL) and we need to promote female candidates to further grow in ultrafast X-ray science. We are continuously and proactively head-hunting candidates to promote international female researchers. |

## Reflections on the process for identifying recruitment needs and focusing areas

**Instructions**: Pick a specific faculty-level recruitment during the evaluation period reflect on how the process of identifying the need for recruitment and focusing the research area worked. First describe the recruitment, e.g., Assistant/Associate/Professor-level and research area. Then discuss how the program worked to identify the need for a recruitment in this area, including discussing how the need was identified, how was it discussed and revised in the program, who was involved in the discussions, etc. For focusing the research area, describe how the balance between continuing existing areas vs. choosing new ones was discussed, who was involved in the discussions, what criteria were discussed to ensure that this direction would strengthen the program, etc. If the program has not done any faculty recruitments during the evaluation period, please reflect on how they would be undertaken.

Motivation: Explain how recruitments are currently motivated and decided

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| Of our 2 recruitments (associate professor in biophysics and professor, now program professor) we discuss the former: The need for an associate professor in biophysics was identified in ÖB19 to strengthen biophysics research and create the “biophysics incubator” as integral part of the new program in Chemical and Biomolecular Physics. The position was announced in 2021 with employment in 2022 (after a total of 9 months). Criteria used were excellence in research in biophysics using XFELs and teaching (equal weight). The position was intimately connected with establishing the educational Master program in Biophysics (also based on ÖB19). The “biophysics incubator” is a success (with 1 professor and 1 associate professor). |

### Initiatives to recruit and retain top researchers/teachers

**Instructions**: Describe:

* How the program defines what a top researcher/teacher is and how that is used in recruiting (criteria, descriptions, search groups, subject representative, addressing younger recruits who have the potential to become top, etc.),
* How the program balances recruiting external talent vs. promoting internal staff, and who is involved in these discussions and decisions,
* How gender and career stage balance is considered in program planning and recruitment decisions, and,
* What the program does to identify and encourage strong external recruits to join.

Motivation: Provide details as to what efforts are made to recruit and retain the best staff.

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| The initiative to recruit an associate professor in biophysics was successful. The requirement was strong research in biophysics at XFELs (an area where Uppsala University excels internationally), to attract external grants, and equally pivotal for teaching, by connecting research to the Master program in biophysics. The best candidate was internal staff. An initiative to recruit an assistant professor failed: The program offered support to a promising female international researcher with relevance to chemical physics with XFELs for application to a Wallenberg Academy Fellowship (application failed at last step). We want to improve in attracting and keeping female candidates at the PI/faculty level. |

## Career support

### Career support activities for non-tenure-track staff (beyond standard employee dialogs)

**Instructions**: Describe the activities for supporting non-tenure-track (PhDs, postdocs, researchers, adjuncts, etc.) staff in their careers and development. For example: financial support for personal development, mentoring, grant assistance, feedback, career planning, help with job searches, etc.. Explicitly address what support is provided for obtaining the docent and distinguished teacher qualifications for post-PhD staff. Specify if activities are informal (e.g., expected as part of advising/mentoring) or formal (e.g., part of a regular process).

Motivation: Provide details as to how the program works with career development for non-tenured staff and encourage the program to reflect on whether it is providing the right type and amount of support.

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| We organize a division kick-off every August (one day, off location) and always have one point on the career path for PhDs and postdocs. Occasionally, we invite PhD alumni, from both academia and industry, to present their experiences to the current PhD students, and to show the breadth of career paths. Discussion of career paths is part of the individual study plan for PhD students with applications and networking. For postdocs and researchers, we encourage taking leadership or coordination roles in our division (such as lab responsibility and teaching coordination), and we provide informal support for docent applications (through their supervisors). |

### Career support activities for tenure-track staff (beyond standard employee dialogs)

**Instructions**: Describe the activities for supporting tenure-track staff (Assistant Professors) in their careers and development. For example: financial support for personal development, startup packages, mentoring, grant assistance, feedback, career planning, co-advising, etc. Include discussions of support for promotion (Assistant to Associate) as well as docent and distinguished teacher qualifications. Specify if activities are informal (e.g., expected as part of advising/mentoring) or formal (e.g., part of a regular process). If there are very few staff in this category, please reflect on why that is and if that is something that should be addressed.

Motivation: Provide details as to how the program works with career development for tenure-track staff and encourage the program to reflect on whether it is providing the right type and amount of support.

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| We currently have no assistant professors. In the past 5 years, one assistant was promoted to associate, and received support in the leadership roles as teaching coordinator (formal), building teacher portfolio (informal), taking leadership roles within the department (formal), and being involved in collegial discussions and strategic decisions (regular). Our lack of assistant professors is due to difficulties in recruiting, which has so far been based on the ability of potential candidates to attract external funds. The program resources are dominantly used on professors. We want to continue improving in coordinating our needs and priorities to be able to open up resources for tenure-track positions. |

### Career support activities for tenured staff (beyond standard employee dialogs)

**Instructions**: Describe the activities for supporting tenured staff (Associate Professors and Professors) in their careers and development. For example: financial support for personal development, mentoring, grant assistance, feedback, career planning. Include discussions of support for promotion (Associate to Professor) as well as docent and distinguished teacher qualifications. Specify if activities are informal (e.g., expected as part of advising/mentoring) or formal (e.g., part of a regular process).

Motivation: Provide details as to how the program works with career development for tenured staff and encourage the program to reflect on whether it is providing the right type and amount of support.

