



DELIVERABLE REPORT D3.3

DELIVERABLE

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	Universität Stuttgart		Germany
	CIC nanoGUNE		Spain
	Thomas Keating Ltd.		United Kingdom

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SUMMARY

Work Task 3.2 “CDE activities” of the Work-Package 3 “Management, communication, dissemination, and exploitation” as described in the PETER Description of Actions aims at increasing the impact of the project through the wide dissemination of project outcomes and maximizing the project exploitation perspectives. The general objective of the Work task is defined as:

To communicate the project outcomes to targeted audience, and to ensure the efficient exploitation of the project results.

The present PETER Interim Communication, Dissemination and Exploitation Plan (ICDEP) drafted at M4, lists all planned dissemination and communication activities, tools and channels and matches them with target audience categories and key performance indicators as well as partners’ preliminary intentions in terms of exploitation plans. This Plan will be a reference framework for evaluating the impact of dissemination activities on a yearly basis and will be updated and adjusted during the duration of the project whenever needed.

Revision update (2. 10. 2019)

The requested overview of dissemination activities in the first interim period has been added as an annex 3 of this document.

Additionally, we have added a section dedicated to Open Education to the project website, as well as a section dedicated to share the scientific output of the project – published manuscripts and the corresponding Open Datasets; abstracts and posters from conferences and Master theses dedicated to the project.

LIST OF ABBREVIATIONS

BUT	Brno University of Technology
CDE	Communication, Dissemination and Exploitation
ECR	Early Career Researcher
EPR	Electron Paramagnetic Resonance
ER	Experienced Researcher
ICDEP	Interim Communication, Dissemination and Exploitation Plan
KPI	Key Performance Indicator
NGU	CIC nanoGUNE
PE	Plasmon Enhanced
PR	Public Relations
SMEs	Small and Medium Enterprises
THz	Terahertz
TK	Thomas Keating Ltd.

1. INTRODUCTION

Dissemination activities, maintenance of public relations and marketing activities are very important means for maximising the impact of the project. Hereby we present the Interim Communication, Dissemination and Exploitation Plan (ICDEP), which is based on the preliminary CDE plan outlined in the project proposal and which will be further adjusted and supported by the Data Management Plan (M6), the Interim Project Report (M24), Final CDE Plan and complementary Open Research Data Pilot (both M36).

ICDEP was developed to fully acquaint potential users with the project outcomes. The plan lists particular measures to be implemented both during and after the project to ensure sustainable dissemination and exploitation of the project results and findings exceeding beyond the circle of involved project partners. CDE activities are tailored to address full range of potential uses including research, industry, policy making, and educational training. Special attention is paid to inform about and popularize science scopes explicitly covered by the project, such as EPR, scanning microscopy methods, plasmonics and terahertz technology.

The effectivity of ICDEP will be evaluated on yearly basis using quantitative key performance indicators defined in the plan.

2. COMMUNICATION, DISSEMINATION AND EXPLOITATION STRATEGY

2.1 Specific objectives of the CDE activities of the PETER project

Beyond specific impacts pertaining to the instrumental characteristics of the developed prototype, the CDE activities of the PETER project deal specifically with the dissemination and communication of the wider-ranging consequences of this work, aimed at the following objectives:

- informing and spreading awareness about EPR spectroscopy transformation from a niche technique into one ubiquitously present in science and society,
- dissemination of the potential of THz EPR spectroscopy to revolutionise other areas where plasmonics and imaging are combined,
- promoting utilisation of the THz EPR spectroscopy in areas in which it hasn't a significant impact yet,
- bringing together the fledgling community of EPR imaging, creating its own research field,
- through exploitation of the project results, stimulating further growth of the THz-related industry
- communication of the significant impact of the project results on society, namely in the areas of energy harvesting and storage, medicine and healthcare.

2.2 CDE target audiences

The PETER project results shall reach for following main target audiences:

- scientific community,
- industry,
- general public.

2.3 Dissemination activities employed with specific target audiences

2.3.1. Dissemination to the scientific community

The prime means for dissemination to the scientific community will be the presentation of results by participation in judiciously chosen **conferences**, including invited talks, oral and poster presentations. The project results will be actively presented in order to realise the transformative impact on other scientific communities (i.e. biophysics, battery and solar cell research).

