Applications are invited for a Postdoctoral Research Fellow in Experimental Photonics at the Emergent Photonics Lab in the Department of Physics & Astronomy at the University of Sussex. The duration of the position is originally for 1 year with the possibility of an extension for a further 2 years based on research requirements. The position is part of the ERC funded project TELSCOMBE-Temporal Laser Cavity-Solitons for Microcombs (for a value of about £1,200,000) – led by Dr Alessia Paquazi.

It involves the development of novel approaches towards the realisation of compact optical frequency combs in microresonators. Key to the project success are elements directly inherited from nonlinear photonics, fibre photonics, mode-locked lasers and optical frequency combs. This project transversely intersects the kernel of our research interests. The outcomes are likely to have a key impact in several domains, from quantum technologies to environmental sensing, metrology, manufacturing, and others.

The successful applicant should have a PhD in a field related to our research areas, nonlinear photonics, ultrafast photonics, nonlinear wave propagation, and background preferably intersecting soliton theory and optical complexity with a good publication record. Previous experimental experience with photonic benches implementation would be desirable, along with basic knowledge of ultrafast laser operation and a history of international involvement and aggressive publication strategy. Evidence of potential leadership, independence and a strong motivation are also essential. Some of the typical tasks for this position include the operation of ultrafast fibre-lasers and optical frequency combs, the design of optical benches, the acquisition of data using fast electronics and their analysis.

The Emergent Photonics Laboratory directed by Alessia Pasquazi and Marco Peccianti, has been established at the University of Sussex with an investment exceeding £6M in equipment and a number research-supporting fellowships and personal grants. Our research aims to develop new photonic technologies, spanning from integrated ultrafast optical devices to optical clocks and THz technology.
The laboratory staff is currently formed by six PhD students, three Post-Docs and two faculty members. Lab activities involve a variable number (four to six) of MPhys and MSc students and internship students.

The successful candidate is expected to actively engage in our research plans, to provide guidance to undergraduate and postgraduate students, to participate in the strategic planning of the group and to contribute to drafting successful research bids. It is expected to travel among our network of collaborators. The salary offered will be appropriate to the qualifications, standing and experience of the successful candidate.

For more information, please email Dr Alessia Pasquazi (Reader in Experimental Physics) (a.pasquazi@sussex.ac.uk).

Or Prof. Marco Peccianti (Professor of Photonics) (m.peccianti@sussex.ac.uk)

Closing date for applications: 1 Feb 2020 (or as soon as a suitable candidate is identified thereafter)

Please include with your completed application form a CV, the contact details of three referees and a list of relevant publications

For full details and how to apply see www.sussex.ac.uk/jobs

The University is committed to equality and valuing diversity, and applications are particularly welcomed from women and black and minority ethnic candidates, who are under-represented in academic posts in science, engineering and mathematics at Sussex.

2. Senior leadership and management

The Vice-Chancellor (Professor Adam Tickell) is the senior academic officer and, as Chief Executive, is responsible to the University Council for management of the University. He is supported by an executive group which includes the three Pro-Vice-Chancellors, the Registrar and Secretary, the Director of Finance and the Director of Human Resources. The Heads of the Schools of Studies at Sussex report to the Pro-Vice-Chancellors.

3. The School / Division

The School of Mathematical and Physical Sciences

The School of Mathematical and Physical Sciences was created in 2009 as part of a University-wide restructuring. It brings together two outstanding and progressive departments – Mathematics, and Physics & Astronomy. The School aims to capitalise on the synergy between
these subjects to deliver new and challenging opportunities for faculty and students.

The School of Mathematical and Physical Sciences combines pioneering research and stimulating teaching in an interdisciplinary academic setting. The faculty work at the frontiers of their fields, as is reflected in the recent growth of both subjects. Each department has a number of thriving research groups and links with outside agencies.

Acting Head of School is Professor Philip Harris.