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| The division kick-offs every August and the program meetings provide platforms for regular discussion on career and strategy. One associate professor was promoted to professor, and received informal support in the application process. Two tenured staff became distinguished teachers within the last period, mostly independent with formal mentoring from the department. We have formal support for the new program responsible, with administration and leadership, weekly meetings with division head and coordination with the partner program in the division. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| Our division with two partner programs provides a good platform for discussions, tight connections around using the same X-ray methods and for coordinating career, infrastructure and budgets. We organize yearly kick-off meetings every August (1 or 1,5 days off-location), which are extremely appreciated by all coworkers, and we have constant activities (1-2 hours) on career paths and development, at all levels, from PhDs to continue in industry or academia, to career support of tenure. The division provides the opportunity for leadership experience (division heads are associate professors), and also promotes leadership at department and faculty level. The division heads get formal support by having a deputy, used to create a leading team, to provide continuity and offloading tasks. Division head and program professors have regular strategic meetings to coordinate the support across programs, and also to provide support to the newly appointed program responsible. The program identifies, encourages and supports international candidates for external applications (KAW, ERC, VR) for new funding and opening tenure-tracks within the program. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| Our program has a heavy gender imbalance, with an all-male faculty, and we want to recruit and promote female faculty. The gender is more balanced at Master and PhD levels. A course of action is to encourage all staff to actively support and promote females at all stages (akin to “He4She”). We want to continue with fostering discussions between the different research directions in the program to prioritize topics and for a unified strategy (including recruitments). We aim at establishing regular strategy meetings including all directions. We want to increase the involvement in leadership and increase the rate of accepting the opportunities in leadership at the division, unit, department, and faculty level, since this can modify and influence the policies for career support and recruitment. Thus, we can learn what is important at a larger scale than just one's own group or program. It is important to rotate leaders to create resilience in the program and to allow opportunities for faculty to grow in leadership, but also to offload us from administrational work so we can excel in other fields (such as research and teaching). |

# Area 3: Collaboration and Outreach (evaluation of processes)

Responsibility: PAP to communicate with all program members, discuss, prioritize, and collate. All program members to report and discuss.

Collaboration and outreach (“samverkan” in Swedish) should be interpreted to mean activities that reach outside of the university to non-academic partners. Specifically, academic collaborations with other research organizations within academia should be considered part of our research and not collaboration and outreach for this evaluation. To help with this section, here is a partial list of the types of collaboration and outreach that we are striving to achieve:

* Joint research projects, student/PhD/postdoc/researcher/faculty exchanges/sabbaticals, etc.
* Advising/consulting, spreading research results/insights, popular science outreach and publications, press interviews, expert panels, etc.
* Interactions with industry, government, schools, society, media, etc.
* Academic entrepreneurship, including creating, joining, and advising startups and companies, etc.
* Feedback of external ideas, challenges, relevant questions, etc., into program(s) or departments.

## Specific collaboration and outreach examples

**Instructions**: Provide up to three specific examples of collaboration and outreach activities connected to the program’s research. Under “Example and connection” describe the activity and person or organization with whom the collaboration or outreach took place. (e.g., “Expert advice on SUBJECT for COMPANY”, “Popular science book on SUBJECT aimed at AUDENICE”, or “Interview on PROGRAM about SUBJECT”.) Specify the value to the program (e.g., “exposure to new challenges and issues that COMPANY experience on a practical level” or “making the SUBJECT expertise of our researchers visible to the nation”) and the value to the partner (e.g., “insight into how COMPANY can model the physical properties from the chemical composition” or “addressing public concern over the impact of SUBJECT on the environment”). Keep in mind the broad range of collaboration and outreach listed above.

Motivation: Provide a list of specific examples of collaboration and outreach activities to motivate the self-reflection below and to serve as a source of examples for others.

|  |  |  |
| --- | --- | --- |
| 1 | Example and connection | “13x13 lectures” at Uppsala University by Rubensson, Caleman, and Timneanu |
| Value to the program | We get: To think about our research and simplify it for the general public, test of our own knowledge, meet and discuss with the public and think about and answer broad questions. |
| Value to the partner | They get: A better picture of reality as we see it. |
| 2 | Example and connection | Visits to our HELIOS lab for ultrafast laser science by research engineer Stefanuik |
| Value to the program | We get: contact with potential recruits, talk about our research in a broadly accessible way, test our own broad knowledge. |
| Value to the partner | They get: To see what it takes to do science and where their tax money is spent. |
| 3 | Example and connection | Development with JAVU (a company) to manufacture thin membranes of diamond-like carbon |
| Value to the program | We get: Thin membrane windows for use in gas and liquid experiments at synchrotrons that are needed and did not exist. |
| Value to the partner | They get: new product to sell, knowledge about our needs for further product developments. |

### Reflections on overall aims and strategies for collaboration and outreach

**Instructions**: Use the above examples, as appropriate, to reflect on the program’s overall aims and strategies for collaboration and outreach and discuss what enabled the above examples (e.g., how were they first identified and initiated? How did they fit into the overall aims and strategies? etc.) and what it takes to keep them functioning well (e.g., staff, networking, meetings, equipment/labs/supplies, etc.).

Motivation: Understand what we need to create and maintain collaboration and outreach

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| Mostly, these are random opportunities that we jump on as they come. And we can only do this if the right people and resources happen to be available at the time. We had co-workers with the will and knowledge to give talks at the “13x13 lecture series” and their lectures reflected results of our research in accordance with our research strategy. Us being an interdisciplinary program helps in this. Having a running lab is good for collaboration and outreach to show real instruments and convey how they are used to measure what we are interested in (“seeing is believing”). |

## Support for outreach and collaboration

**Instructions**: Describe the specific support resources and processes available to program members for outreach and collaboration towards non-academic actors, such as collegial discussions, meetings with external actors, etc. Describe whether the activities are formal or informal and whether they are managed by the research program, department, or faculty.

Motivation: Understand what support the program has for outreach and collaboration.

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| There is no specific budget in the program to support outreach. Our communication officer Camilla Thulin is available at the department level to help with outreach and communication (of research results, e.g.). We have not interacted with communication officers at the faculty or university levels. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| --- |
| We have been good at grabbing opportunities as they arise. Showing the HELIOS lab with real instruments and “knobs to turn” is a huge asset. Our interdisciplinary science fits well public outreach because it can be made broadly accessible and touched upon numerous challenges, problems, solutions or technologies in every-day life. We are active every year at the Uppsala Culture Night, organizing a science station in the University aula, where the general public can interact hands-on with our demonstrations. The PhD students and postdocs are very enthusiastic about this organization and keep it running. The 13x13 lecture series organized by the department is extremely popular, and we have been active for two years in a row in presenting ultrafast X-ray science and its applications to the general public. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| --- |
| It would be beneficial to allocate resources (time, funding) for outreach and collaboration activities. Broader or longer-term development of plans and strategies for outreach, we think, are best placed at the department/faculty. We want to continue actively inviting the public to visit out labs and talk about our research. |

# Area 4: Connection between Research and Teaching (evaluation of processes)

Responsibility: PAP to communicate with all program members and the director of studies, discuss, prioritize, and collate. All program members to report and discuss.