The involvement of project partners in various EU-and worldwide **networks** (e.g. COST CA15128 MOLSpin) will be used as a channel to spread awareness of the scientific results of this project via conferences, workshops and early career investigator mobility.

The project partners aim to disseminate the various results of this project via **publications** in premier peer-reviewed scientific journals. The quantifiable key performance indicators are given in Table 1.

The scientific results of this project, including raw data gathered as part of the first scientific studies employing the developed prototype, will be made available to the public according to guidelines set by the Data Management Plan (D3.4, M6) and Open Research Data Pilot (D3.10, M36).

Summer school organised for early career researchers (ECRs) and dedicated **workshops** for the scientific community and industrial partners present the opportunity to disseminate results to a wide portion of emerging scientific community and to create a network vital for achieving of the major scientific and technological impact in the future.

A direct outcome of the involvement of ECRs with this project and a valuable additional dissemination tool will be the successfully completed **PhD theses** on themes pertaining the project scopes and containing the theoretical and experimental project results.

Tab. 1 – Key Performance Indicators for dissemination to scientific community

DISSEMINATION CHANNEL	KPI	AIM
Conferences	Number of presentations	≥6
Papers on the use of plasmonics in EPR	Number of papers	≥2
Papers on the applications of PE THz EPR spectroscopy	Number of papers	≥3
Papers on operational principles of PE THz EPR microscopy	Number of papers	≥2
Papers on the applications of PE THz EPR microscopy	Number of papers	≥3
Workshops for scientific community I and II (M18, M36)	Number of participants	≥30/workshop
Summer school (M10)	Number of participants	≥60
PhD theses of the ECRs involved with the project	Number of theses	≥8

2.3.2. Dissemination to industry

Dissemination to industry will be centred around four main dissemination activities:

(i) Direct dissemination to the representatives of relevant industries (THz sources, detectors, EPR instruments, battery and solar cells producers etc.) on scientific **conferences**. This activity will be aimed at networking, strengthening of contacts and maximising the future commercial impact of the developed prototype.

(ii) Organisation of the **Workshop for industrial partners** (M32) on the theme of EPR microscopy, focused on the dissemination to SMEs.

(iii) Involvement in major **industrial fairs** (e.g. Hannover Messe, International Engineering Fair in Brno etc.) in order to demonstrate the developed prototype.

(iv) Local dissemination via **Business Detection Systems** that serve to create awareness among local SMEs of the expertise and capabilities available within the project consortium.

Tab. 2 – Key Performance Indicators for dissemination to industry

DISSEMINATION CHANNEL	KPI	AIM
Direct networking on conferences	Number of contacts	≥10
Workshop for industrial partners (M32)	Number of participants	≥10 SME representatives
Industrial fairs	Number of participations	≥1
Business Detection Systems	Number of systems involved	≥3

2.3.3. Dissemination to general public

(i) General activities

General public dissemination activities include the maintaining of a dedicated project **website** as well as accounts and groups on **social media platforms** (Twitter, Facebook, ResearchGate). These dissemination tools are described in detail in the PETER Visual Identity Report (D3.1). Furthermore, the project will be actively disseminated on **popularisation events** such as Open Days, Researchers' Night, and so on.

(ii) Specific activities

Selected results of the project will be disseminated via **press releases**, ensuing **newspaper articles** and **radio/TV shows**.

Tab. 3 – Key Performance Indicators for dissemination to general public

DISSEMINATION CHANNEL	KPI	AIM
Website and social media	Number of hits/likes/shares	N/A
Events	Number of visitors	≥100/event
Press release	Number of ensuing articles	≥1 per a release
Media coverage	Number of viewers	N/A

2.4 Dissemination tools

2.4.1 Online tools

The online tools for dissemination of the project results include project website and social media platforms, as described in the D3.1.

2.4.2 Printed tools

The physical dissemination material created for targeting mainly the general public include a brochure, poster and roll-up (see Annex 1). These tools can be used on popularisation events to spread awareness and provide basic information about the project.

