Programme title: Super-intense laser-matter interactions

Programme acronym: SILMI

Acronym of the Standing Committee: PESC

Name and full coordinates of principal applicants:

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Keywords: Super-intense-lasers, Attophysics, Multiphoton processes,
Laser-plasma interactions

Abstract:
The availability of super-intense laser pulses and the planned development of new large-scale and medium-size facilities dedicated to the generation of laser light with unprecedented capabilities calls for a vigorous effort to study laser-matter interactions in the ultra-high intensity regime. Europe is at the forefront of the scientific and technological advances in this fast-growing and highly competitive domain at the frontier of Physics, thanks to its strong commitment in the implementation of new sources of super-intense laser radiation. Foremost among the projects relevant to this field are ELI (Extreme Light Infrastructure), HiPER (High Power laser Energy Research facility) and FLASH (Free-electron LASer in Hamburg). Other medium-size facilities delivering intense and ultra-short (femtosecond) pulses of infra-red coherent radiation, which are grouped in the Laserlab-Europe consortium, are also available. In addition, Europe plays a leading role in the development of sources of high-order harmonics, which deliver pulses of ultra-violet radiation with durations in the attosecond range. This proposal requests support for a combined effort of leading European research groups to investigate fundamental processes and applications in super-intense laser-matter interactions, ranging from ultra-fast phenomena on the attosecond scale to ultra-strong interactions of matter with petawatt pulses. The SILMI network represents an invaluable opportunity to allow European scientists to discuss new trends in the field, encompassing theory, experiments and applications. The network will orient research efforts, coordinate their implementation and promote the transfer of knowledge between the participating groups. It will also allow young European scientists to broaden their training and increase their professional skills by interacting with first-rank scientists in an international environment and in a rapidly expanding ara of science and technology.

Previous or other applications: C.J.Joachain and D. Batani submitted a proposal for an ESF-PESC network (Acronym: FEMTO) which was launched in January 1999 and ended in March 2004, and for a COST Action (Acronym: ULTRA) which was launched in June 2004 and will end in June 2008.

Status of the relevant research, scientific context, objectives and envisaged achievements

The aim of this progamme is to study the highly non-linear response of matter interacting with ultra intense pulses of laser radiation. Although several European research programmes related to similar topics have been successfully brought to completion in the past, the scientific context has significantly changed as a result of the recent development of new facilities delivering laser pulses with unprecended characteristics, in two complementary directions: (i) infra-red and optical pulses of higher repetition rates (beyond the kHz), with shorter durations (down to a few optical cycles) and/or higher peak intensities (up to 10^{21} W); and (ii) extreme ultra-violet and soft X-ray pulses generated by accelerator-based free-electron-lasers (FEL) and laser-pumped high-order harrmonic sources, which can generate trains of attosecond (10^{-18} s) pulses.

Current research efforts are mostly dedicated to the development and the implementation of a new generation of experiments made possible with the new sources of super-intense laser radiation. In parallel, theoretical methods are under development in order to interpret the experimental results and to guide future investigations. The potential applications of this research are enormous, not only in physics, but also in chemistry, biology, medicine, material science and in the fast ignition approach to inertial confinement fusion.

This programme is based on two mutually interlocking working groups. The first one will investigate the physics of atoms, molecules and clusters interacting with super-intense laser pulses, i.e., the physics of super-intense laser-matter interactions at the microscopic level. The second group will investigate the problem at the macroscopic level, i.e., it will study the interaction of super-intense laser radiation with solids and plasmas.

i) Super-intense laser-matter interactions at the microscopic level

Since the first evidence of multiphoton absorption by atoms in the late 1960s, the study of the interaction of atoms, molecules and clusters with high-intensity laser radiation has attracted a steadily growing interest in the Atomic, Molecular and Optical Physics community. Milestones in the development of the field were the discoveries of new effects and of new experimental methods, most of them not anticipated at the time. A non exhaustive list includes:

- the so-called above-threshold ionization (ATI) of atoms;
- the related phenomena in molecules and clusters of above-threshold dissociation and ionization and of Coulomb explosion;
- the evidence for non-sequential multiple ionization dominated by electron correlations;
- the advent of a new generation of sources of coherent XUV and soft x-ray radiation, based on the process of high-order harmonics generation;
- the production of attosecond pulses of XUV and soft x-ray radiation;
- the possibility to image molecular orbitals.