The types of connections between research and teaching that we are striving to achieve include, but are not limited to:

* Activities that lead to a scientific approach and student progression in learning how to apply the scientific method within courses and throughout education programs
* Teachers who are active researchers take opportunities to develop their pedagogical skills
* Researchers who are active teachers and take opportunities to develop their pedagogical skills
* Students being trained to find, use, and evaluate research results
* Students being active in on-going research projects
* Integration of research results, methods, and facilities in teaching

## Main teaching areas

**Instructions**: List up to four teaching programs, course packages, or contract/continuing education that the research program’s members contribute to. Specify the level (e.g., bachelor’s or master’s), how much the members of the research program contribute to the teaching program based on the number of full courses taught and whether the teaching program is managed (e.g., the program coordinator/director is in the research program) by members of the research program (yes/no). For the number of courses taught, exact values are not needed. Instead estimate the teachers’ contribution in terms of full courses taught (e.g., 1.0 means the teacher taught the equivalent of one full course) and use the ranges of: <1, 1-5, >6 to simplify accounting.

Motivation: To show what subjects the program primarily teaches in.

|  |  |  |  |
| --- | --- | --- | --- |
| Teaching program, course package, or contract/continuing education | Level | Courses Taught | Managed |
| KF, HI, I, ES, W, F (Mechanics) | Bachelor | >6 | No |
| Science and Technology Foundation Year program (Basår) | - | - | No |
| Master Physics, Master in Quantum Technology (ex. Synchrotron Radiation Methods, Advanced Quantum Mechanics, Free Electron Laser Science, Spectroscopy of Atoms and Molecules) | Bachelor and Master | >6 | Yes/No (dep. on course) |
| Master's program in Biophysics (introductory course, theses) | Master | 1-5 | Yes |

## Infrastructure use in teaching

**Instructions**: Please list any major research infrastructures that are used in teaching, the courses that use it, the education level, and the approximate number of students who use it each year.

Motivation: To understand what infrastructure is being used in teaching and to support the faculty’s ongoing work on developing an infrastructure policy

|  |  |  |  |
| --- | --- | --- | --- |
| Infrastructure | Courses | Level | Students |
| Beamlines at MAX-IV | Master courses, project courses, Synchrotron Radiation Methods | Master | 20 |
| Small Angle X-ray Scattering (at BMC) | Synchrotron Radiation Methods | Master | <10 |
| SNIC/NAISS/Davinci clusters | Project courses, Master thesis | Master | <10 |
| HELIOS | Laserlab-Sweden’s PhD course in Experimental Laser Physics | Master/PhD | <5 |
|  |  |  |  |

## Specific teaching/research connections

**Instructions**: Provide up to four specific examples of how the program’s research has been incorporated into teaching activities or strengthened courses, and/or how teaching activities have been incorporated into the program’s research activities or strengthened the program’s research. Under “Example” describe the connection (e.g., “lab exercise using the facility X that exposes students to research technique Y”). Under “Course Info” specify the course name, program, level (introduction/advanced), and the approximate number of students taking it each year. Describe the value to the teaching experience from the research connection (or vice versa).

Motivation: Provide a list of specific examples of teaching/research connections to motivate the self-reflection below and to serve as a source of examples for others.

|  |  |  |
| --- | --- | --- |
| 1 | Example | Project courses with computational resources |
| Course Info | Courses are given for Applied Physics, F, Master Physics, Bachelor thesis, Master program in Biophysics |
| Value to teaching/ research | Here we let our students use our research simulation software packages to simulate real research problems. This strongly connects this research activity to teaching. |
| 2 | Example | Students are asked to critically evaluate needs for a certain topic and write a detailed beamtime application for beamtime justifying their choice of beamline. |
| Course Info | Examination in Synchrotron Radiation Methods |
| Value to teaching/ research | This is what researchers in our program do routinely, and this helps the students understand how to evaluate different aspects of different beamlines. |
| 3 | Example | In a python-based lab the students are studying how a protein orients in an external electric field |
| Course Info | Mechanics |
| Value to teaching/ research | This helps the students to learn python and connects several topics in their education (mechanics, programing, electric fields). |
| 4 | Example |  |
| Course Info |  |
| Value to teaching/ research |  |

### Reflections on overall aims and strategies for connections

**Instructions**: Use the above examples, as appropriate, to reflect on the program’s overall aims and strategies for teaching and research connections and discuss what enabled the above examples (e.g., How were they first identified and initiated? How did they fit into the overall aims and strategies? etc.) and what it takes to keep them functioning well (e.g., staff, networking, meetings, equipment/labs/supplies, etc.).

Motivation: Understand what we need to create and maintain connections

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| The teachers in the program are all active researchers, it is therefore quite natural to include our own research into our teaching whenever possible. One example from the list above is that students in the course “Synchrotron Radiation Methods” use the software RayUI to build a virtual beamline, this is all based on research done within the program. Today we lack a formal structure to ensure this integration, but instead it is all based on the individual teachers. |

## Support for integrating teaching and research

**Instructions**: Describe the support resources and processes for integrating teaching and research available to program members such as collegial discussions, meetings with students, course reviews, teaching follow-up, etc. Describe whether the activities are formal or informal and whether they are managed by the research program, department, faculty, or teaching program. If there are no such resources or processes in the research program, then please reflect on whether that is something the research program or department should address under reflections below.

Motivation: Explain what support there is for improving the research and teaching connection.

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| The department organizes “teacher lunches” where several aspects of teaching are discussed, and this can be one of them. There are no formal resources or processes at the program level to address this. Since our teaching is spread over several courses for several different programs ranging from preschool teachers to PhD students, this has been left to the individual teacher to organize in the best possible way - sometimes alone and other times in collegial discussions. The faculty offers formal support though didactics courses organized by TUR (including integration of research). One of our lecturers (Timneanu) is active in developing and these courses. Our program has two distinguished teachers that offer constant support. |

## Reflections on what is working well

**Instructions**: From the above, reflect on what is working well and should be continued over the next 5 years.

Motivation: Require programs to identify where current activities are successful. This will provide the panel with insights into our own self-assessment.