Further dissemination material (e.g. flyers, specific event brochure etc.) will be created during the implementation of the project as needed.

2.5 Communication

Whereas dissemination as a process is defined as the spreading of knowledge and awareness without direct response from the target audience, communication is a two-way process. Thus, in part the dissemination activities described above will also serve as communication devices, for example:

- Interaction of the public with the presenter at a poster session
- Comments or likes on social media posts
- Discussion sessions of conferences and workshops
- Contact form on the project website

2.5.1 Communication with the EU

The main communication tool with the EU concerning the project implementation and results are the project reports (deliverables) and the Participant Portal, which serves as a contact interface with the appointed Project Officer. For the consortium, the Coordinator and the Project Manager are in charge of the communication with the EU.

2.5.2 Communication within the project community

(i) Meetings

A **kick-off meeting** was organised in M1 in order to consolidate the project team, review project schedule and milestones to be met, and set up the management structure.

Further **progress steering meetings** will be organised yearly (M12, M24) followed with a **final steering meeting** (M36) to assess the project progress.

(ii) E-mail and teleconferences

Day-to-day matters within the project consortium are communicated via e-mail. In need of discussion in time-sensitive matters where a meeting in person cannot be organised, a teleconference can take place.

(iii) Intranet section of the website and cloud-based document repository

These tools allow the communication within the project consortium as well as between the management and involved researchers. The document repository contains confidential material, such as presentations and meeting minutes from Steering meetings. Password-protected contents are made accessible to the authorised persons (e.g. Project Officer). The data storage management is further described in the Data Management Plan (D3.4).

2.6 Exploitation of results

The direct goal of PETER project is the development of an operating setup (proof-of-concept) of the PE THz EPR microscope. Dependent on the results (performance, reliability, user-friendliness etc.) a design of the setup can be improved towards a prototype. Typically, such instruments are individually adapted to the customer's needs. University of Stuttgart will be in charge of future development of the prototype.

Thomas Keating Ltd. as a member of the consortium will use their expertise in handling the **direct commercialisation** of the instrument (evaluation of the market potential, finding potential customers etc.). TK staff connected with PETER have this as a specific objective.

Due to the high complexity of the developed microscope (low-temperature THz near-field microscope) coupled with the use of unprecedented technology (special probes and concepts), the commercialisation is expected to come to fruition well after the end of the project.

A strong possibility is the formations of a **spin-off company** by one of the project employees, aided by local structures specialising in founding and supporting commercial exploitation of scientific results in general (e.g. Technologie Transfer Initiative GmbH, South Moravian Innovation Centre). This, too, is expected to potentially happen after the end of the project.

Both the use of plasmonics in THz EPR and the PE THz EPR microscope are expected to be protected by **patent**, if patent protection-worthy results are obtained by the end of the project.

For the duration of the project, the KPIs for exploitation cannot be reasonably estimated and will not be observed during the implementation of the project.

2.6.1 Knowledge management and protection

The IPR resulting from this project will be protected by patents and shared equally between the consortium members.

The IPR strategy of the project consortium follows the rules adopted by the European Commission, the best practice of IPR protection published by the EC and the internal rules of all the partners involved in the consortium.

The Consortium Agreement containing clauses codifying IPR issues, background and Non-disclosure agreement (NDA) has been signed.

2.6.2 Exploitation measures to be implemented after the end of the project

Consortium of the members shall be among the first users of the developed technique and PE THz EPR scanning microscope. As those they will steadily communicate its advantageous performance as a part of their research or development work.

The spread of the PE THz EPR spectroscopy and microscopy techniques to other laboratories is expected after the end of the project, and it will be monitored by the relevant publications from these laboratories.

The achievements of the project will be reflected in the education programmes of the university-type consortium members (Brno University of Technology; University of Stuttgart) and a number of related student positions (B.Sc., M.Sc., Ph.D.) shall be available.

Thomas Keating Ltd. will pursue the market opportunities both outlined in the proposal and revealed during the works on the project. Organizing of further professional meetings will be considered based on the evaluation of their need.