These discoveries were made possible by the spectacular advances in laser technology, due to the implementation of the Chirped Pulse Amplification (CPA) technique, which have permitted to concentrate the energy output of a laser system in pulses as short as a few femtoseconds (10^{-15} s). The parallel improvement of the detection devices designed to analyse the energy spectra and the angular distributions of the fragments, such as magnetic bottles and time-of flight spectrometers, COLTRIMS (Cold Target Recoil Ion Momentum Spectroscopy), velocity map imaging and related techniques, has dramatically improved the resolution and the dynamical range in the collection of the experimental data.

This impressive progress has motivated strong efforts in the theory of laser-atom interactions, with the aim to develop new conceptual and computational tools designed to describe the time-dependent response of quantum systems in the presence of pulses of radiation, with peak electric field strengths comparable to or even larger than the characteristic atomic unit $E_0 = 5.1 \times 10^9$ V cm^{-1}. In such extreme conditions, there was an obvious need for the development of theoretical approaches going beyond the standard "Fermi's golden rule" deduced from a perturbative treatment. Profound insights into the dynamics were achieved through the development of new conceptual tools such as the Floquet and R-matrix-Floquet approaches and methods based on the so-called strong-field approximation. The latter incorporates the tunnelling ionization mechanism and the semi-classical re-collision model that accounts for high-order harmonic generation, high-order above-threshold ionization and multiple ionization. In parallel, together with the advances in the performances of the available computers, powerful numerical codes designed to solve the time-dependent Schrödinger equation have been implemented. Nowadays, very efficient codes are available for single-active electron systems and methods for tackling systems with multiple-active electrons have been designed and implemented.

In all these areas (experiments and theory), European groups are at the forefront of the research in the field. A major objective of this programme is to maintain this position in the future, in direct relation with the development of the new sources of radiation generating super-intense and ultra-short pulses.

ii) Super-intense laser-matter interactions at the macroscopic level

At laser intensities above 10^{16} W cm^{-2}, the laser-plasma interaction is governed by the collective response of the free electron gas , the key quantity being the plasma angular frequency ω_p which is proportional to $(n_e / m_e)^{1/2}$, where n_e is the electron density and m_e is the electron mass. Typically, in the intensity range 10^{16}-10^{18} W cm^{-2}, optical light with angular frequency ω can still propagate in gas targets with $\omega_p < \omega$, while it is reflected from solid surfaces with $\omega_p > \omega$. For laser intensities 10^{18}-10^{20} W cm^{-2}, now available in many laboratories, the electron motion in the laser focus becomes relativistic, and the interaction changes drastically. This is due to the fact that ω_p now depends on the laser field intensity through the relativistic change of electron mass, giving rise to relativistic non-linear optics, and the Lorentz force turns the transverse electron motion into motion along the laser field propagation direction, thus generating huge currents and magnetic fields.

The relativistic interaction with dense matter turns out to be a highly non-linear multi-particle multiphoton problem that cannot be treated by traditional optical and plasma perturbation theory but requires full kinetic treatment. Simulations based on the Particle-in-Cell (PIC) method have been most fruitful in mapping out the new asymptotic features. Most spectacular results are the generation of ultra-bright highly collimated beams (relativistic electrons, ions, X-rays, and a host of secondary nuclear beams) and very efficient generation of high harmonics from solid surfaces, which may open a new route to attosecond physics. The recent highlights in this respect have been the demonstration of intense GeV electron beams generated by table-top lasers and the demonstration of high laser harmonics far into the keV regime generated from steep overdense plasma surfaces.

While dense matter is typically electrically neutral, the light pressure of these ultra-intense laser pulses can separate electrons from ions completely, at least over spatial distances of order c/ω_p , thus generating huge space charge fields in which charged particles are accelerated. In simple gas targets, this may lead to the “bubble” regime, in which an electron-void volume trailing a short laser pulse self-traps electrons and accelerates them to hundreds of MeV. Corresponding electron pulses are now observed by many groups. Guiding the laser pulse in capillaries, thus extending the acceleration distance, has led to the production of GeV electrons. At solid interfaces, the space charge fields accelerate ions to multi-MeV energies. These beams have been observed with remarkably low emittance, and much of the current discussion concentrates on how to make mono-energetic ion pulses. Recent theoretical work shows that ultra-thin foils and clusters can be accelerated as a whole close to the velocity of light, with pushed electrons dragging all ions.