**The Department of Physics and Astronomy**

The Physics & Astronomy Department currently has 44 faculties divided into five research groups: Astronomy; Atomic, Molecular & Optical Physics; Experimental Particle Physics; Materials Physics; Theoretical Particle Physics.

We are part of the South East Physics Network (SEPNet) - a consortium of nine physics departments of the University of Sussex, University of Kent, Queen Mary University of London, Royal Holloway University of London, Southampton University, University of Surrey, University of Portsmouth, University of Hertfordshire, and the Open University. This has been awarded substantial government funding (from HEFCE) to support vital UK science research, teaching and development.

In 2016 Physics research at the University of Sussex has been ranked as 13th in western Europe and seventh in the UK and has been profiled as one of its top-25 “rising stars” worldwide (source: Nature).

The Department has approximately 350 undergraduate students, 30 MSc students, over 110 PhD students and 41 postdoctoral fellows.

**Research groups**

**4.1. The Astronomy Centre**

Current research interests are: physics of the early Universe; constraining cosmological models; numerical simulations of structure formation; extragalactic survey science; and galaxy formation and evolution. The first of these has strong overlaps with the Theoretical Particle Physics group.

The Centre consists of 11 permanent faculty members 8 postdoctoral researchers and 22 PhD students. The group’s main source of funding comes from a consolidated grant Science and Technology Facilities Council (STFC) and EU funding in the form of Starting, Consolidator and Cooperation grants.

The Centre’s activity is focussed around three themes: Theoretical cosmology, with focus on inflationary cosmology, the cosmic microwave background, dark energy, and statistical methods; Simulations/modelling of reionization, large-scale structure, galaxy and cluster formation; Observations; surveys of galaxies and clusters from the infra-red through to X-ray.

We have major roles in extra-galactic surveys: Seb Oliver coordinates the Herschel Multi-tiered Extra-galactic Survey (HerMES) and EU funded Herschel Extra-galactic Legacy Project (HELP); Kathy Romer leads the XMM Cluster Survey (XCS); Jon Loveday leads the Galaxy Mass Assembly (GAMA) spectra working group. We are the main UK contributor to 4-MOST on the VISTA telescope and have a leading role in the WAVES spectroscopic galaxy We are partners in various supercomputing collaborations including COSMOS and VIRGO. We have key roles in Cosmology and Dark Energy studies including Planck and the Dark Energy Survey (DES).
The Centre has access to substantial computing resources, including locally and various supercomputing consortia.

The Astronomy Centre’s web site is http://www.sussex.ac.uk/astronomy/

4.2. The Atomic, Molecular & Optical (AMO) Physics Group

Research in the AMO group at Sussex is devoted to the study of fundamental physics and quantum effects and technologies using the techniques of atomic and laser physics. The research covers both experimental and theoretical AMO physics. There are six experimental faculty in the AMO group.

Marco Peccianti’s (Emergent Photonics Laboratory) research is focussed on nonlinear optics, including integrated optics, ultra-fast photonics, Tera-Hertz Imaging and applications of Tera-Hertz radiation.

Alessia Pasquazi (Emergent Photonics Laboratory) is working on ultra-fast photonics, optical complexity, and also on optical sources for quantum technologies and optical metrology.

Winfried Hensinger is developing new quantum technologies using trapped ions. His group is developing a quantum simulation engine and they are in the process of constructing a large-scale trapped-ion quantum computer. Another research area is the development of portable quantum sensors.

Peter Kruger, is starting a major activity in Quantum Systems and Technologies. This will involve a range of experiments and device development at the interface of cold atomic and condensed matter physics.

Matthias Keller is investigating the interaction of single photons and ions assisted by optical cavities with the aim of generating large scale entangled states and developing quantum networks. His work also includes the physics of trapped molecular ions.

Jose Verdu’s team is developing a novel Penning trap technology based upon superconducting microwave transmission-lines. This work has applications to circuit-QED with trapped electrons, quantum metrology and mass spectrometry.

There are two theorists in the AMO group.

Jacob Dunningham (AMO group leader) is investigating Bose-Einstein condensates and quantum technologies with a particular emphasis on quantum metrology, sensing, and imaging.