3. MANAGEMENT OF THE CDE ACTIVITIES

During the implementation phase of the project, the leader of the WP3 is responsible for dissemination activities described in this ICDEP. Within the WP3, the task 3.2 is directly dedicated to Dissemination, Communication, and Exploitation Activities. The Heads of PR and Marketing departments of project partners will collaborate on continual updating of the CDEP, reporting on the Dissemination Progress and on realization of the planned actions. In general, following principles will be observed:

- The project partners will always be asked to give their formal approval for dissemination activities containing or affecting their know-how and they have the right to refuse any dissemination activity which could potentially harm their interests.
- All the partners will be given prior notice before any dissemination activity concerning the project results, according to EC guidelines.
- The EC support will be acknowledged regarding all the project outcomes as requested by EC guidelines and given rules (for specification, see Visual Identity Report, D3.1).
The dissemination rules are part of the Consortium Agreement.

4. CONCLUSIONS

This project will initiate a radically new line of technology, based on combining the specificity and spectral resolution of electron paramagnetic resonance with the spatial resolution of scanning probe techniques. The novel scientific underpinning is represented by the unprecedented use of plasmonic technology in electron paramagnetic resonance. This will increase the detection sensitivity by four orders of magnitude. The main outcome of this project is a working prototype of a plasmon-enhanced terahertz electron paramagnetic resonance microscope (PE THz EPR microscope).

Therefore, the project has a dedicated work task for dissemination, communication and exploitation in order to ensure the project knowledge transfer to the scientific community, industry and general public. The Communication, Dissemination and Exploitation plan as presented here will be regularly updated according to the current project's needs, and is complemented by other deliverables of the PETER project – the Visual Identity Report (D3.1), the Data Management Plan (D3.4) and the Open Research Data Pilot (D3.10).



PLASMON ENHANCED TERAHERTZ ELECTRON PARAMAGNETIC RESONANCE

Horizon 2020 project FET OPEN

Project Outcomes

- » Establishing a **brand novel** terahertz-frequency EPRmicro-spectroscopic **technique** based on a combination of **plasmonic-based magnetic field enhancement** and **scanning probe microscopy**.
- » **Developed THz EPR micro-spectroscope** will offer unprecedented **sensitivity** (several orders higher than conventional EPR instruments) and **spatial resolution below 1 μm** (approx. 1/300th of used wavelength).

Why all the fuss?

If successful, PE THz EPR micro-spectroscopy will mean a revolution in the field of EPR by opening new possibilities to in-situ study of wide variety of materials for scientific, technological and medical purposes.



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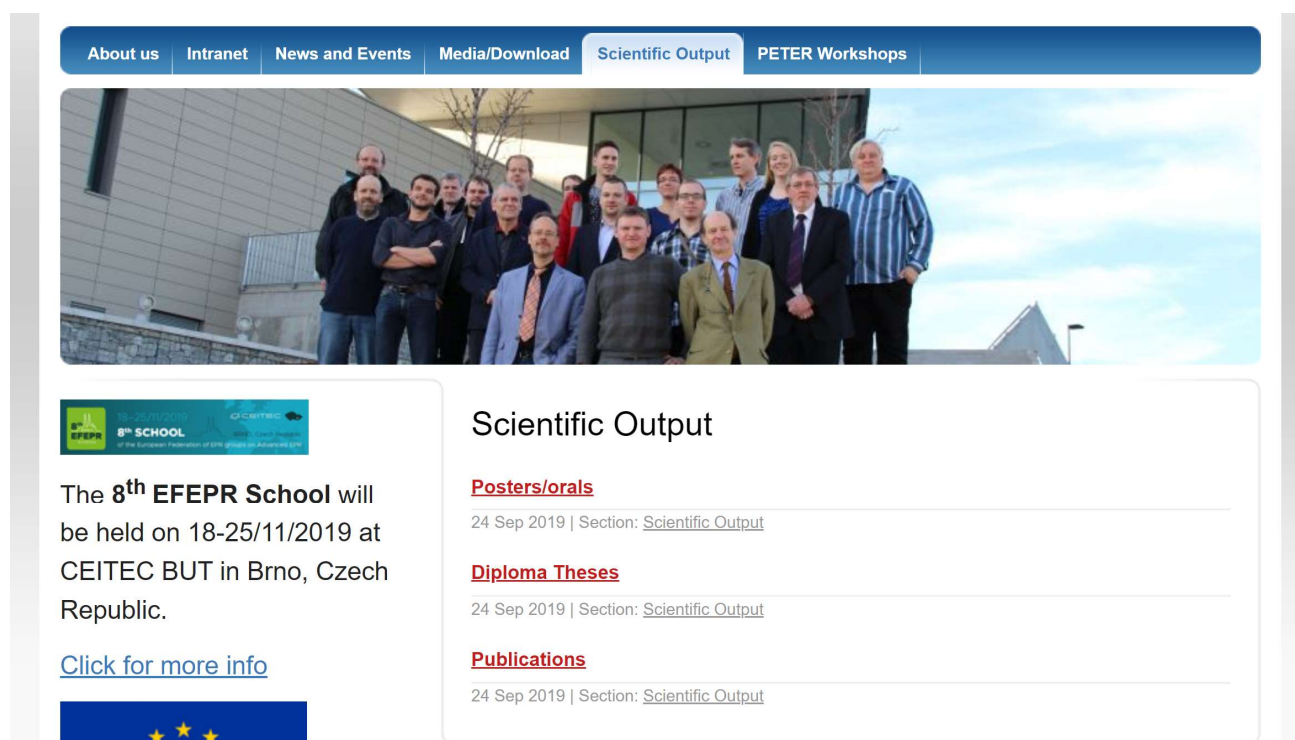
This project has received funding from the European Union's Research and Innovation programme Horizon 2020 under Grant Agreement No. 767227.