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| The teachers in our program teach on varied levels, both undergraduate courses with large student groups as well as graduate courses with few students. In all cases, the courses are very relevant for our and related to our research directions. This gives the teachers different challenges in their profession which, we think, is important. As much of our research is done at large scale facilities, it is not always easy to integrate our research into our teaching, but we try to do this by flexible arrangements where ever possible (this is clearly easier for our research that involves simulations).  Two faculty in the program are distinguished teachers, in in the X-ray science division there are in total 3 distinguished teachers – they are a valuable resource for both programs for motivating change and pedagogical development. |

## Reflections on what needs to be improved

**Instructions**: From the above, reflect on what needs to be improved over the next 5 years. Please focus on areas that need improvement and do not list areas that could be improved but where it is not needed.

Motivation: Require programs to identify where they feel that they need to invest. This will both provide the panels with insights into our own self-assessment as well as help us improve.

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| Several of our graduate courses have very few students, which is a problem for several graduate programs at the faculty. This needs to be (and is) addressed at several levels in the organization. We can absolutely work towards attracting more students in this field. This will however take time. We feel that teaching is not always valued as highly as research, making it difficult for an individual to put that extra time into this instead of research. We support initiatives that increase awareness of the value of teaching at the department and faculty levels. Systematically and better integrating our research into our teaching will require resources (time, funding, personnel). We also note that the reimbursement for teaching is comparably low (we think this should be increased and may be a challenge at a national level). |

# 5-year Priorities

**Instructions**: Identify, describe, and motivate specific Priorities that have a high likelihood of meaningfully strengthening or meaningfully broadening research over the next 5 years. The Priorities should be well-motivated and have sufficiently developed plans that it is clear what needs to be done to accomplish them and how to evaluate if they are successful. The Priorities can cover a wide range of activities with the overall goal of strengthen research, and do not need to require additional expenses. These can include, but are not limited to:

* Strengthening existing areas (e.g., to adapt to future challenges in the field or are necessary to maintain high quality, including by investing in new equipment, facilities, or staff, etc.)
* Investing in new areas (e.g., to adapt to changes in the field or new developments, by including investing in new equipment, facilities, or staff, etc.)
* Changing research organization by splitting, merging, closing, or moving research programs/departments (e.g., to improve collaboration or use of facilities or resources, etc.)
* Changing research policies (e.g., to address funding/co-funding, multi-disciplinary work, or recruiting, etc.)
* Changing research support (e.g., to improve grant success rates, recruiting, management, adoption of new techniques/technologies, etc.)

Building upon existing strategic plans is encouraged and co-funding/support from the program or department is expected to demonstrate commitment to the plan. There will be a yearly lightweight follow up process to see what progress has been made for each Priority with an opportunity to revise/change them as needed. The goals are to both ensure that we follow up on our stated Priorities and that we always have clear Priorities at each level in the faculty.

Each program is allowed to propose 3 Priorities: one that can be fully accomplished within the program, one that may require support at the department level, and one that may require support at the faculty level. This done to ensure that all programs will have at least one Priority they can work on as the very limited faculty funding available means only a few programs will receive additional resources.

Prioritization at the department level: Each department will review the Priorities from all of its programs and consider which to include in the department’s own list of Priorities, along with department’s own Priorities.

Motivation: Identifying Priorities encourages strategic analysis and medium-term planning within the program, and makes it easier for the department and panel to understand the programs’ own assessments of their needs and opportunities. Requiring two of the Priorities to be able to be accomplished within the program and the department emphasizes the need to work locally as well as at the faculty level.

Responsibility: PAP in discussion with program members.

# Priority 1 of 3: An activity that can be accomplished within the program

## Description of the Priority

**Instructions**: Provide the department name (since these will be collected at the section/faculty level) and the program name (if this is a program Priority), the title of the Priority, and whether it may require department support (Yes/No) and/or faculty support (Yes/No).

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| --- | --- | --- | --- | --- |
| Department: | Department of Physics and Astronomy | | | |
| Program: | Chemical and Bio-Molecular Physics | | | |
| Title: | Attosecond non-linear X-ray science – “New dimensions to ESCA” | | | |
| Support: | May require department support: | No | May require faculty support: | No |

### Goal

**Instructions**: Specify the goal of the Priority, for example, to strengthen a specific existing activity or start a new one.

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| Explore new science in atomic, molecular, and optical physics, chemistry, catalysis, and biology using the unprecedented attosecond X-ray pulse properties at X-ray free-electron lasers (European XFEL in particular) |

### Expected meaningful research improvement

**Instructions**: Provide a description of the research that investing in this Priority will accomplish over the next 5 years. Explain how it has the potential to significantly strengthen or broaden the program for program proposals or department for department proposals. Specifically, this should go beyond continuing or slightly enlarging current activities by having a clear description of what change it will accomplish.

Motivation: The overall goal is to strengthen our research. As a result, the Priority should deliver meaningful improvements in research quality and/or breadth.

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| We want to use our strengths in ultrafast X-ray spectroscopy and diffraction with XFELs in experiment and theory to discover, develop and establish new ways of making use of the non-linear interactions of intense attosecond X-ray pulses now becoming available at XFELs with matter. We want to demonstrate how atto-second non-linear X-ray science adds new dimensions to ESCA by: resolving the coupled motions of nuclei and electrons (non-Born-Oppenheimer dynamics) with element, site, and orbital specificity at passages of conical intersections, in charge motion and in molecular fragmentation, by revealing how excited-state dynamics and electric-field (solvent) fluctuations drive chemical reactions and determine catalytic pathways in the condensed phase, by imaging non-crystalline matter with fluorescence correlation spectroscopy (incoherent diffractive imaging) of single particles and proteins, and by exploring applications in nano(bio)-technology for quantum confinement, plasmonics, and light upconversion. This will impact our under-standing of hidden processes in nature and technology from the primary events of vision to photocatalysis. |

### Implementation plan

**Instructions**: Provide a brief description of specifically what is planned to be done over the next 5 years to realize the potential of this Priority. For example: new hires, investments in equipment, starting collaborations, closing down existing activities, moving resources from existing activities, etc. Use the limited space provided here to discuss the most important aspects of how this activity will be carried out.