Barry Garraway is developing new kinds of atom traps with applications to quantum information and quantum metrology and in addition works on cavity QED and non-Markovian dynamics.

Along with the faculty there are currently 14 research fellows and 40 PhD students in the AMO group. Sources of funding include the European Union, EPSRC and European and national research networks on quantum information processing. The Atomic, Molecular & Optical Physics group web site is http://www.sussex.ac.uk/amo

4.3. The Experimental Particle Physics (EPP) Group

The Sussex EPP group counts ten permanent faculty members, plus one Emeritus Professor. The group’s main source of funding is the Science and Technology Facilities Council (STFC), with additional support from the European Research Council (ERC) and the Royal Society.
Antonella De Santo, who is also the EPP Group Leader, together with Fabrizio Salvatore has established and leads a fast-growing team working on the ATLAS experiment at the CERN Large Hadron Collider (LHC). The other ATLAS faculty members are Lily Asquith, Alessandro Cerri and Iacopo Vivarelli. The group has a long-standing leadership in the search for supersymmetry at ATLAS, and also leads in the areas of jet physics, Higgs physics, flavour physics, and top physics. Sussex also holds key responsibilities in the ATLAS High-Level Trigger (HLT) system, including in view of future LHC and ATLAS upgrades. It also has a major role in the proposed Level-1 tracking trigger project, for use by ATLAS at the High-Luminosity LHC.

Historically, the Sussex EPP is world-renowned for its high-precision measurement of the neutron electric dipole moment (EDM). The EDM is uniquely sensitive to physics beyond the Standard Model, and the group is currently involved in the nEDM experiment at the PSI. Philip Harris leads this effort at Sussex together with Clark Griffith and Visiting Senior Lecturer Mike Hardiman.

Sussex EPP also boasts a vibrant and expanding programme of neutrino physics. Sussex is one of the leading UK institutes involved in the SNO+ experiment, which seeks to determine whether the neutrino is its own antiparticle by searching for neutrino-less double-beta decays. Simon Peeters leads the SNO+ effort at Sussex, together with Lisa Falk and Jeff Hartnell. Additionally, Jeff Hartnell was recently awarded substantial ERC funding to work on the Fermilab-based NOVAs neutrino oscillation experiment and the future long-baseline programme (LBNE/LBNF). Peeters and Falk are also involved in LBNE/LBNF.

Sussex EPP currently has ten postdoctoral level researchers, eleven PhD students, three engineer/technician posts directly involved in EPP research, and a Linux system administrator. We have a number of well-equipped laboratories, and we enjoy good access to the University’s technical facilities, including shared technicians. Sussex EPP researchers have uncontented access to a dedicated Grid Tier-3 cluster, and Sussex is a member of the SouthGrid Tier-2 grouping of Grid-enabled research institutions in the South of England.

Sussex EPP has close links with colleagues in the Sussex Theoretical Particle Physics group and with other partners in the SEPnet consortium.

The Experimental Particle Physics group web site is http://www.sussex.ac.uk/epp

4.4. The Materials Physics Group

This is a new research group set up by Professor Alan Dalton who joined the Department from Surrey University in February 2016.

A number of new appointments are underway.

The group will focus on understanding the fundamental structure-property relationships in materials containing one- and two-dimensional structures such as carbon nanotubes, graphene and other layered nanomaterials. Prof Dalton is particularly interested in developing viable applications for nano-structured organic composites (mechanical, electrical and thermal). He is also interested in the directed-assembly and self-assembly of nanostructures into functional macrostructures and more recently interfacing biological materials with synthetic inorganic and organic materials and associated applications.

The Materials Physics group webpage is http://www.sussex.ac.uk/materials-physics/

4.5. Sussex Centre for Quantum Technologies
The Sussex Centre for Quantum Technologies is focused on the exploitation and development of disruptive quantum technologies. The Centre hosts ten research groups covering the broad spectrum of quantum technologies as well as hosting a number of associate member groups that share significant overlap with our mission.