ANNEX 2 – Open Education at the project website

Following the requests raised at the First Interim Review Meeting (25. 3. 2019), we have established an open education section at the project website <https://www.peter-instruments.eu/inpage/peter-education/>.

It contains educational materials for students, researchers and interested public created in relation to the PETER project, and also includes scientific talks on various topics related to EPR, THz and plasmonics, given at the PETER project organised workshops.

Following the principles of the Open Access, we also share the scientific output from the project - <https://www.peter-instruments.eu/section/scientific-output/>. The sections on the project website include Project related Diploma Theses; Abstracts and Posters from conferences where PETER results have been disseminated; and a comprehensive overview of project related papers, including abstracts and links to open access depository for both the full-text versions and the ORDP datasets.



The screenshot shows the 'Scientific Output' section of the PETER project website. The navigation bar includes 'About us', 'Intranet', 'News and Events', 'Media/Download', 'Scientific Output', and 'PETER Workshops'. Below the navigation bar is a large group photo of project members. The main content area is titled 'Scientific Output' and lists three categories: 'Posters/orals', 'Diploma Theses', and 'Publications', each with a date and a link to the 'Scientific Output' section. A sidebar on the left contains a banner for the '8th EFEP School' and a link for more information.

Figure 1: Screenshot of the Scientific Output section of the PETER project website

ANNEX 3 – List of dissemination activities

Below are listed the CDE activities realised during the first interim project period – from the project start on 1. 1. 2018 to the revised submission date of this report.



date	activity	audience type	No of persons reached	Link to the event website	person	Details
29. 1. 2018	Kick-Off	Students, policy makers, media	40 present	https://www.peter-instruments.eu/inpage/kick-off-meeting/	All consortium partners	PETER introduction (available on https://www.peter-instruments.eu/inpage/peter-education/)
30. 1. 2018	Seminar presentation	Researchers, administrative workers	25	https://www.conbri.com/event/eic-pilot	Jiří Spousta (BUT)	Sharing experience with FET proposal preparation
9. 3. 2018	Press conference	Media, policy makers		Days of Electron Microscopy Brno 2018	Jiří Spousta (BUT)	Launch of DEM
17. 3. 2018	Open Day CEITEC	General public	150	Days of Electron Microscopy Brno 2018	PETER BUT team	https://www.peter-instruments.eu/inpage/electron-microscopy-days-in-brno/
23. 3. 2018	Open Day FME BUT	Students (secondary education)	55	Days of Electron Microscopy Brno 2018	BUT team	Lab excursions, general project introduction
6 – 9. 5. 2018	poster	academic	100	6 th EOS Topical Meeting on Terahertz Science & Technology http://www.old.myeos.org/events/tst2018	C.M. Maissen (NGU)	Synthetic optical holography for phase resolved terahertz nanoimaging at sub-50 nm resolution
11. 5. 2018	event	General public	200	Science party Brno https://www.facebook.com/events/935413809956706	BUT team	Workshops, demonstrations
17-19. 5. 2018	workshop	Researchers / industry	75 / 20	BigMag workshop, USBC http://bigmag.ucsb.edu/	Richard Wylde (TK)	Discussions, networking
30. 6. 2018	Open Day USTUTT	General public	70	Tag der Wissenschaft	USTUTT team	Communication, poster, etc.