Motivation: For a Priority to be credible, there must be a plausible plan and what needs to be accomplished must have been thought through. It is understood that these plans will change over the next 5 years, however.

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| In order to best tap the transformative opportunities offered by intense attosecond pulses at XFELs (in general and at the European XFEL in Hamburg in particular) and to demonstrate how to make use of these pulses in diverse science fields, we plan to focus and combine common interests by first establishing a discussion forum with the goals: to outline the content of this new, interdisciplinary and joint research line, to perform first steps in developing the necessary theory, and to ultimately develop plans for first experiments. We want to then direct and combine existing resources to kick-start first concrete investigations (in theory and/or experiment) and to prepare the case for joint grant and beamtime applications with the ultimate aim to attract new (external) funding to the program and to perform joint beamtime campaigns. Our discussion forum and ensuing initiatives will be open to all staff in the program and aims at enabling research in attosecond non-linear X-ray science for all in the program (and ultimately for all interested at Uppsala University). |

### What previous accomplishments indicate a high likelihood of success?

**Instructions**: Describe what recent (last 5 years) accomplishments make it clear that the there is a good chance of success in this project. Use specific examples (e.g., grant X, collaboration Y, paper Z) and explain how those recent accomplishments are evidence of having the competencies needed to be successful in this project.

Motivation: For a Priority to be credible, the expertise and track record needed to support it must be present.

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| Our internationally leading roles in the respective science fields with XFELs, our past and ongoing externally funded grants, our current research with femto- to picosecond X-ray pulses in the lab (HELIOS) and at XFELs and synchrotrons (science that is complementary to the new attosecond non-linear X-ray science direction), our numerous beamtimes at XFELs and our publications from work at XFELs, our spectrometers for transient XAS and imaging RIXS (that we developed and contributed the European XFEL), us being leaders of community proposals (at the European XFEL), and, finally, our numerous international collaborations on XFEL science, all motivate us to believe that we are uniquely positioned to succeed in this new direction. |

## Current status of the area at Uppsala University

Instruction: Describe the current status of the area at Uppsala University as a whole. Include any existing funding, support, staff, and success in this area. Explicitly identify any overlap with other existing activities at the program(s), department, section, faculty, and/or university levels.

Motivation: To avoid duplicating efforts, it is important to understand the local Uppsala context when enhancing existing activities or starting new efforts. As part of the evaluation process, the panel will try to identify synergies between proposed Priorities.

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| Our interdisciplinary program is the ideal nucleus at Uppsala University for demonstrating the value of this new and virtually non-existent field. Our expertise in interdisciplinary X-ray science qualifies us to broaden the case to include diverse researchers and questions in materials science, chemistry, catalysis, and biology. |

### Current and planned contributions to support the initiative

**Instructions**: Describe the current (already in-place and on-going) and planned contributions to this goal from the local level (from the program for program proposals, from the department for department proposals, and from both the program(s) and department, as appropriate, for program proposals selected by the department). For example, co-funding, in-kind support, shared funding of facilities, transfers of FFFs, etc.

Motivation: Evidence of financial commitment from the local environment strongly supports the proposal as being important. Conversely, if the local environment is unable or unwilling to support it, the importance to the environment as a whole is much weaker.

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| We want to use our current collaborations for exploring first steps, we want to pool resources by combining parts of our individual grants, we plan to work on upgrades of our instrumentation at the European XFEL to enable the proposed research, and we want to test initial ideas during our upcoming (granted) beamtimes. |

## Strategic value

### Strategic value of the area in the global context

Instruction: Describe the importance of the area in the global context. For example: fundamental challenges in research; new developments in research; societal challenges and priorities; global impact and importance.

Motivation: To ensure consideration of the larger context.

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| Attosecond non-linear X-ray science emerges from the combination of 3 Nobel prizes (ESCA in 1981, femtochemistry in 1999, attosecond pulses in 2023) and has the potential to place Uppsala University at the fore-front of a new science field with enormous opportunity for impact in science broadly and in societies. |

### Strategic value of the area at the next level

Instruction: Describe the importance of the area to the department (for program proposals) and for the section and faculty (for department proposals). For example: synergies with other activities, connections to teaching and collaboration, both currently and potential for new ones, etc. Explain the value of this activity beyond any overlapping ones identified above.

Motivation: To ensure that there is awareness of where this activity fits in at the next level up in the organization. This is particularly important if support is to be requested at that level.

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| Attosecond non-linear X-ray science builds on and further develops the strategic direction Ultrafast Processes at the department. It has the potential to establish new collaborations, new science, and new funding at the faculty by relating questions in physics, materials science, chemistry, catalysis, and biology. |

## Contributions needed for success

**Instructions**: Identify what contributions are needed for success in terms of time, expertise, resources, facilities, staff, etc. Explicitly include estimates of financial resources needed and where they will come from.

Motivation: To ensure the costs and resources required have been thought through, and that they are reasonable given the scope of the benefit.

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| We have the expertise and our planned discussion and development forum will need commitment and regular scientific exchange. The faculty in our program will lead the discussions and leverage the expertise in their respective international collaborations to develop new ideas and concepts with all in the program. |

### Success indicators

**Instructions**: Describe specific results that will indicate success in 5 years. For example: increases in publications in top venues X and Y, publications in new field Z, strengthened or new collaborations with university A, new hires in B, new grants from C, etc.

Motivation: To ensure that the local- and faculty-levels will be able to assess whether this Priority was successful at the next evaluation so that we develop a positive cycle of following up on our strategic planning.

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| New accepted beamtime proposals at XFELs (at the European XFEL in particular), invited scientific presentations at ultrafast X-ray science meetings, new publications based on joint efforts and collaborations. |

### First steps that can be taken today

**Instructions**: Describe the first concrete steps needed to move in this direction that can be taken today. These should be clear enough that they can be followed up on in a year to see what progress has been made. Identify initial activities that can be started locally to enable progress to help motivate further support for the larger goal. In the exceptional case where no steps can be taken today, explain why a Priority has been chosen that cannot be started.

Motivation: To ensure that there is a clear idea of how to get started and enable easy follow-up of how the Priority is progressing.