Our research groups are involved in the UK Quantum Technology Hub on Networked Quantum Information Technologies and the UK Quantum Technology Hub for Sensors and Metrology as well as DSTL initiatives, Centres for Doctoral Training and numerous national and international collaborations. The centre is integrated within the UK National Quantum Technology Programme. The centre leadership consists of Prof. Winfried Hensinger (director) and Prof. Jacob Dunningham (deputy director).

The Centre’s five experimental research groups are led by Prof Winfried Hensing (Ion Quantum Technology), Dr Matthias Keller (Ion Trap Cavity-QEG and Molecular Physics), Prof Peter Krueger (Quantum Systems and Technologies), Dr Alessia Pasquazi (Ultrafast Photonics), Dr Marco Peccianti (Tera-Hertz Imaging), and Dr Jose Verdu (Electrons in Quantum Circuits). The centre also hosts ground breaking theory groups led by Prof Claudia Eberlein (Quantum Field Theory in AMO), Prof. Jacob Dunningham (Quantum metrology, Bose-Einstein condensates and Entanglement), Prof Barry Garraway (Trapped Ultracold Atoms &Theoretical Quantum Optics) and Dr Diego Porras (Quantum optics and condensed matter systems).

The Sussex Centre for Quantum Technologies features numerous state-of-the-art quantum technology laboratories along with key infrastructure. In addition to the high quality research environment, training plays an integral role and the centre hosts the pioneering MSc in Frontiers of Quantum Technology as well as carrying out specialized quantum technology training for doctoral and postdoctoral researchers.

The Sussex Centre for Quantum Technologies web page is http://www.sussex.ac.uk/scqt/

4.6. The Theoretical Particle Physics (TPP) Group

The current research activities in the group are: particle astrophysics and cosmology, including cosmological phase transitions, baryogenesis, topological defects, inflation, dark matter, and dark energy; collider and low-energy phenomenology, including Higgs and BSM physics, flavour, QCD, supersymmetry and extra dimensions; and quantum field theory, including quantum gravity, tests the asymptotic safety conjecture, the renormalisation group, effective theory and strong coupling phenomena,

The group consists of Andrea Banfi, Xavier Calmet, Mark Hindmarsh, Stephan Huber (group leader), Sebastian Jaeger, Daniel Litim, Veronica Sanz, Emeritus Professors David Bailin and Norman Dombey, two Postdoctoral Research Fellows, and about 20 PhD and MSc students. The group maintains a research consortium with Royal Holloway (Nikolas Kauer) and University College London (Frank Deppisch). The group's research funding comes mainly from the UK Science and Technology Facilities Council (STFC), and is also supported by the European Science Foundation and the Higher Education Funding Council for England.

The group has close links with both the Experimental Particle Physics and Astronomy research groups, and is a member of the NExT Institute, a regional collaboration for particle physics phenomenology. It benefits from excellent computing resources including a Linux-based system of workstations and servers and access to the University’s High Performance Computing cluster.

The Theoretical Particle Physics group web page is http://www.sussex.ac.uk/tpp/
**JOB DESCRIPTION**

**Job Title:** Research Fellow in Experimental Photonics  
**Grade:** Research Fellow I, Grade 7  
**School:** Mathematical and Physical Sciences  
**Location:** Pevensey II  
**Responsible to:** Dr Alessia Pasquazi through to Head of School  
**Direct reports:** n/a  
**Key contacts:** Dr Alessia Pasquazi (a.pasquazi@sussex.ac.uk)  
Prof Marco Peccianti (m.peccianti@sussex.ac.uk).

**Role description:** Research Fellow I is an early career-grade research position. Post-holders will be expected to contribute to the work of the research team, and also to develop their research skills with support from more experienced members of staff.