Complementary to electron-void regions, one finds dense electron fronts moving with high relativistic velocities. These fronts may backscatter optical photons and convert them into X-rays. At steep surfaces, oscillating relativistic mirrors compress incident laser light into attosecond flashes, corresponding to high harmonic spectra. It looks feasible to even focus these flashes, thereby reaching intensities close to the Schwinger limit for pair production from the vacuum. It is the first time that we have a realistic option to achieve electric fields of the order of 10^{16} V cm^{-1} at which light significantly disturbs the vacuum. We include theoretical work on QED of multiphoton multi-virtual-electron physics in this proposal.

These developments will have important applications, in particular because they will lead to compact, ultra-bright radiation sources for medical and many other applications. Another prominent application is fast ignition of compressed inertial confinement fusion (ICF) fuel. Fast ignition is presently a most innovative route to ICF and in the focus of the HiPER project.

There is a plethora of fascinating new horizons opening up by the emerging availability of ultrashort, ultrahigh-field laser pulses. Making these options real requires first of all the development of high-power, high-contrast femtosecond laser technology. OPCPA is a central technique to be further developed.

Facilities and expertise accessible to the Programme

In recent years, a great number of experimental and theoretical advances have been made in the field of super-intense laser-matter physics. European researchers have played a leading role in these achievements. The most important of these have been:

- the development of new laser systems, delivering ultra-short pulses, high-frequency pulses and ultra-intense pulses;
- the generation of pulses in the attosecond range, opening the new domain of attosecond and Angstrom science;
- the acceleration of electrons and protons in laser-plasma interactions;
- the progress in the fast ignitor approach to inertial confinement fusion;
- the development of theoretical methods to interpret the experimental data and design new experiments in multiphoton physics and laser-plasma interactions.

The members of this programme can have access to the facilities belonging to the Laserlab-Europe consortium, i.e., currently, in the Czech Republic, PALS (Prague); in France, LOA (Palaiseau), LULI (Palaiseau), SLIC (CEA Saclay) and CESTA (CEA Le Barp); in Germany, MBI (Berlin), FSU-IOQ (Jena), and GSI (Darmstadt); in Greece, ULF-FORTH (Heraklion); in Italy, LENS (Firenze), CUSBO (Milano); in Lithuania, VULRC (Vilnius); in the Netherlands, LCVU (Amsterdam); in Sweden, LLC (Lund); and in the United Kingdom, CLF (Rutherford Appleton Laboratory).

In addition, new major facilities devoted to the study of super-intense laser-matter interaction have been approved by the European Union authorities. These are XFEL FLASH (Germany), HiPER (UK), and, for the preparatory phase, ELI (France). The researchers involved in this programme will play an important role in the development of these new facilities.

The SILMI programme will also develop existing collaborations and create new links between the leading European research groups in the field of super-intense laser-matter physics. These include the experimental and theoretical groups working at the above-mentioned facilities as well as groups working at other institutions. A list of the researchers and research groups foreseen to participate in the programme is given in Appendix 3.

Expected benefit from European collaboration

The study of the interaction of matter with super-intense, ultra-short and high frequency laser pulses is an important new and rapidly expanding branch of physics, where European scientists have made leading contributions in recent years. The potential applications of this research in physics, as well as in chemistry, biology and materials science are enormous.

The present programme, involving the leading European experimental and theoretical group in this field will further develop the existing collaborations between these groups, create new links and provide expertise for the new European projects (ELI, HiPER and FLASH) under development. It will contribute to maintaining the leadership of Europe in this field.

The close collaboration between the groups in this programme builds upon long-standing research links, fully developed since 1999 within the ESF-PESC "FEMTO" programme (1999-2004) and the COST P14 Action “ULTRA” (2004-2008). The ESF funding will be invaluable in allowing young researchers and research groups to participate in the development of this fast developing scientific domain. It will ensure that research expertise and human resources will increase in Europe in a field of vital importance to many areas of science and technology.