8 – 13. 7. 2018	Poster	Academia / industry	150 / 10	Plasmonics and Nanophotonics (GRS) https://www.grc.org/plasmonics-and-nanophotonics-grs-conference/2018/	Curdin Maissen (NGU)	Phonon-polariton based nanosplit ring resonators
23 – 27. 7. 2018	poster	academia	100	ICN+T Brno 2018 http://www.icnt2018.org/	Michal Kvapil (BUT)	Spontaneous silicon substrate oxidation after FIB milling probed by mid-infrared plasmonic antennas
	oral				Vlastimil Křápek (BUT)	Babinet's principle for disc-shaped plasmonic antennas
	poster				Shu Chen (NGU)	Acoustic graphene plasmon nanoresonators for field enhanced infrared molecular spectroscopy
26 – 31. 8. 2018	posters	Academia / industry	150 / 10	The 15 th International Conference on Near-Field Optics, Nanophotonics and Related Techniques http://nfo15.utt.fr/	D. Madhi (NGU)	Synthetic THz nanoholography for imaging CVD Graphene
					C. Maissen (NGU)	Phonon-polariton based nanosplit ring resonator
					S. Mastel	Resonant THz near-field probes
					A. Govyadinov (NGU)	Probing low-energy hyperbolic polaritons in van der Waals crystals with an electron microscope
2 – 5. 9. 2018	conference	Academia / industry / potential customers	150 / 20 / 8	HYP18: An international conference on Hyperpolarized Magnetic Resonance https://www.ocs.soton.ac.uk/index.php/hyp/hyp18	Alisa Leavesley, Kevin Pike (TK)	Discussions, networking with partners and potential customers
2 – 7. 9. 2018	poster	Academia	300	Joint European Magnetic Symposia https://jems2018.org	Michal Kern, USTUTT	Integration of molecular quantum bits with semiconductor spintronics
10 – 13. 9. 2018	oral	academia	100	40 th Conference of the Fachgruppe Magnetische Resonanz of the German chemical society	J. van Slageren (USTUTT)	Improving the sensitivity of THz frequency domain magnetic resonance
26. 9. 2018	event	Industry / general public	150 / 10	Wissenswert! Presentation Vector GmbH	USTUTT	Project presentation (poster)