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| We will start by conceptualizing experiments, predicting them with theory, planning first steps (first studies), and execute joint experiments at XFELs. We have started discussing with the European XFEL facility to have common PhD students related to attosecond non-linear X-ray science in AMO and/or chemistry. |

# Priority 2 of 3: An activity that may require department support

## Description of the Priority

**Instructions**: Provide the department name (since these will be collected at the section/faculty level) and the program name (if this is a program Priority), the title of the Priority, and whether it may require department support (Yes/No) and/or faculty support (Yes/No).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Department: | Department of Physics and Astronomy | | | |
| Program: | Chemical and Bio-Molecular Physics | | | |
| Title: | Instrumentation development platform | | | |
| Support: | May require department support: | Yes | May require faculty support: | Yes? |

### Goal

**Instructions**: Specify the goal of the Priority, for example, to strengthen a specific existing activity or start a new one.

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| Keep and develop highly specialized expert personnel for the development of complex instrumentation to enable new science in advanced analysis with X-rays and lasers |

### Expected meaningful research improvement

**Instructions**: Provide a description of the research that investing in this Priority will accomplish over the next 5 years. Explain how it has the potential to significantly strengthen or broaden the program for program proposals or department for department proposals. Specifically, this should go beyond continuing or slightly enlarging current activities by having a clear description of what change it will accomplish.

Motivation: The overall goal is to strengthen our research. As a result, the Priority should deliver meaningful improvements in research quality and/or breadth.

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| Scientific breakthroughs are often enabled by advances in instrumentation and methodology. Combining our tradition in developing novel X-ray tools with our priority 1 “Attosecond non-linear X-ray science”, with our priority 3 “Ultrafast X-rays for advanced analysis at UU”, and with our support of the LigHt-infrastructure define our need to develop novel X-ray instrumentation and methods in X-ray scattering and spectroscopy. The increasing complexity of the scientific questions determines the increasing complexity of the instrumentation used in experiments to answer these questions. That complexity of instrumentation nowadays often exceeds what a single research program can achieve. The platform will create the necessary critical mass for the development of complex instrumentation and this enables the anticipated research opportunities. The platform will enable support and development of career paths for key/expert personnel in a way a single program would not be capable of. This is key to attracting and keeping the highly specialized personnel needed to develop complex infrastructure for exploratory science at the international forefront. |

### Implementation plan

**Instructions**: Provide a brief description of specifically what is planned to be done over the next 5 years to realize the potential of this Priority. For example: new hires, investments in equipment, starting collaborations, closing down existing activities, moving resources from existing activities, etc. Use the limited space provided here to discuss the most important aspects of how this activity will be carried out.

Motivation: For a Priority to be credible, there must be a plausible plan and what needs to be accomplished must have been thought through. It is understood that these plans will change over the next 5 years, however.

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| To enable the high-risk-high-gain development of instrumentation for ultrafast X-ray science (to enable our priorities 1 and 3), dedicated expert personnel will aggregate to share and transfer knowledge and expertise. Starting with existing personnel (from the research programs engaged in the strategic direction Ultrafast Processes, e.g., see 3.5) and around existing instrumentation, the platform will bring together experts and link them to users at Uppsala University and, potentially, nationally to ultimately grow into a long-term initiative with shared responsibility at the department (and/or at the faculty). For our program, the platform will enable the development of beamlines and end stations at large-scale X-ray facilities (including advanced detection systems, data acquisition), instrumentation for ultrafast laser science and ultrafast X-ray science (for new capabilities beyond our existing HELIOS lab), dedicated instrumentation for specialized sample en-vironments to make accessible the specialized samples from non-expert groups in diverse fields (chemistry, biology, catalysis, materials science) to enable (ultrafast) X-ray studies beyond demonstration experiments. |

### What previous accomplishments indicate a high likelihood of success?

**Instructions**: Describe what recent (last 5 years) accomplishments make it clear that the there is a good chance of success in this project. Use specific examples (e.g., grant X, collaboration Y, paper Z) and explain how those recent accomplishments are evidence of having the competencies needed to be successful in this project.

Motivation: For a Priority to be credible, the expertise and track record needed to support it must be present.

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| The division of X-ray photon Science with our program and the Condensed Matter Physics of Energy Materials program pioneers cutting-edge X-ray spectroscopy tools across diverse research fields. Recent developments include high-resolution RIXS/XAS at MAXIV, beamlines at BESSY II for high transmission/time-resolved measurements and an imaging RIXS spectrometer at European XFEL. We have also developed, in the division, ambient measurement tools, tools for dynamic and operando measurements in-house and at large scale facilities. Significant progress has also been made in device physics. These efforts are supported by ERC, VR, SSF, FORMAS and KAW. |

## Current status of the area at Uppsala University

Instruction: Describe the current status of the area at Uppsala University as a whole. Include any existing funding, support, staff, and success in this area. Explicitly identify any overlap with other existing activities at the program(s), department, section, faculty, and/or university levels.

Motivation: To avoid duplicating efforts, it is important to understand the local Uppsala context when enhancing existing activities or starting new efforts. As part of the evaluation process, the panel will try to identify synergies between proposed Priorities.

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| The department, including our division of X-ray Photon Science, has a strong tradition in instrument development (including beamline development at synchrotrons), tightly integrated with UU research in various fields at the faculty, including collaborations with the Centre for Photon Science. |

### Current and planned contributions to support the initiative

**Instructions**: Describe the current (already in-place and on-going) and planned contributions to this goal from the local level (from the program for program proposals, from the department for department proposals, and from both the program(s) and department, as appropriate, for program proposals selected by the department). For example, co-funding, in-kind support, shared funding of facilities, transfers of FFFs, etc.

Motivation: Evidence of financial commitment from the local environment strongly supports the proposal as being important. Conversely, if the local environment is unable or unwilling to support it, the importance to the environment as a whole is much weaker.

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| Substantial resources to instrument/methodology development (incl. depreciation and running costs, 15% of internal research funding, 20% of the total budget). We seek to share responsibility for instrumentation development initiatives at the department/faculty level. We want to contribute (co-funded) personnel. |

## Strategic value

### Strategic value of the area in the global context

Instruction: Describe the importance of the area in the global context. For example: fundamental challenges in research; new developments in research; societal challenges and priorities; global impact and importance.

Motivation: To ensure consideration of the larger context.