European context

The SILMI network can build on the synergy already achieved by the community thanks to many international conferences and workshops organized during the last years. SILMI plans to further support and sponsor these meetings, which bring together leading research groups. Also, SILMI plans to continue the stimulation and support of small or medium-sized pan-European events. With its natural emphasis on interdisciplinarity, the SILMI network plans to establish links and synchronize its activities with the corresponding programmes of the ESF and of the European Union. The network will also work in close collaboration with national research programmes in which members of the Steering Committee are actively involved, and with the Laserlab-Europe Consortium.

Proposed activities, key targets and milestones

The goal of the proposed Research Network is to facilitate exchanges and foster collaboration between the European groups active in the area of the programme, with the aim that the following major objectives be completed by the participants:

i) Super-intense laser-matter interactions at the microscopic level

- To develop a new generation of sources of intense attosecond pulses in order to perform pump-probe experiments at the sub-femtosecond level.
- To realize the imaging, in "real time", of atomic and molecular wave functions in the course of atomic or molecular reactions. The basic idea is to exploit the properties of the electron wave packets that re-collide with the parent atom or molecule after being strongly driven by an infra-red laser field in the process of harmonic generation.
- To control the re-collision process itself for the electron wave packets.
- To understand the mechanisms leading to the enhancements of the plateaus in ATI photoelectron spectra.
- To analyze the dynamics of laser-assisted collisions.
- To control the fragmentation dynamics of laser-driven molecular processes.
- To investigate multiphoton transitions involving inner-shell states and develop new multiphoton spectroscopies in the high frequency domain.

- To create "hollow atoms", through inner-shell multiple ionization.
- To develop two-colour spectroscopies by combining femtosecond or attosecond pulses from a high-frequency source (XFEL or harmonics) with IR femtosecond pulses.
- To follow "in real time" the relaxation of the electronic cloud in inner-shell ionized atoms or molecules.
- To develop a comprehensive theory of the non-linear dynamics of multi-electron systems, taking into account electron correlation effects. This task represents one of the major challenges for theory in the field, given the formidable complexity of *ab-initio* numerical calculations for this class of systems.
- To develop new approaches that properly describe the re-collision of laser-driven electron wave packets with the ionic core in few-cycles laser pulses. This would help to find novel ways to study and to control electronic processes in atoms and molecules on attosecond time scales.
- To provide a consistent time-dependent description of the relaxation of the electronic cloud, through Auger-like processes, following inner-shell ionization.
- To develop new codes for computing angular distributions of the electrons in ATI spectra. This is important in the context of the characterization of the pulses delivered by the new sources. The existing codes are not precise enough for determining the correct phase-shifts of the continuum wave functions.

ii) Super-intense laser-matter interactions at the macroscopic level

- To perform experiments at intensities of 10^{18}-10^{21} W cm^{-2}, fully exploiting existing laser facilities.
- To develop X-ray sources from high intensity laser-matter interactions.
- To understand laser interactions with solids for applications.
- To perform collisional-radiative calculations in plasma and clusters.
- To develop laser-driven particle beams, exploring the bubble regime with few-cycle pulses and developing laser guiding in plasma channels, to achieve GeV energies.
- To generate high harmonics from solid surfaces by using few-cycle pulses.
- To study theoretically how to disturb the vacuum: describing light propagation at intensities near the Schwinger limit and similarities with propagation in ionizing media.
- To develop strategies for probing Unruh radiation.
- To study experimentally high current transport in compressed matter and perform the corresponding numerical simulations.
- To analyse laser ablation with short laser pulses and the generation of warm dense matter.
- To investigate the collisional transport in fast ignition simulations and develop the required numerical codes.
- To generate monoenergetic laser-driven ion beams.

The following activities are proposed:

1. Application for and co-sponsoring of an ESF Research Conference Series bringing together the main European actors as well as colleagues from outside Europe every two years. Such a series will follow the tradition of the Euresco conference series and allow for high level scientific meetings inside Europe, and should become the most important biennial event in this field. The SILMI network proposes two conferences of this kind.

2. Organization and co-sponsoring of two workshops per year, gathering about 50 participants for 3-4 days.

3. Organization of summer schools gathering about 100 participants for a period of two weeks. These will be organized at the Ettore Majorana Centre for Scientific Culture at Erice (Italy), following the very successful previous Summer Schools organized there in 2000, 2003 and 2006 within the framework of the “FEMTO” and “ULTRA” programmes. These Summer Schools will take place in the years between the ESF conferences, that is in 2009 and 2012.

