Objective

While the origin of magnetic order in condensed matter is in the exchange and spin-orbit interactions, with time scales in the subpicosecond ranges, it has been long believed that magnetism could only be manipulated at nanosecond rates, exploiting dipolar interactions with external magnetic fields. However, in the past decade researchers have been able to observe ultrafast magnetic dynamics at its intrinsic time scales without the need for magnetic fields, thus revolutionising the view on the speed limits of magnetism. Despite many achievements in ultrafast magnetism, the understanding of the fundamental physics that allows for the ultrafast dissipation of angular momentum is still only partial, hampered by the lack of experimental techniques suited to fully explore these phenomena. However, the recent appearance of two new types of coherent radiation, single-cycle THz pulses and x-rays generated at free electron lasers (FELs), has provided researchers access to a whole new set of capabilities to tackle this challenge. This proposal suggests using these techniques to achieve an encompassing view of ultrafast magnetic dynamics in metallic ferromagnets, via the following three research objectives: (a) to reveal ultrafast dynamics driven by strong THz radiation in several magnetic systems using table-top femtosecond lasers; (b) to unravel the contribution of lattice dynamics to ultrafast demagnetization in different magnetic materials using the x-rays produced at FELs and (c) to directly image ultrafast spin currents by creating femtosecond movies with nanometre resolution. The proposed experiments are challenging and explore unchartered territories, but if successful, they will advance the understanding of the speed limits of magnetism, at the time scales of the exchange and spin-orbit interactions. They will also open up for future
investigations of ultrafast magnetic phenomena in materials with large electronic correlations or spin-orbit coupling.

Field of Science

/humanities/arts/modern and contemporary art/film
/natural sciences/physical sciences/optics/laser physics

Programme(s)

H2020-EU.1.1. - EXCELLENT SCIENCE - European Research Council (ERC)

Topic(s)

ERC-2016-STG - ERC Starting Grant

Call for proposal

ERC-2016-STG

See other projects for this call

Funding Scheme

ERC-STG - Starting Grant

Host institution

STOCKHOLMS UNIVERSITET

Address
Universitetsvägen 10
10691 Stockholm
Sweden

Activity type
Higher or Secondary Education Establishments

EU Contribution
€ 1 749 005

Website
Contact the organisation

Beneficiaries (2)
<table>
<thead>
<tr>
<th>Organisation</th>
<th>Country</th>
<th>EU Contribution</th>
<th>Address</th>
<th>Activity Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOCKHOLMS UNIVERSITET</td>
<td>Sweden</td>
<td>€ 1 749 005</td>
<td>Universitetsvägen 10</td>
<td>Higher or Secondary Education Establishments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10691 Stockholm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNIVERSITA CA' FOSCARI VENEZIA</td>
<td>Italy</td>
<td>€ 218 750</td>
<td>Dorsoduro 3246</td>
<td>Higher or Secondary Education Establishments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30123 Venezia</td>
<td></td>
</tr>
</tbody>
</table>

**Share this page**

Last update: 20 March 2017  
Record number: 207863

Permalink: https://cordis.europa.eu/project/id/715452/en

© European Union, 2019