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| Access to and development of world-class facilities lay the foundation for strengthening UU’s position as an internationally leading and attractive university. Infrastructure is a strategic priority at the faculty and its de-velopment enables providing scientific foundations for solving global challenges locally and internationally. |

### Strategic value of the area at the next level

Instruction: Describe the importance of the area to the department (for program proposals) and for the section and faculty (for department proposals). For example: synergies with other activities, connections to teaching and collaboration, both currently and potential for new ones, etc. Explain the value of this activity beyond any overlapping ones identified above.

Motivation: To ensure that there is awareness of where this activity fits in at the next level up in the organization. This is particularly important if support is to be requested at that level.

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| Our strategy and department goals include ensuring access to qualified research infrastructure, consolidating local facilities, and enhancing Swedish instrumentation at international research facilities. This enables new opportunities across fields (in atomic, molecular, optical physics, chemical sciences, catalysis). |

## Contributions needed for success

**Instructions**: Identify what contributions are needed for success in terms of time, expertise, resources, facilities, staff, etc. Explicitly include estimates of financial resources needed and where they will come from.

Motivation: To ensure the costs and resources required have been thought through, and that they are reasonable given the scope of the benefit.

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| Consolidating a platform requires a 5 year 1 FTE/program initiative, with support evenly distributed among program, department, and faculty. Within departmental research program activities in experimental/applied physics as well as the FREIA-lab and the workshop, we possess the facilities. |

### Success indicators

**Instructions**: Describe specific results that will indicate success in 5 years. For example: increases in publications in top venues X and Y, publications in new field Z, strengthened or new collaborations with university A, new hires in B, new grants from C, etc.

Motivation: To ensure that the local- and faculty-levels will be able to assess whether this Priority was successful at the next evaluation so that we develop a positive cycle of following up on our strategic planning.

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| Number of instrumentation systems developed, number of publications enabled by instrumentation systems developed, number of highly specialized expert personnel attracted, kept, and developed (instead of lost to industry or other universities in Sweden and abroad). |

### First steps that can be taken today

**Instructions**: Describe the first concrete steps needed to move in this direction that can be taken today. These should be clear enough that they can be followed up on in a year to see what progress has been made. Identify initial activities that can be started locally to enable progress to help motivate further support for the larger goal. In the exceptional case where no steps can be taken today, explain why a Priority has been chosen that cannot be started.

Motivation: To ensure that there is a clear idea of how to get started and enable easy follow-up of how the Priority is progressing.

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| Integrate 2 of our experts in the platform (salary from the department/faculty) to keep their knowledge and expertise (in X-ray optics, X-ray instrumentation, ultrafast optical lasers, ultrafast X-rays) at the department or faculty and to make their expertise broadly available at the department, faculty, potentially nationally. |

# Priority 3 of 3: An activity that may require faculty support

## Description of the Priority

**Instructions**: Provide the department name (since these will be collected at the section/faculty level) and the program name (if this is a program Priority), the title of the Priority, and whether it may require department support (Yes/No) and/or faculty support (Yes/No).

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| --- | --- | --- | --- | --- |
| Department: | Department of Physics and Astronomy | | | |
| Program: | Chemical and Bio-Molecular Physics | | | |
| Title: | Ultrafast X-rays for advanced analysis at UU (a graduate school and UL/BUL recruitments) | | | |
| Support: | May require department support: | No | May require faculty support: | Yes |

### Goal

**Instructions**: Specify the goal of the Priority, for example, to strengthen a specific existing activity or start a new one.

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| Demonstrate the impact of advanced analysis of matter and materials with short X-ray pulses for atomic resolution in space and time (with the combined use of the European XFEL and MAX IV) |

### Expected meaningful research improvement

**Instructions**: Provide a description of the research that investing in this Priority will accomplish over the next 5 years. Explain how it has the potential to significantly strengthen or broaden the program for program proposals or department for department proposals. Specifically, this should go beyond continuing or slightly enlarging current activities by having a clear description of what change it will accomplish.

Motivation: The overall goal is to strengthen our research. As a result, the Priority should deliver meaningful improvements in research quality and/or breadth.

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| Developing a new and interdisciplinary initiative at Uppsala University for advanced analysis with ultrafast X-rays from XFELs and synchrotrons (with, in particular but not limited to, the European XFEL and MAX IV) will render transformative insight into the fundamental atomic-scale processes across borders of established disciplines. Ultrafast X-ray methods, for the first time, offer atomic resolution both in space and time for studies in physics, materials science, chemistry, catalysis and biology. The goal of the initiative is to bring together and educate researchers from diverse science fields with their respective questions to form teams with critical mass, all in one science hub related by one set of methods in spectroscopy, scattering, and diffraction with short X-ray pulses. By sharing expertise, we will excel in our respective fields by improved approaches, concepts, experiments and theory due to synergistic effects. Advanced analysis with ultrafast X-rays holds the key to understanding and controlling materials at the level of single atoms and electrons. The initiative will make accessible new opportunities at XFELs and synchrotrons to help broaden their user base. |

### Implementation plan

**Instructions**: Provide a brief description of specifically what is planned to be done over the next 5 years to realize the potential of this Priority. For example: new hires, investments in equipment, starting collaborations, closing down existing activities, moving resources from existing activities, etc. Use the limited space provided here to discuss the most important aspects of how this activity will be carried out.

Motivation: For a Priority to be credible, there must be a plausible plan and what needs to be accomplished must have been thought through. It is understood that these plans will change over the next 5 years, however.

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| Kick-start with a graduate school of 6 PhD students for 5 years plus 2 new UL/BUL recruitments, ensure interdisciplinary integration of the initiative with 3 PhD students to our program and 3 to other programs at the faculty, of the 2 UL/BUL recruitments, 1 will be to our program and 1 to another program at the faculty. Our program will take the lead, coordinate and represent the nucleation point for the initiative. “Ultrafast X-rays for advanced analysis at UU” builds on our current research and encompasses our priorities 1 and 2. Collaborations for joint PhD projects and with the new ULs/BULs will be found along established lines: within our department (Ultrafast Processes roadmap), within our collaborations in the biophysics network (with Maia@ICM, Marklund@Chem-BMC, Wohlert@Mat. Eng.), within the Photon Science Center (various), with Chemistry at Ångström (Ott, Borbas, Lundberg, Messinger, Hammarström, possibly relating to their initiative on CO2 capture, conversion, utilization), within the Center of Artificial Photosynthesis, or with BMC in relation to their initiative for infrastructure for “Chemical and Dynamic Mechanism of Life” (Westenhoff). |

### What previous accomplishments indicate a high likelihood of success?

**Instructions**: Describe what recent (last 5 years) accomplishments make it clear that the there is a good chance of success in this project. Use specific examples (e.g., grant X, collaboration Y, paper Z) and explain how those recent accomplishments are evidence of having the competencies needed to be successful in this project.