3. Organization of short term research visits between collaborating research groups on a international basis with particular attention to promote exchanges between theory and experiments.

4. Organization of exchange visits of researchers between the groups.

5. Creation of a website which will present the European activities in the field.

6. Organization of an annual committee meeting in conjunction with an ESF conference, a summer school or a workshop. The activities of the committee will include the programme organization of subsequent conferences, workshops and summer schools, the management of short term visits and of grants in the framework of the programme of exchanges, and the preparation of an annual report to ESF.

Duration: 60 months

Budget estimate

The programme duration is planned to be 5 years from January 2009 to December 2013. Its budget derives from the activities described above (all figures in kEuros).

Activity	2009	2010	2011	2012	2013
Conferences		60		60	
Workshops	50	50	50	50	50
Exchanges	30	30	30	30	30
Summer schools	60		60		60
Short term visits	20	20	20	20	20
Coordination	5	3	3	3	3
Website	5	2	2	2	2
Total	170	165	165	165	165

RESEARCH NETWORKING PROGRAMME SILMI (07-RNP-128)

Revised budget estimate

The programme duration is planned to be 5 years from January 2009 to December 2013. (all figures in kEuros).

Activity	2009	2010	2011	2012	2013
Conferences		40		40	
Workshops	30	35	30	35	30
Exchanges	30	30	30	30	30
Summer schools	45		45		45
Short term visits	20	20	20	20	20
Coordination	3	3	3	3	3
Website	2	2	2	2	2
Total	130	130	130	130	130

ESF Administrative costs (14.5%) per year: 18,9 kEuros

Total per year (including ESF administrative costs) : 148,9 kEuros

APPENDIX 1: SHORT CURRICULUM VITAE

Charles Joachain

Academic record

- Ph.D. in Physics, Université Libre de Bruxelles, La plus grande distinction (1963)

Appointments

2002 -	Professeur Ordinaire Emérite, Université Libre de Bruxelles
1978 - 02	Professeur Ordinaire, Université Libre de Bruxelles
1969 - 04	Invited Professor with the University of California and Lawrence Berkeley Laboratory (1969-1970, 1976, 1989, 1991), the University of Massachusetts (1972), the University of Durham (1983), the Université Pierre et Marie Curie, Paris VI (1987), the Max-Planck Institut für Quantenoptik, Garching (1999-2004), and the University of Rome "La Sapienza" (2001-2002)

Honors and Awards

1963 Prix Scientifique Louis Empain, Sciences Physiques
1974 Fellow of the Institute of Physics (UK)
1977 Fellow of the American Physical Society
1989 Doctor Honoris Causa of the University of Durham
1998 Alexander von Humboldt Research Award
2004 Member of the Académie Royale de Belgique (Classe des Sciences)
2006 Member of the Academia Europaea

Publications

147 research articles, 43 review articles, 4 books, co-editor of 3 books.

5 recent publications related to the proposed programme:

1. Non-dipole effects in photon emission by laser-driven ions (with C.C. Chirila, N.J. Kylstra and R.M.Potvliege), Physical Review A **66**, 063411 (2002).
2. Atoms in intense, ultra-short laser pulses: non-dipole and relativistic effects (with N.J. Kylstra and R.M. Potvliege), Journal of Modern Optics **50**, 313 (2003).
3. Relativistic effects in laser-atom interactions (with N.J. Kylstra), Physica Scripta **68**, 672 (2003).
4. Interaction of super-intense laser pulses with relativistic ions (with C.C. Chirila, N.J. Kylstra and R.M. Potvliege), Physical Review Letters **93,** 243603 (2004).
5. R-matrix-Floquet theory of multiphoton processes :concepts, results and perspectives, Journal of Modern Optics **54** (Supplement 1), 15 (2007).