**PRINCIPAL ACCOUNTABILITIES**

To engage in individual and/or collaborative research activity resulting in high-quality publications; and to develop research funding and knowledge exchange income individually or in collaboration with others, as appropriate, depending on the size and scope of the bid. To contribute to School teaching activities

**KEY RESPONSIBILITIES**

1. **Research, Scholarship & Enterprise**
   1.1 Develop research objectives and proposals for own or joint research, at international levels, with assistance if required.
   1.2 Conduct research projects individually and in collaboration with others.
   1.3 Analyse and interpret research findings and draw conclusions on the outcomes.
   1.4 Produce high-quality research outputs for publication in monographs or recognised high-quality journals, or performance/exhibition, as appropriate, and contribute to the School’s REF submission at acceptable levels of volume and academic excellence.
   1.5 Contribute to the preparation of proposals and applications to external bodies, for example for funding purposes.
1.6 Individually or with colleagues, explore opportunities for enterprise activity, knowledge exchange income and/or consultancy, where permissible.

1.7 Build internal contacts and participate in internal networks and relevant external networks in order to form relationships and collaborations.

1.8 Continually update knowledge and understanding in field or specialism, and engage in continuous professional development.

2. **Teaching & Student Support**

2.1 Undertake teaching duties, if required.

2.2 Assist in the assessment of student knowledge and supervision of student projects if required.

2.3 Assist in the development of student research skills, for example as part of a postgraduate supervision team.

3. **Contribution to School & University**

3.1 Attend and contribute to relevant School and project meetings.

3.2 Undertake additional duties, as required by the Principal Investigator and/or Head of School.

4. **Role-specific duties**

1. Operation and construction ultrafast nonlinear optics diagnostic benches

2. Design, implementation and testing of nonlinear imaging systems based on ultrashort optical pulses and optical propagation in complex media.

3. Assistance in supervision of undergraduate and doctoral students.

4. Dissemination of research findings.

5. Prepare proposals and reports to external bodies, e.g. for funding and contractual purposes.

6. Participate in shaping research directions and leadership making use of detailed expertise in the research area.

Specific Duties (they also contributes to compose the essential person specifications)

1. **Operation and construction ultrafast nonlinear optics diagnostic benches**
   - This involves work with a state-of-the ultrafast lasers source, and understanding of the principle of the nonlinear field matter interaction.

2. **Design, implementation and testing of nonlinear systems based on micro-cavities and fibre lasers**
   - The central part of the project is the exploitation of nonlinear optical phenomena and complex light propagation within novel concepts for the generation of optical frequency combs withing micro-resonators. The candidate is expected (i) to independently investigate,
understand and model the nonlinear interactions (ii) to experimentally and theoretically contribute to the enlargement of the backgrounds established within the Emergent Photonics Laboratory and (iii) to contribute to the creation of novel foreground towards the project objectives. Details will be discussed at the interview stage.

3. **Assistance in the supervision of undergraduate and postgraduate students**
   Helping in the supervision of the undergraduate and postgraduate students in the group.

4. **Dissemination of research findings**
   Dissemination routes that the candidate is expected to assist in are: conference presentations; writing articles for physics highly-ranked journals.

5. **Prepare proposals and reports to external bodies, e.g. for funding and contractual purposes.**
   Participate and lead in the preparation of research applications to external bodies.

6. **Participate in shaping research directions and leadership making use of detailed expertise in the research area**
   Building on solid knowledge in the research area, you take a prominent role in shaping research directions of the group.

This Job Description sets out current duties of the post that may vary from time to time without changing the general character of the post or the level of responsibility entailed.

**INDICATIVE PERFORMANCE CRITERIA**

- A PhD or equivalent scholarly or relevant professional activity
- Pursuing a line of independent research within a research group.
- Aggressive research publication strategy in highly ranked journal.
- Other forms of externally recognised professional practice of creative output of a standing equivalent to regular publication of original research.
- Initiating, developing or participating in links between the University and external bodies such as business and industry, the professions, community organisations and policy-makers.
- Evidence of successful engagement in teaching or supervision.
5. **Person Specification**

**ESSENTIAL CRITERIA**

1. Normally educated to doctoral level, or other equivalent qualification, or appropriate level of experience, as appropriate to the discipline (see role-specific criteria below).