Motivation: For a Priority to be credible, the expertise and track record needed to support it must be present.

|  |
| --- |
| Our internationally leading roles ultrafast X-ray science with XFELs, our past and ongoing externally funded grants, our current research with complementary capabilities and science with short X-ray pulses in the lab (HELIOS) and at XFELs and synchrotrons, our numerous beamtimes at XFELs and our publications from work at XFELs, our spectrometers for transient X-ray absorption and imaging X-ray emission spectroscopy (that we developed and contributed the European XFEL), us being leaders of community proposals (at the European XFEL), our numerous international collaborations on XFEL science, our existing collaborations within the faculty, our participations in the SPIDOC PhD school (EU funded) and PRISMAS graduate school with MAX IV. |

## Current status of the area at Uppsala University

**Instruction**: Describe the current status of the area at Uppsala University as a whole. Include any existing funding, support, staff, and success in this area. Explicitly identify any overlap with other existing activities at the program(s), department, section, faculty, and/or university levels.

Motivation: To avoid duplicating efforts, it is important to understand the local Uppsala context when enhancing existing activities or starting new efforts. As part of the evaluation process, the panel will try to identify synergies between proposed Priorities.

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| Steady-state X-rays for analysis are strongly present throughout the faculty. Ultrafast X-ray science is present in single strong groups, albeit scattered throughout the faculty. Ultrafast science (without X-rays) is strong in Chemistry at Ångström and elsewhere in the faculty with untapped potential for ultrafast X-rays. |

### Current and planned contributions to support the initiative

**Instructions**: Describe the current (already in-place and on-going) and planned contributions to this goal from the local level (from the program for program proposals, from the department for department proposals, and from both the program(s) and department, as appropriate, for program proposals selected by the department). For example, co-funding, in-kind support, shared funding of facilities, transfers of FFFs, etc.

Motivation: Evidence of financial commitment from the local environment strongly supports the proposal as being important. Conversely, if the local environment is unable or unwilling to support it, the importance to the environment as a whole is much weaker.

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| Resources of our program (time of PIs/faculty, existing/future PhDs of which most are externally funded), our courses, our ongoing grants, our instrumentation expertise and capabilities (at the European XFEL and in the HELIOS lab, in particular). We will co-fund 1-2 additional PhD students. |

## Strategic value

### Strategic value of the area in the global context

**Instruction**: Describe the importance of the area in the global context. For example: fundamental challenges in research; new developments in research; societal challenges and priorities; global impact and importance.

Motivation: To ensure consideration of the larger context.

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| “Ultrafast X-rays for advanced analysis at UU” helps returning on Sweden’s investments in the large-scale X-ray facilities European XFEL and MAX IV. Uppsala University has the potential to become an internationally leading center for ultrafast X-ray science, adding a new, internationally visible, interdisciplinary science hub. |

### Strategic value of the area at the next level

**Instruction**: Describe the importance of the area to the department (for program proposals) and for the section and faculty (for department proposals). For example: synergies with other activities, connections to teaching and collaboration, both currently and potential for new ones, etc. Explain the value of this activity beyond any overlapping ones identified above.

Motivation: To ensure that there is awareness of where this activity fits in at the next level up in the organization. This is particularly important if support is to be requested at that level.

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| --- |
| “Ultrafast X-rays for advanced analysis at UU” builds on and extends the strategic direction Ultrafast Pro-cesses at the department, it relates and unifies, in one hub, the different existing strong groups at the faculty (see above), it opens up new science opportunities in chemistry, catalysis, biology, materials science. |

## Contributions needed for success

**Instructions**: Identify what contributions are needed for success in terms of time, expertise, resources, facilities, staff, etc. Explicitly include estimates of financial resources needed and where they will come from.

Motivation: To ensure the costs and resources required have been thought through, and that they are reasonable given the scope of the benefit.

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| Salaries of 4 PhD students (fixed-term for 5 years, 2 will be co-funded), salaries of 2 UL/BUL including startup packages, funding for coordination, leadership, and outreach. This need follows up on our previous initiative to attract new base funding to our growing program within ÖB19 and upon installation of our new program. |

### Success indicators

**Instructions**: Describe specific results that will indicate success in 5 years. For example: increases in publications in top venues X and Y, publications in new field Z, strengthened or new collaborations with university A, new hires in B, new grants from C, etc.

Motivation: To ensure that the local- and faculty-levels will be able to assess whether this Priority was successful at the next evaluation so that we develop a positive cycle of following up on our strategic planning.

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| --- |
| PhD theses, granted XFEL and synchrotron beamtimes, papers, invited presentations, Master theses, attractiveness of PhDs for future employers, new external funding, growing programs and a growing new science field in “Ultrafast X-rays for advanced analysis” with international visibility. |

### First steps that can be taken today

**Instructions**: Describe the first concrete steps needed to move in this direction that can be taken today. These should be clear enough that they can be followed up on in a year to see what progress has been made. Identify initial activities that can be started locally to enable progress to help motivate further support for the larger goal. In the exceptional case where no steps can be taken today, explain why a Priority has been chosen that cannot be started.

Motivation: To ensure that there is a clear idea of how to get started and enable easy follow-up of how the Priority is progressing.

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| Coordination of joint new projects within existing collaborations, submission of grant applications for ex-ternal funding: Wernet, Borbas, Ott, Lundberg, Högbohm (Stockholm University) submitted an application for a Wallenberg grant. Use the Biophysics network with their graduate students as a grad-school nucleus. |

# Questions to the panel

The panel will provide feedback on research quality, strengths and opportunities for improvement, and comment and give feedback on staffing, funding, and at least one priority area.

**Instructions**: If you have specific questions for the panel that are not covered by those areas, please list up to three of them here. Please note that due to time constraints during the visit, not all questions may be answered.

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