Scientific Coordination

- Director, NATO Advanced Study Institute on "Atomic and Molecular Physics of Controlled Thermonuclear Fusion" (Santa Flavia, Italy, 1982)
- Member of the Scientific Committee of five NATO Advanced Study Institutes (1979-1995)
- Member of the Physics Panel of the European Community (Third and Fourth Framework Programmes, 1992-1996)
- Coordinator of the research project "Theoretical atomic, nuclear and particle physics" (Fellowship to Institutes programme of the European Community, 1993-1996)

- Coordinator of the EC Network "Atoms in Super-Intense Laser Fields" (1994-1997)
- Director of the symposium on " Multiparticle atomic systems in intense laser fields" at the Institute for Theoretical Atomic and Molecular Physics, Harvard University (1995)
- Chairman of the ESF-PESC "FEMTO" Programme "Interaction of Super-Intense, Femtosecond Laser Fields with Atoms, Solids and Plasmas" (1999-2004)
- Co-director of the "FEMTO"and "ULTRA" Summer Schools at the Ettore Majorana Centre for Scientific Culture in Erice (2000, 2003, 2006).
- Chairman of the Euroconference "Atoms and Molecules in Super-Intense Laser Fields" (Maratea, 2000)
- Chairman of the "ULTRA" Progamme "Laser-matter interactions with ultra-short pulses, high frequency pulses and ultra-intense pulses. From attophysics to petawatt physics" (COST Action P14 of the Sixth Framework Programme of the European Union, 2004-present).

<u>Dimitri Batani</u>

Academic Record

- University of Milan, Italy, Laurea in physics with laude (1986)
- University of Pisa, Italy, PhD in Physics (1990)

Appointments

2004 -	Associate Professor at the University of Milano Bicocca
1997 - 97	Visiting Researcher at LULI, Ecole Polytechnique, France
1992 - 98	Researcher at Dipartimento di Fisica of Università di Milano
1991 - 92	Post Doctoral Researcher at LULI, Ecole Polytechnique, France
1990 - 91	Fellow of the Italian Physical Society, at LULI, Ecole Polytechnique, France, in the framework of the «Inertial Fusion» programme

Publications

More than 200 journal publications, 3 books edited.

5 recent publications related to the proposed programme:

1. Ultraintense laser produced fast electron propagation and filamentation in insulators vs conductors by optical diagnostics (with M. Manclossi, J.J. Santos, J. Faure, A. Guemnie-Tafo, V.Tikhonchuk, A. Debayle and V. Malka), Physical Review Letters **96**, 125002 (2006).
2. Evidence of ultrashort electron bunches in laser plasma interaction at relativistic intensities (with S.D. Baton, J.J. Santos, F. Amiranoff, H. Popescu, L. Gremillet, M. Koenig, E. Martinolli, O. Guilbaud, C. Rousseaux, M. Rabec Le Gloahec, T. Hall, E. Perelli, F. Scianitti and T.E. Cowan), Physical Review Letters, **91**, 105001 (2003).
3. Hugoniot data for carbon at megabar pressures (with H.Stabile. M.Tomasini, G.Lucchini, A.Ravasio, M. Koenig, A. Benuzzi-Mounaix, H.Nishimura, Y.Ochi, J.Ullschmied, J.Skala, B.Kralikova, M.Pfeifer, Ch.Kadlec, T.Mocek, A.Präg, T.Hall, P.Milani, E.Barborini and P.Piseri), Physical Review Letters, **92**, 065503 (2004).
4. Ultra-intense laser-produced fast electron propagation in gas jets (with S.D.Baton, M.Manclossi, J.J. Santos, F.Amiranoff, M. Koenig, E. Martinolli, A.Antonicci, C.Rousseaux, M.Rabec Le Gloahec, T.Hall, V.Malka, T.E.Cowan, J.King and R.Freeman), Physical Review Letters, **94**, 055004 (2005).
5. Laser-accelerated protons with energy dependent beam direction (with F. Lindau, O.Lundh, A.Persson, P.McKenna, K.Osvay and C.-G. Wahlstrom), Physical Review Letters, **95**, 175002 (2005).