2. Evidence of engagement in high-quality research activity, with partial or total leadership.

3. Excellent presentation skills, with the ability to communicate effectively, both orally and in writing, with students, colleagues and external audiences.

4. Evidence of work within international networks.

5. Ability to work individually on own initiative and without close supervision, and as part of a team.

6. Ability to exercise a degree of innovation and creative problem-solving.

7. Excellent organisational and administrative skills.

8. Ability to prioritise and meet deadlines.

9. Excellent IT skills.

10. Report at project meetings and present results at other sites as required

11. Coordinate meetings with staff and collaborators.

12. Carry out routine administrative tasks associated with a specified research project, for example risk assessment of research tasks, organisation of project meetings and documentation. This will entail planning own day-to-day research activity within the framework of the agreed programme, dealing with problems that may affect the achievement of research objectives and deadlines and implementing procedures required to ensure accurate and timely delivery.

**DESIRABLE CRITERIA**

1. Emerging track record of high-quality publications in top-ranked journals and other appropriate media of similar standing.

2. Experience of generating research or knowledge exchange income.

**ROLE-SPECIFIC CRITERIA**

<table>
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<tr>
<th>SKILLS / ABILITIES</th>
<th>Essential</th>
<th>Desirable</th>
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<tbody>
<tr>
<td>Ability to carry out original research in experimental photonics research</td>
<td>✔</td>
<td></td>
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<tr>
<td>Abilities in modelling experimental observation in</td>
<td></td>
<td>✔</td>
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photonics

| Competence in using data acquisition software (MATLAB - LABVIEW) and data analysis software | ✓ |
| Good communication skills, written and oral | ✓ |
| Electronics skills | ✓ |
| Writing journal articles | ✓ |
| Skills in working with free space optical setups | ✓ |

| Clear leadership potential in the specific research area | ✓ |
| Ability to give oral and written reports on project progress and outcomes. Ability to report at both a technical low-level and conceptual high-level to a range of audiences including the public and industry. | ✓ |
| Ability to continually update knowledge and develop skills | ✓ |

### KNOWLEDGE

<table>
<thead>
<tr>
<th>Essential</th>
<th>Desirable</th>
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<tbody>
<tr>
<td>Photonic materials and technologies</td>
<td>✓</td>
</tr>
<tr>
<td>Nonlinear Optics</td>
<td>✓</td>
</tr>
<tr>
<td>Fibre Optics</td>
<td>✓</td>
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<tr>
<td>Laser Optics</td>
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### EXPERIENCE

<table>
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<tr>
<th>Essential</th>
<th>Desirable</th>
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<tbody>
<tr>
<td>Experimental experience in optics and photonics</td>
<td>✓</td>
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<tr>
<td>Experimental experience in nonlinear optics</td>
<td>✓</td>
</tr>
<tr>
<td>Handling of ultrafast lasers</td>
<td>✓</td>
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<tr>
<td>Theoretical experience with nonlinear propagation</td>
<td>✓</td>
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<tr>
<td>Proven record of writing journal articles</td>
<td>✓</td>
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<tr>
<td>Proven record of writing high profile journal articles</td>
<td>✓</td>
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### QUALIFICATIONS

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<th>Essential</th>
<th>Desirable</th>
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<tbody>
<tr>
<td>PhD in optics, photonics or equivalent level of scholarly achievement</td>
<td>✓</td>
</tr>
<tr>
<td>A proven track record of experience in photonics</td>
<td>✓</td>
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### PERSONAL ATTRIBUTES AND CIRCUMSTANCES

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<thead>
<tr>
<th>Essential</th>
<th>Desirable</th>
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<tr>
<td>Ability to work independently</td>
<td>✓</td>
</tr>
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</table>
Active commitment to team work ✔

Demonstrated leadership abilities ✔

Closing date for applications: 1 Feb 2020 (or as soon as a suitable candidate is identified thereafter)