3 – 5. 10. 2018	Summer school	academia	93	PETER Summer School https://www.peter-instruments.eu/inpage/summer-school/	BUT, USTUTT, NGU, TK	Lectures, poster session, networking
5. 10. 2018	Event (Open Day)	General public	750	Brno Researchers' Night 2018 https://www.peter-instruments.eu/inpage/researchers-night-brno-2018/	BUT team	Lab tours, demonstrations
20 – 26. 10. 2018	poster	academia	150	European Conference on Molecular Spintronics 2018 http://icmol.es/ecmols2018/	M. Kern (USTUTT)	Integration of molecular quantum bits with semiconductor spintronics
14. 11. 2018	Seminar lecture	academia	15	Frankfurt Goethe University (Germany)	P. Neugebauer (BUT)	Our recent progress in HFEPR spectroscopy
28. 11. 2018	Seminar lecture	academia	25	University Pardubice (CZ)	P. Neugebauer	High Frequency Electron Spin Resonance Spectroscopy Today and Tomorrow
28. 11. 2018	Seminar lecture	academia	8	New York Einstein College of Medicine (USA)	P. Neugebauer	Our recent progress in HFEPR spectroscopy
2019						
10. 2. 1029	Seminar lecture	academia	15	Casablanca École Centrale (Morocco)	P. Neugebauer	High Frequency Electron Spin Resonance Spectroscopy
9. 3. 2019	Event (open day)	General public	50	Days of Electron Microscopy Brno 2019	BUT team	Lab excursions, demonstrations
31. 3. – 5. 4. 2019	oral	academia	100	DPG 19 (DPG-Frühjahrstagung der Sektion Kondensierte Materie, 2019) https://regensburg19.dpg-tagungen.de/	V. Křápek (BUT)	Electric, magnetic, and electromagnetic hot spots
23 – 31. 5. 2019	poster	academia	100	SPP9 (Copenhagen, Denmark)	Shu Chen (NGU)	Antenna tips for sub-15nm resolving THz nanoscopy
1 – 8. 6. 2019	Invited lecture	academia	50	<u>International Summit on OPTICS, PHOTONICS AND LASER TECHNOLOGIES</u> ; San Francisco	T. Šikola (BUT)	Quantitative Phase Imaging of Fields Shaped by Plasmonic Metasurfaces
13. – 17. 6. 2019	Invited lecture	academia	50	<u>9th International Multidisciplinary Conference on Optofluidics</u> ; Hong-Kong	T. Šikola (BUT)	High resolution quantitative phase imaging
23. 6. 2019	Seminar lecture	academia	35	Krakow Jagiellonian University (Poland)	P. Neugebauer	High Frequency Electron Spin Resonance Spectroscopy Today and Tomorrow: Our Recent Progress in HFEPR Spectroscopy
20 – 27. 7. 2019	Invited lecture	academia	100	<u>International Congress on Advanced Materials, Sciences and Engineering</u> , Japan	T. Šikola, J. Spousta (BUT)	Mid-IR Plasmonic Antennas on Absorbing Substrates: Optimization of

						Localised Plasmon-Enhanced Absorption upon Strong Coupling Effect
7/2019	Seminar lecture	academia	30	University of California Santa Barbara (US)	P. Neugebauer	High Frequency Electron Spin Resonance Spectroscopy Today and Tomorrow, Our Recent Progress in HFEPR Spectroscopy
16. 7. 2019	Seminar lecture	Academia	30	University of California Santa Barbara (US)	A. Leavesley (TK)	HF EPR and the PETER project
20 – 24. 7. 2019	Lecture	academia	100	60th Annual Rocky Mountain Conference on Magnetic Resonance https://rockychem.com/	P. Neugebauer	Multi-Frequency Rapid-Scan HFEPR Spectroscopy
20 - 22. 8. 2019	Conference	Academia/industry	150	<u>12th UK/Europe China Workshop on millimetre waves and Terahertz technologies</u>	A. Leavesley, K. Pike, R. Wylde (TK)	Discussions, networking with partners and potential customers
1 – 5. 9. 2019	Lecture	academia	100	11 th EFEPR conference, Bratislava (SK) https://efepr2019.conference.fchpt.stuba.sk/	P. Neugebauer	Contactless millimeter wave method for quality assessment of large area graphene
1 – 6. 9. 2019	Conference	Academia/industry	800	44th International Conference on Infrared, Millimeter, and Terahertz Waves http://www.irmmw-thz2019.org/	R. Wylde (TK)	Discussions, networking with partners and potential customers
15. – 18. 9. 2019	poster	academia	250	7th European Conference on Molecular Magnetism, Florence, Italy http://www.ecmm2019.org/	J. Čechal (BUT)	Deposition of molecular magnets by atomic layer injection
24 – 26. 9. 2019	Conference	Academia/industry	1500	UK Space Conference, ICC Wales https://www.ukspace2019.co.uk/ehome/200183909/whatson/	K. Pike, R. Wylde (TK)	Discussions, networking with partners and potential customers
27. 9. 2019	Event (Open Day)	General public	600	Brno Researchers' Night 2019 https://www.peter-instruments.eu/inpage/researchers-night-brno-2019/	BUT team	Lab tours, demonstrations