Scientific Coordination

- Vice-Chairman of the “ULTRA” Progamme “Laser-matter interactions with ultra-short pulses, high frequency pulses and ultra-intense pulses. From attophysics to petawatt physics” (COST Action P14 of the Sixth Framework Programme of the European Union, 2004-present)
- Elected member of the Board of the Plasma Physics Division of the European Physical Society
- Member of the International Selection Panel of the Central Laser facility of Rutherford Appleton Laboratory, UK
- Member of the Editorial Board of the Journal “Laser and Particle Beams”
- User Representative in the Access Board of the LASERLAB Europe
- Co-ordinator of the INTAS Project 01-846 “Laser-driven shock tube for generation of hypersonic gas flows and investigation of hydrodynamic instabilities at contact interfaces” and of the INTAS - RFBR project on "Laser Driven Shock Waves and Dense Plasma Physics"
- Referee for proposals submitted to INTAS, to ESF, and to the European Large Scale LASER Facilities
- Task leader of the sub-project on development of diagnostics in the HiPER project
- Organiser or co-organiser of several conferences or workshops, including "Advanced Diagnostics for Magnetic and Inertial Fusion" (Varenna, 2001); “Ultrashort High-Energy Radiation and Matter” (Varenna, 2003) ; "Matter in Super Intense Laser Fields" (S.Feliu, Spain, 2001) ; the first and second international workshops on "Particle Sources from High Intensity Lasers" (Milano-Bicocca, 2001 and Paris, 2002)
- Co-director of the “FEMTO”and “ULTRA” Summer Schools at the Ettore Majorana Centtre for Scientific Culture in Erice (2000, 2003, 2006)

Juergen Meyer-ter-Vehn

Academic Record

- Diploma in Physics, University of Munich (1966)
- PhD (Dr. rer. nat) in Physics , Technical University of Munich (1969)
- Habilitation in Theoretical Physics, Technical University of Munich (1976)

Appointments

1996 -	Apl. Professor at the Technical University of Munich
1981 -	Head of Laser Plasma Theory Group at MPQ Garching
1977 - 79	Gastwissenschaftler an Kernforschungszentrum Jülich
1975 - 77	Guest scientist at the Swiss Institute of Nuclear Research
1973 - 75	Guest scientist at the Lawrence Berkeley Laboratory, Berkeley (USA)
1969 - 73	Wissenschaftlicher Assistent at the Technical University of Munich

Publications

172 journal publications, 1 book

5 recent publications related to the proposed programme:

1. The Physics of Inertial Fusion (with S. Atzeni), Oxford Science Publications, Clarendon Press, Oxford, 2004. (Book, 500 pages).

2. Dense plasma physics studied with XFELS (with A. Krenz, Ke Lan, K. Eidmann, E. Fill, F. Rosmej, Th. Schlegel, K. Sokolowski-Tinten, D. von der Linde and Th. Tschentscher) in *Inertial Fusion Sciences and Applications* (eds. B.A. Hammel et al), American Nuclear Society, La Grange Park Illinois (2004).pp 912 -6 .
3. Three-dimensional fast electron transport for ignition-scale inertial fusion capsules (with J.J. Honrubia), Nuclear Fusion **46**, L25 (2006).
4. Bubble acceleration of electrons with few-cycle laser pulses (with M. Geissler and J. Schreiber), New Journal of Physics **8**, 186 (2006).
5. Route to intense single attosecond pulses (with George D. Tsakiris, Klaus Eidmann and Ferenc Krausz), New Journal of Physics **8**, 19 (2006).

Scholarships and Awards

1961 - 69	Stipendiat der Studienstiftung des Deutschen Volkes
1979 - 81	Heisenberg Stipendiat
1997	Edward-Teller Award

Scientific Coordination

- Board Member (1990 – 2003) of the Eur. Conf. of Laser Interaction with Matter (ECLIM)
- Board Member (2000 – 2006) of the EPS Plasma Physics Division
- Founder and Chairman (2002- 2006) of the EPS Section of Beam-Plasma & Inertial Fusion
- Member of the ESF-PESC Programme “FEMTO” (1999 – 2004)
- Member of the Core Committee of the COST Project “ULTRA” (2004 – 2007)
- Member of the Inertial Fusion Energy Cordinating Committee (EURATOM) (1996 –).
- (Co)Organizer of many conferences and workshops reklated to the current project.

APPENDIX 2: PROGRAMME STEERING COMMITTEE

Austria: Dr. A. Scrinzi, Photonics Institute, Vienna University of Technology, Gußhausstraße 27-29/387, A-1040 Wien, scrinzi@tuwien.ac.at

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- Prof. Ken Ledingham, Physics Department, University of Strathclyde
- Prof P. McKenna, Physics Department, University of Strathclyde
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